DATA SHEET

NEC

TFT COLOR LCD MODULE

NL10276AC30-04R

38 cm (15.0 inches), 1024 × 768 pixels, 262,144 colors, LVDS interface, Wide viewing angle, High luminance

DESCRIPTION

NL10276AC30-04R is a TFT (thin film transistor) active matrix color liquid crystal display (LCD) comprising amorphous silicon TFT attached to each signal electrode, a driving circuit and a backlight. NL10276AC30-04R has a built-in backlight with inverter.

The 38 cm (15.0 inches) diagonal display area contains 1024 × 768 pixels and can display 262,144 colors simultaneously.

FEATURES

- Wide viewing angle (with retardation film)
- High luminance
- Low reflection
- LVDS interface (Equivalent of THC63LVDF64A, THine Electronics, Inc.)
- Incorporated edge type backlight (two lamps, inverter) and Lamp holder replaceable

APPLICATIONS

- Desk-top type of PC
- Engineering work station
- Display terminal for control system
- Monitor for process controller

The information in this document is subject to change without notice.

Please confirm with the delivery specification before starting to design the system.

Document No. EN0490EJ1V0DS00
Date Published April 2000 P
Printed in Japan

STRUCTURE AND FUNCTIONS

A color TFT (thin film transistor) LCD module is comprised of a TFT liquid crystal panel structure, LSIs for driving the TFT array, and a backlight assembly. The TFT panel structure is created by sandwiching liquid crystal material in the narrow gap between a TFT array glass substrate and a color filter glass substrate. After the driver LSIs are connected to the panel, the backlight assembly is attached to the backside of the panel.

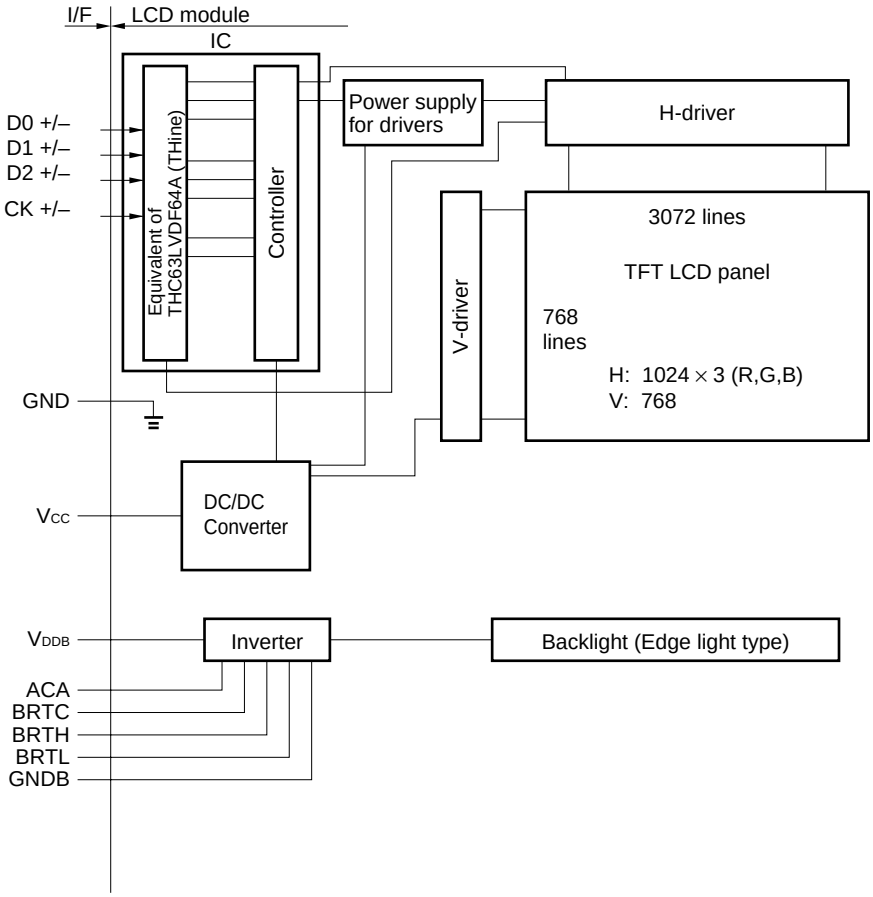
RGB (red, green, blue) data signals from a source system is modulated into a form suitable for active matrix addressing by the onboard signal processor and sent to the driver LSIs which in turn addresses the individual TFT cells.

Acting as an electro-optical switch, each TFT cell regulates light transmission from the backlight assembly when activated by the data source. By regulating the amount of light passing through the array of red, green, and blue dots, color images are created with clarity.

OUTLINE OF CHARACTERISTICS (at room temperature)

Items	Description
Display area	304.128 (H) × 228.096 (V) mm
Drive system	a-Si TFT active matrix
Display colors	262,144 colors
Number of pixels	1024 × 768 pixels
Pixel arrangement	RGB vertical stripe
Pixel pitch	0.297 (H) × 0.297 (V) mm
Module size	350.0 (H) × 265.0 (V) × 20.0 (typ.) (D) mm
Weight	1350 g (typ.)
Contrast ratio	200 : 1 (typ.)
Viewing angle (more than the contrast ratio of 10 : 1)	• Horizontal : 60° (typ., left side, right side) • Vertical : 40° (typ., up side), 50°(typ., down side)
Designed viewing direction	• Wider viewing angle without image reversal : up side (12 o'clock) • Wider viewing angle with contrast ratio: down side (6 o'clock) • Optimum grayscale (γ = 2.2): perpendicular
Color gamut	40% (typ., at center, to NTSC)
Response time	15 ms (typ.), "white 100%" to "black 10%"
Luminance	200 cd/m^2 (typ.)
Signal system	RGB 6-bit signals, Synchronous signals (Hsync, Vsync), Dot clock (CLK) LVDS interface (Equivalent of THC63LVDF64A, THine Electronics, Inc.) 1 port
Supply voltage	5 V (Logic, LCD driving), 12 V (Backlight)
Backlight	Edge light type: Two cold cathode fluorescent lamps with inverter • Lamp holder: type No.150 LHS11 • Inverter: type No.141PW201
Power consumption	11.8 W (typ.)

BLOCK DIAGRAM OF BASIC STRUCTURE



Note: Neither GND nor GNDB is connected to FG (Frame Ground).
GND and GNDB should be connected to customer equipment FG.

GENERAL SPECIFICATIONS

Items	Specifications	Unit
Module size	350.0 ± 0.6 (H) × 265.0 ± 0.6 (V) × 20.5 (max.) (D)	mm
Display area	304.128 (H) × 228.096 (V)	mm
Number of pixels	1024 (H) × 768 (V)	pixel
Dot pitch	0.099 (H) × 0.297 (V)	mm
Pixel pitch	0.297 (H) × 0.297 (V)	mm
Pixel arrangement	RGB (Red, Green, Blue) vertical stripe	–
Display colors	262,144 (RGB, 6 bit)	color
Weight	1350 (typ.), 1500 (max.)	g

ABSOLUTE MAXIMUM RATINGS

Parametesrs	Symbols	Ratings	Unit	Remarks
Supply voltage	V_{CC}	–0.3 to +6.0	V	T_a = 25°C
	V_{DDB}	–0.3 to +14	V	
Logic input voltage	V_I	–0.3 to V_{CC} + 0.3	V	
Logic input voltage (backlight-logic signal)	V_{IBL1}	–0.3 to +5.5	V	
Logic input voltage (backlight-BRTL signal)	V_{IBL2}	–0.3 to +1.5	V	
Storage temp.	T_{ST}	–20 to +60	°C	
Operating temp.	T_{OP}	0 to +50	°C	Module surface **Note 1**
Relative humidity (RH) **Note 2**		≤ 95	%	T_a ≤ 40°C
		≤ 85	%	40 < T_a ≤ 50°C
Absolute humidity **Note 2**		Absolute humidity shall not exceed T_a = 50°C, Relative humidity = 85% level.	g/m^3	T_a > 50°C

Note 1: Measured at the LCD panel of the module.

Note 2: No Condensation.

ELECTRICAL CHARACTERISTICS

(1) Logic, LCD driving

T_a = 25°C

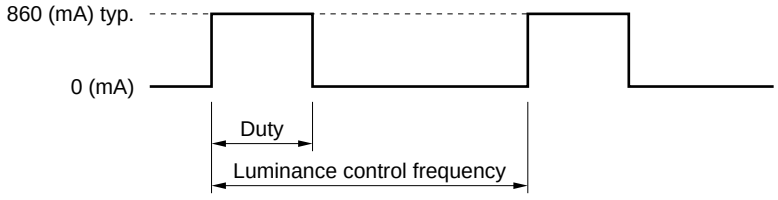
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	V_{CC}	4.75	5.0	5.25	V	–
Ripple voltage	V_{RP}	–	–	100	mV	for V_{CC}
LVDS signal input "L" voltage	V_{IL}	–100	–	–	mV	V_{CM} = 1.2 V V_{CM}: Common mode voltage in LVDS driver
LVDS signal input "H" voltage	V_{IH}	–	–	+100	mV	
Input voltage	V_I	0.25	0.35	0.45	V	–
Common mode voltage	V_{CM}	1.125	1.25	1.375	V	R_T = 100Ω
Terminating resistor	R_T	–	100	–	Ω	–
Supply current	I_{CC}	–	300 **Note**	600	mA	V_{CC} = 5.0 V

Note: Checkered flag pattern (in EIAJ ED-2522)

(2) Backlight

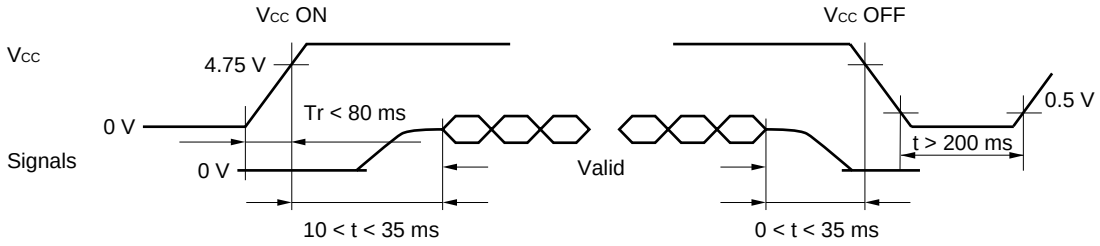
T_a = 25°C

Parameters	Symbols	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	V_{DDB}	10.8	12.0	13.2	V	–
Logic input "L" voltage 1	V_{IL1}	0	–	0.6	V	for BRTP
Logic input "H" voltage 1	V_{IH1}	4.5	–	5.25	V	
Logic input "L" voltage 2	V_{IL2}	0	–	0.8	V	for BRTC, ACA, BRTL
Logic input "H" voltage 2	V_{IH2}	2.2	–	5.25	V	
Logic input "L" current 1	I_{IL1}	–1.0	–	–	mA	for BRTP
Logic input "H" current 1	I_{IH1}	–	–	10	mA	
Logic input "L" current 2	I_{IL2}	–1.0	–	–	mA	for BRTC, ACA, BRTL
Logic input "H" current 2	I_{IH2}	–	–	0.8	mA	
Supply current	I_{DDB}	–	860	1000	mA	V_{DDB} = 12.0 V (at max. luminance)



maximum luminance control: 100 % (Duty)
minimum luminance control: 20 % (Duty)
Luminance control frequency: 243 to 297 Hz 270 Hz (typ.)

SUPPLY VOLTAGE SEQUENCE



Notes 1: Logic signals (synchronous signals and control signals) must be “0” voltage(V), when V_{CC} is not input. If input voltage to signal lines is higher than 0.3 V, the internal circuit will be damaged.

2: The supply voltage for input signals should be the same as V_{CC}.

3: Apply V_{DDB} within the LCD operation period. (more than 4 Vsync after the Vcc are input.) When the backlight turns on before LCD operation or the LCD operation turns off before the backlight turns off, the display may momentarily become white.
However, 12 V for backlight should be started up within 80 ms, otherwise, the protection circuit makes the backlight turns off.

4: When the power is off, please keep whole signals low level or high impedance.

INTERFACE AND CONNECTOR PIN ASSIGNMENT

(1) Interface connector for signal and power

Part No. : FI-SE20P-HF
Adaptable socket: FI-SE20M
Supplier : Japan Aviation Electronics Industry Limited (JAE)

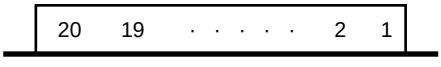
CN1

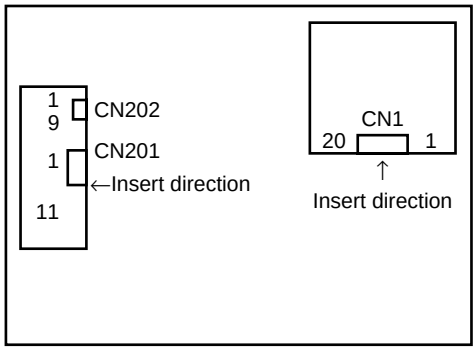
Pin No.	Symbol	Signal type	Function
1	GND	Ground	**Note 1**
2	GND		
3	NC	Non-connection	–
4	NC		
5	GND	Ground	**Note 1**
6	CK+	Pixel clock	CLK for pixel data f = 65 MHz (typ.) (LVDS level)
7	CK–		
8	GND	Ground	**Note 1**
9	D2+	Pixel data	LVDS differential data input
10	D2–		
11	GND	Ground	**Note 1**
12	D1+	Pixel data	LVDS differential data input
13	D1–		
14	GND	Ground	**Note 1**
15	D0+–	Pixel data	LVDS differential data input
16	D0–		
17	GND	Ground	**Note 1**
18	GND		
19	V_{CC}	+5.0 V power supply	Supply +5.0 V ±5%
20	V_{CC}		

Notes 1: GND is Signal ground for logic and LCD driving. The GND should be connected to system ground. The GND is not connected to FG (Frame Ground) in this module.

2: Connect all pins (expect 3.4) to the appointed places to avoid noise problems. Use 100 Ω twist pair wires for the cable.

CN1: Figure from socket view





Note: CN202 should be opened.

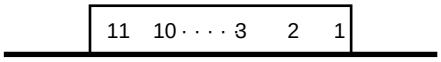
(2) Connector for backlight unit

Part No. : IL-Z-11PL1-SMTY
Adaptable socket: IL-Z-11S-S125C3
Supplier : Japan Aviation Electronics Industry Limited (JAE)

CN201

Pin No.	Symbol	Signal type	Function
1	V_{DDB}	12 V power supply	Supply +12 V ±10 %
2	V_{DDB}		
3	V_{DDB}		
4	GNDB	Ground for backlight	**Note 1**
5	GNDB		
6	GNDB		
7	ACA	Luminance control signal	"H" or "Open": Normal luminance (100%) "L" : Low luminance (1/2 of the normal luminance)
8	BRTC	Backlight ON/OFF control signal	"H" or "Open": Backlight ON "L" : Backlight OFF
9	BRTH	Luminance control signal	**Note 2**
10	BRTL	Luminance control signal	
11	N.C.		

CN201: Figure from socket view



Part No. : IL-Z-9PL1-SMTY
Adaptable socket: IL-Z-9S-S125C3
Supplier : Japan Aviation Electronics Industry Limited (JAE)

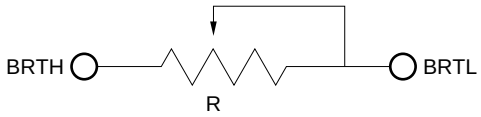
CN202

Pin No.	Symbol	Signal type	Function
1	GNDB	Ground for backlight	**Note 1**
2	GNDB		
3	ACA	Luminance control signal	"H" or "Open": Normal luminance (100%) "L" : Low luminance (1/2 of the normal luminance)
4	BRTC	Backlight ON/OFF control signal	"H" or "Open": Backlight ON "L" : Backlight OFF
5	BRTH	Luminance control signal-1	**Note 2**
6	BRTL	Luminance control signal-1	
7	BRTP	Luminance control signal-2	**Note 3**
8	GNDB	Ground for backlight	**Note 1**
9	PWSEL	Luminance control select signal	"H" or "Open": Variable resistor control or voltage control (Note 2) "L" : BRTP signal control (Note 3)

Notes 1: Neither GND nor GNDB connected to FG (Frame Ground) in this module. They should be connected to the FG of customer equipment.

2: The ways to controll luminance are as follows.

(1) A way of luminance control by a variable resistor.
The variable resistor for luminance control should be 10 kΩ , and zero point of the resistor corresponds to the minimum of luminance.

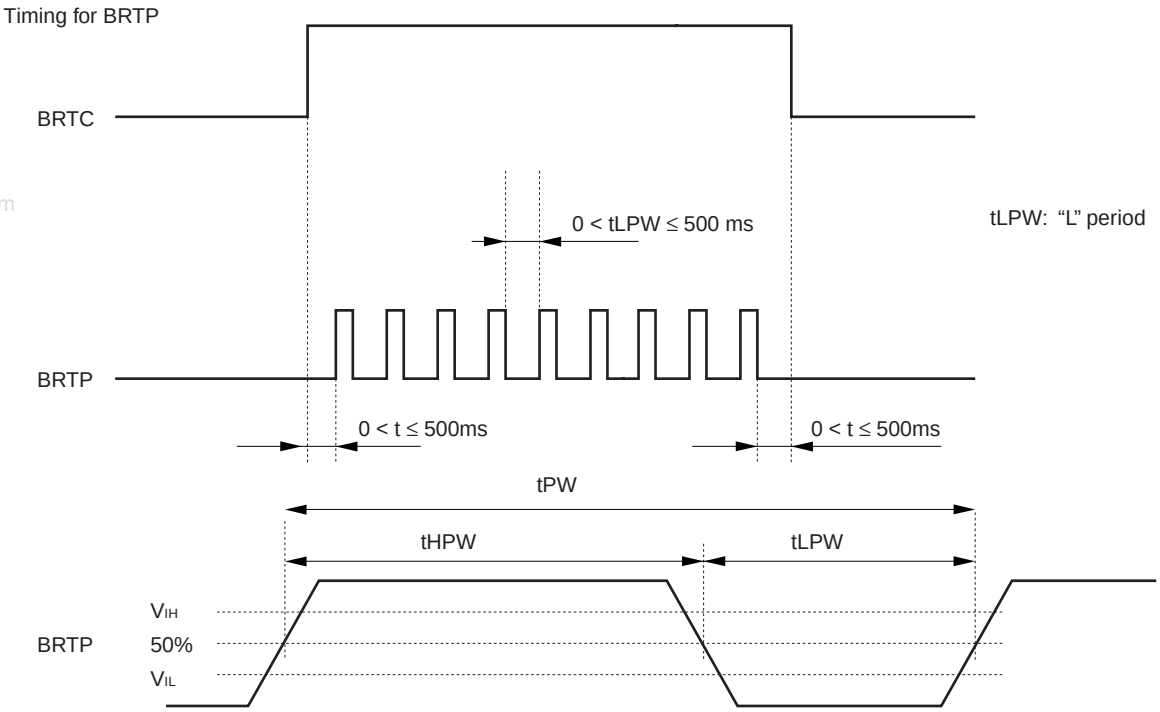


Mating variable resistor : 10 kΩ ±5% (1/10 W), B curve
Maximum luminance (100 %): R = 10 KΩ
Minimum luminance (30 %) : R = 0 Ω

(2) A way of luminance control by voltage
BRTH should be fixed to 0 V to control luminance by voltage. The range of input voltage between BRTL and GNDB is as follows.
Maximum luminance (100%, ACA = H) : 1 V (typ.)
Minimum luminance (30%, ACA = H) : 0 V

3: The way of luminance control with BRTP signal

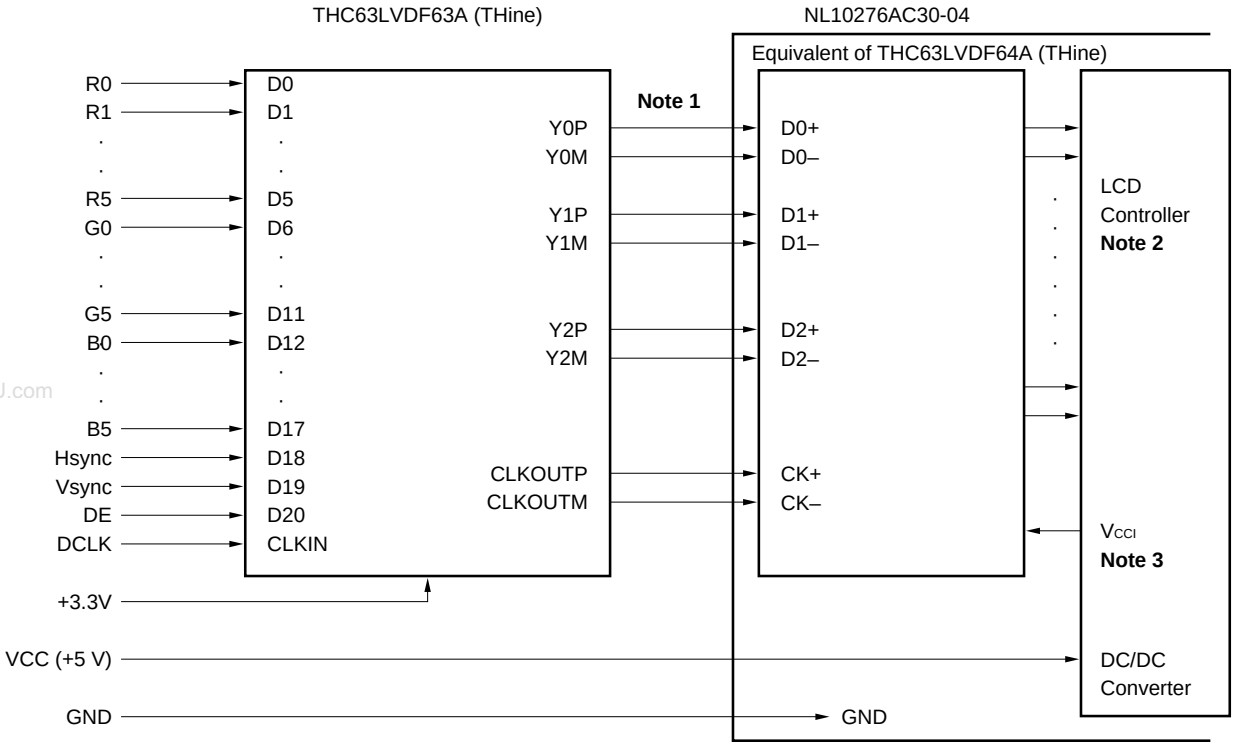
When PWSEL is “L,” inputting signal pulse from the outside to BRTP enables to control the luminance. The luminance can be controlled by the duty value of the input signal.
Duty = 100%: luminance is maximum. (100%)
Duty = 20%: luminance is minimum. (30%)



Parameters	Symbols	Min.	Typ.	Max.	Unit	Remarks
Frequency	1/tPW	185	–	340	Hz	–
Pulse-width	tHPW/tPW	20	–	100	%	at max. luminance (100%)
Input voltage	V_{IL}	0	–	0.6	V	–
	V_{IH}	4.5	–	5.0	V	–

Regarding set up for frequency, refer to the below formula.
Set up frequency = Vsync frequency × (n + 0.25) or (n + 0.75)
But, please fix the frequency after evaluating the display quality sufficiently, because it can be disturbed due to the frequency.

METHOD OF CONNECTION FOR THC63LVDF63A



Notes 1: 100 Ω twist pair.

2: These signals should be kept the range specified by Page 13 **INPUT SIGNAL TIMING**.

3: V_{CCI} = 3.3 V (LCD internal voltage)

4: THC63LVDF63A is used as LVDS transmitter at the shipping inspection.

DISPLAY COLORS vs. INPUT DATA SIGNALS

Display colors		Data signal (0: Low level, 1: High level)																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	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 grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	dark	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑																		
	↓																		
	bright	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	↑																		
	↓																		
	bright	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
		0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑																		
	↓																		
	bright	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note: Colors are developed in combination with 6-bit signals (64 steps in grayscale) of each primary red, green, and blue color.

This process can result in up to 262,144 ($64 \times 64 \times 64$) colors.

INPUT SIGNAL TIMING

(1) Input signal specifications for LCD controller

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remarks
CLK	Frequency	1/tc	60.0	65.0	68.0	MHz	15.385 ns (typ.)
	Duty	tch/tc	**Note**			–	–
	Rise, fall	tcrf				ns	–
Hsync	Period	th	16.0	20.676	22.7	μs	48.363 kHz (typ.)
			1110	1344	–	CLK	
	Display period	thd	–	1024	–	CLK	–
	Front-porch	thf	0	–	–	CLK	–
	Pulse width	thp*	12	–	–	CLK	–
	Back-Porch	thb*	2	–	–	CLK	–
	*thp + thb		86	–	–	CLK	–
	Hsync-CLK timing	ths	**Note**			ns	–
	CLK-Hsync timing	thh				ns	–
	DE-CLK timing	tes				ns	–
	CLK-DE timing	teh				ns	–
	Rise, fall	thrf				ns	–
Vsync	Period	tv	–	16.666	–	ms	60.004 Hz (typ.)
			–	806	–	H	
	Display period	tvd	–	768	–	H	–
	Front-porch	tvf	1	–	–	H	–
	Pulse width	tvp*	1	3	–	H	–
	Back-porch	tvb*	1	–	–	H	–
	*tvp + tvb		3	–	–	H	–
	Vsync-Hsync timing	tvs	1	–	–	CLK	–
	Hsync-Vsync timing	tvh	1	–	–	CLK	–
	Rise, fall	tvrf	**Note**			ns	–
DATA	DATA-CLK (set up)	tds				ns	–
	CLK-DATA (Hold)	tdh				ns	–

Note: These values are in the timing standards of THC63LVDF63A. The timing standard prescribes in the input of LCD transmitter. THC63LVDF63A is recommended for LVDS transmitter.

(2) Input signal of LVDS RECEIVER (It is preseribed for the part CN1 input)

Parameters	Symbols	Min	Typ.	Max.	Unit	Remarks
CLK Frequency	TRCP	14.71	T	16.66	ns	–
Bit0 position	TRIP1	–0.5	0	0.5	ns	T = 15.38 ns
Bit1 position	TRIP0	T/7–0.5	T/7	T/7+0.5	ns	T = 15.38 ns
Bit2 position	TRIP6	2T/7–0.5	2T/7	2T/7+0.5	ns	T = 15.38 ns
Bit3 position	TRIP5	3T/7–0.5	3T/7	3T/7+0.5	ns	T = 15.38 ns
Bit4 position	TRIP4	4T/7–0.5	4T/7	4T/7+0.5	ns	T = 15.38 ns
Bit5 position	TRIP3	5T/7–0.5	5T/7	5T/7+0.5	ns	T = 15.38 ns
Bit6 position	TRIP2	6T/7–0.5	6T/7	6T/7+0.5	ns	T = 15.38 ns

Note: See the specifications of LVDS manufactures for detailed design.

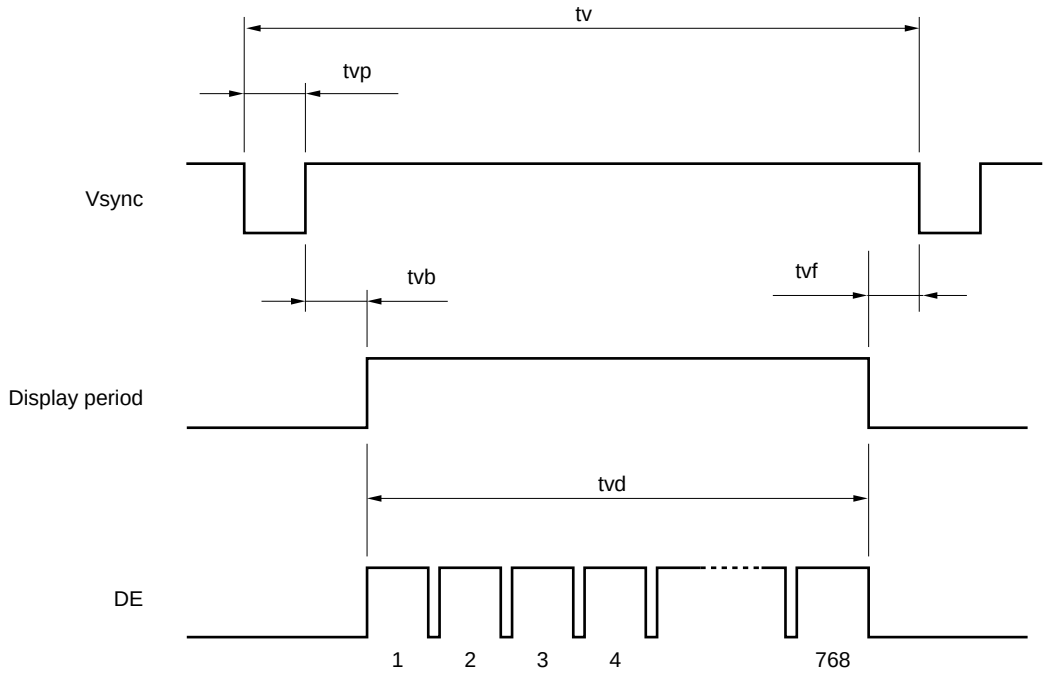
In case that CLK jitter value between current cycle and next cycle is big, skew time of the next cycle decreases with the value of the jitter.

CLK jitter + LVDS output skew + cable skew ≤ 500 ps

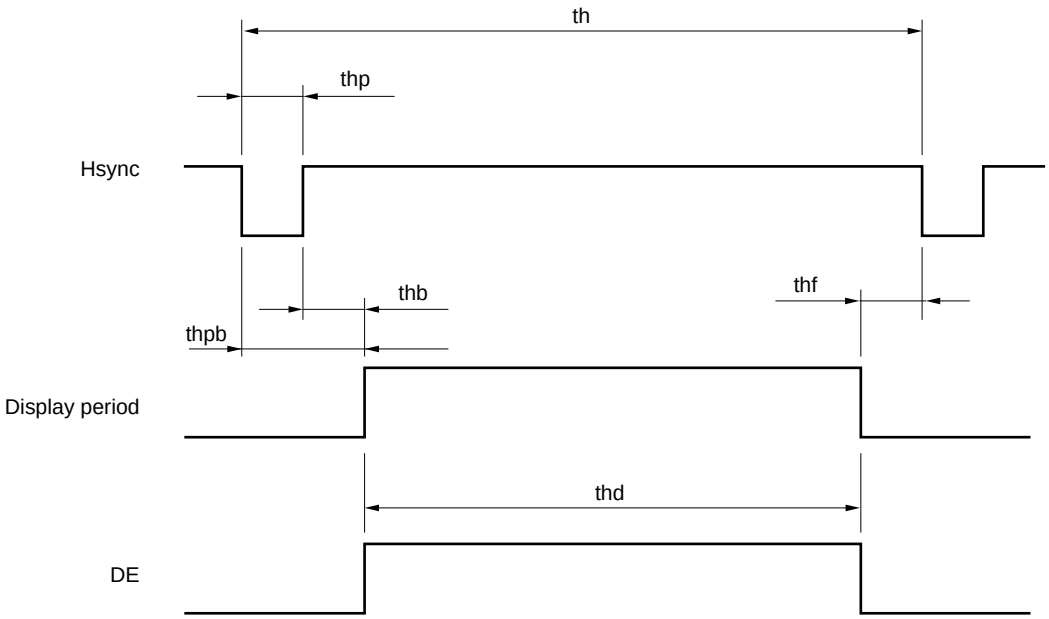
e.q. LVDS output skew: ± 200 ps
Cable skew: ± 100 ps
} acceptable CLK jitter = ± 200 ps (500 – (200 + 100) = 200 ps)

(3) Definition of input signal timing for LCD controller

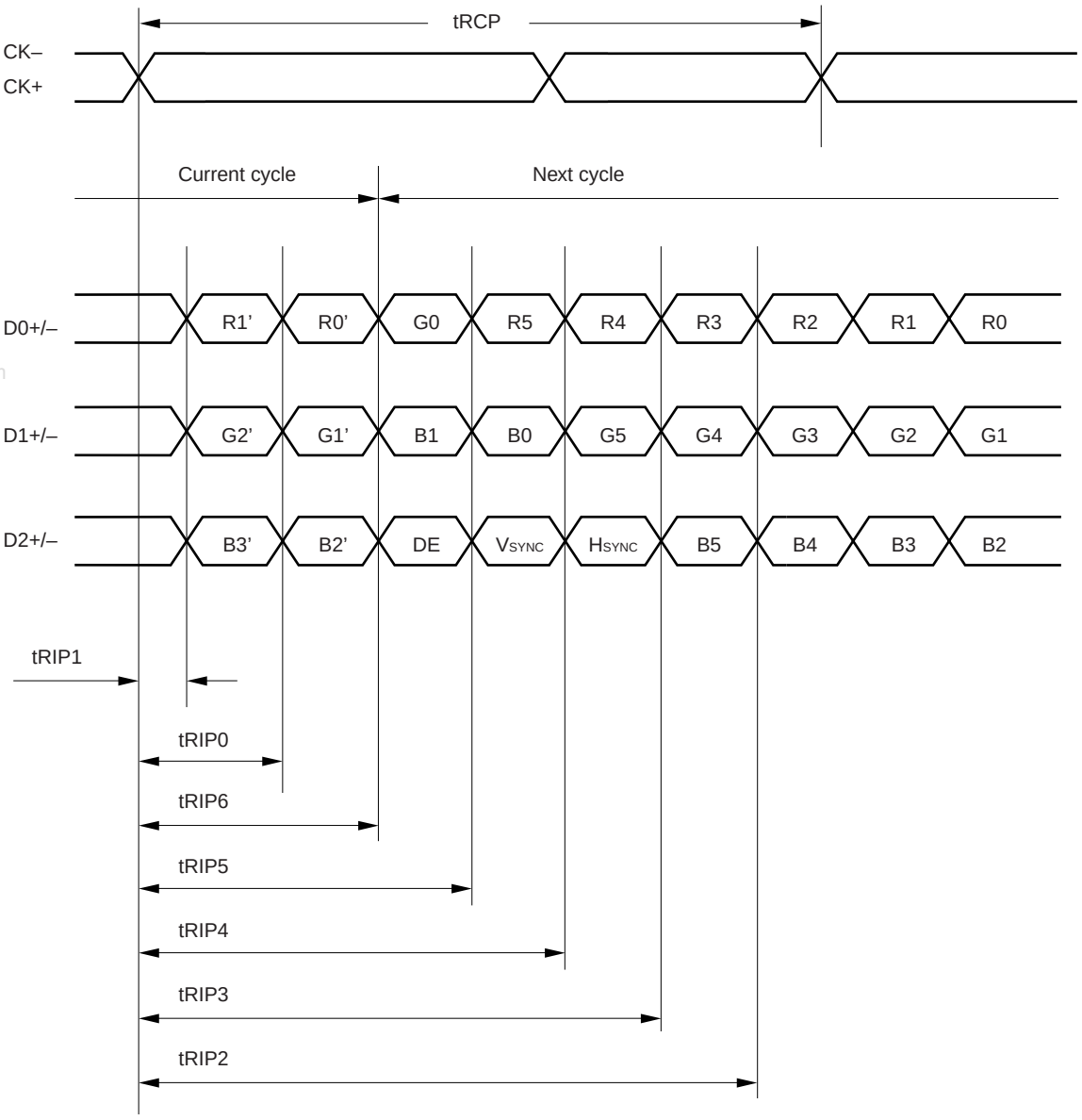
<Vertical>

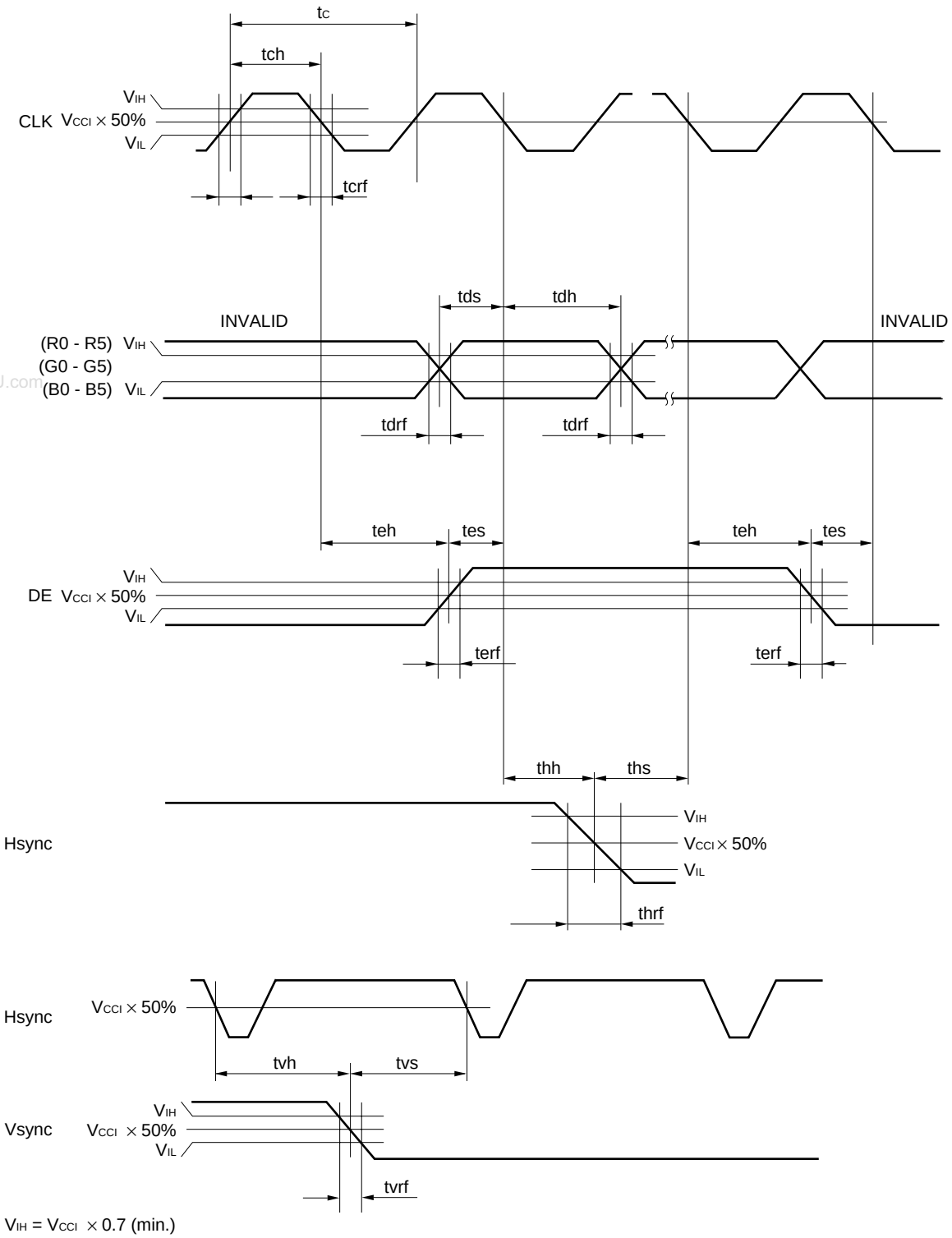


<Horizontal>



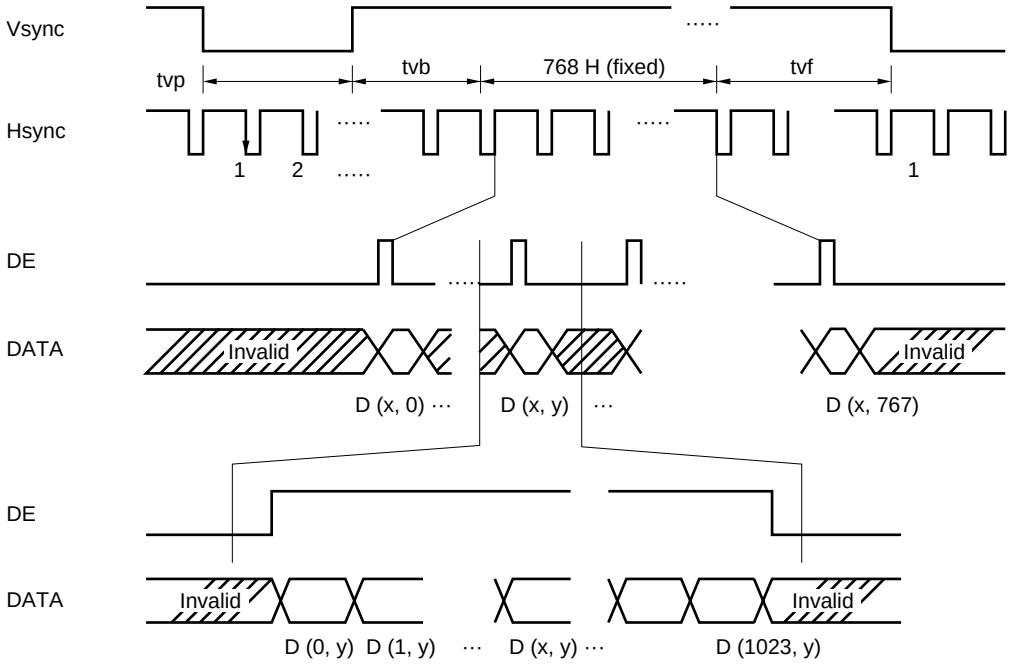
<LVDS Receiver>

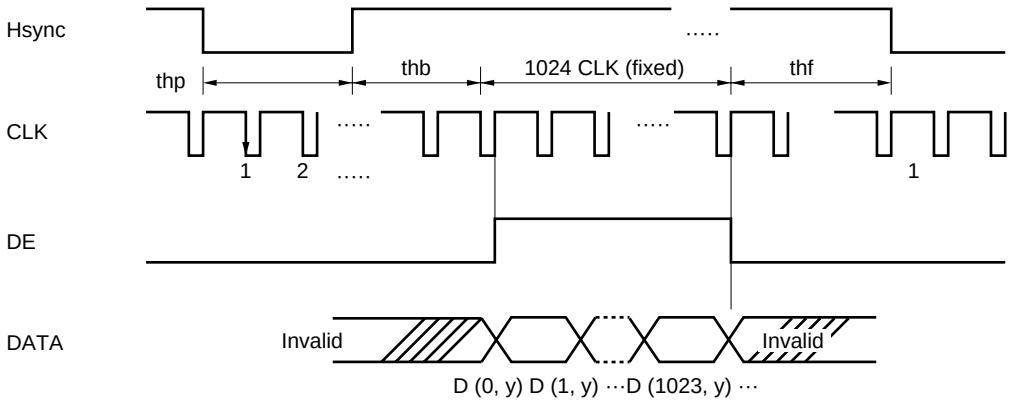




$V_{IH} = V_{CCI} \times 0.7$ (min.)
$V_{IL} = V_{CCI} \times 0.3$ (max.)
V_{CCI} = 3.3 V (LCD internal voltage)

(4) Input signal timing chart FOR LCD





Note: These values are in the output of THC63LVDF64A.
(Refer to Page 11 **METHOD OF CONNECTION FOR THC63LVDF63A**).

(5) Display position of input data

D (0, 0)	D (1, 0)	–––	D (X, 0)	–––	D (1022, 0)	D (1023, 0)
D (0, 1)	D (1, 1)	–––	D (X, 1)	–––	D (1022, 1)	D (1023, 1)
¦	¦	–¦–	¦	–¦–	¦	¦
D (0, Y)	D (1, Y)	–––	D (X, Y)	–––	D (1022, Y)	D (1023, Y)
¦	¦	–¦–	¦	–¦–	¦	¦
D (0, 766)	D (1, 766)	–––	D (X, 766)	–––	D (1022, 766)	D (1023, 766)
D (0, 767)	D (1, 767)	–––	D (X, 767)	–––	D (1022, 767)	D (1023, 767)

OPTICAL CHARACTERISTICS

(T_a = 25°C, V_{CC} = 5 V, V_{DDB} = 12 V, **Note1**)

Parameters	Symbols	Conditions	Min.	Typ.	Max.	Unit	Remarks
Contrast ratio	CR	White/Black, **Note1**	80	200	–	–	**Note 2**
Luminance	Lumax	"White"	150	200	–	cd/m^2	**Note 3**
Luminance uniformity	–	Maximum luminance / Minimum luminance	–	–	1.30	–	**Note 4**

Reference data

(T_a = 25°C, V_{CC} = 5 V, V_{DDB} = 12 V)

Parameters		Symbols	Conditions	Min.	Typ.	Max.	Unit	Remarks
Contrast ratio		CR	Best contrast angle, θR = 0°, θL = 0° θD = 5° White/Black, at center	–	450	–	–	**Note 2**
Color gamut		C	θR, θL, θU, θD = 0° At center, To NTSC	35	40	–	%	–
Viewing angle range (CR>10)	Horizontal	θR	CR > 10, White/Black	50	60	–	deg.	**Note 5**
		θL	θU = 0°, θD = 0°	50	60	–	deg.	
	Vertical	θU	CR > 10, White/Black	30	40	–	deg.	
		θD	θR = 0°, θL = 0°	35	50	–	deg.	
Response time		Ton	White (100%) to black (10%)	–	15	40	ms	**Note 6**
		Toff	Black (0%) to white (90%)	–	40	80		
Luminance control range		–	Maximum luminance: 100%	–	30 to100	–	%	–

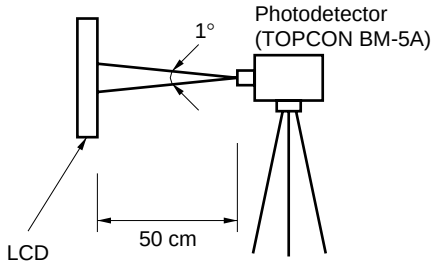
Notes 1: Viewing angle : θR = 0°;θL = 0°, θU = 0°, θD = 0°, At center

2: The contrast ratio is calculated by using the following formula.

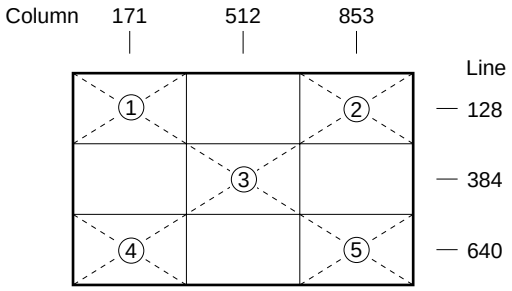
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance with all pixels in white}}{\text{Luminance with all pixels in black}}$$

The Luminance is measured in darkroom.

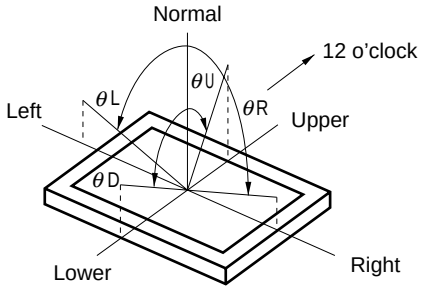
3: The luminance is measured after 20 minutes from the module works, with all pixels in white. Typical value is measured after luminance saturation.



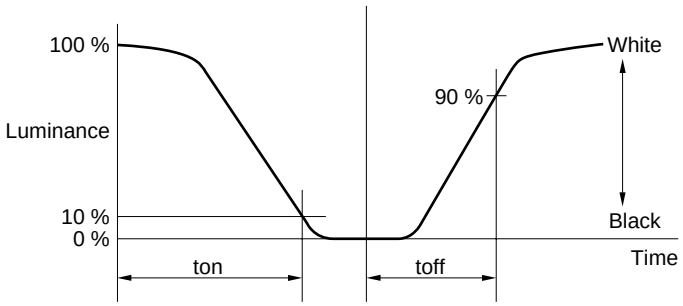
4. The luminance uniformity is calculated by using the formula in the table.
The luminance is measured at near the five points shown below.



5. Definitions of viewing angle are as follows.



6. Definition of response time is as follows.



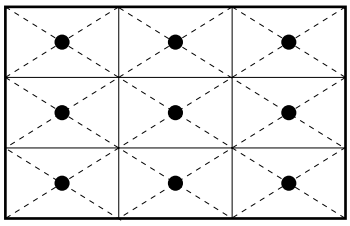
RELIABILITY TEST SPECIFICATIONS

Test items	Test conditions	Judgment
High temperature/humidity (operation)	50 ± 2°C, 85% relative humidity 240 hours Display data is black.	**Note 1**
Heat cycle (operation)	<1> 0°C ± 3°C ⋯ 1 hour 55°C ± 3°C ⋯ 1 hour <2> 50 cycles, 4 hours/cycle <3> Display data is black.	**Note 1**
Thermal shock (non-operation)	<1> –20°C ± 3°C ⋯ 30 minutes 60°C ± 3°C ⋯ 30 minutes <2> 100 cycles <3> Temperature transition time within 5 minutes.	**Note 1**
Vibration (non-operation)	<1> 5 - 100 Hz, 19.6 m/s^2 (2G) 1 minute/cycle X, Y, Z direction <2> 50 times each direction	**Notes 1, 2**
Mechanical shock (non-operation)	<1> 294 m/s^2 (30G), 11 ms X, Y, Z direction <2> 3 times each direction	**Notes 1, 2**
ESD (operation)	150 pF, 150 Ω, ±10 kV 9 places on a panel 10 times each place at one-second intervals	**Notes 1, 3**
Dust (operation)	15 kinds of dust (JIS Z 8901) Hourly 15 seconds stir, 8 times repeat	**Note 1**

Notes 1: Display function is checked by the same condition as LCD module out-going inspection.

2: Physical damage.

3: Discharge points "●" are shown in the figure.



GENERAL CAUTIONS

Next figures and sentence are very important. Please understand the following contents.

 CAUTION	This mark indicates that you will get hurt and/or the module will have damages when you make a mistake to operate.

	This mark indicates that you will get an electric shock when you make a mistake to operate.
	This mark indicates that you will get hurt when you make a mistake to operate

 CAUTION

 Do not touch an inverter, on which a caution label is stucked, while the LCD module is under the operation, because of dangerous high voltage.

(1) Caution when taking out the module

a) Pick the pouch only, in taking out module from a carrier box.

(2) Cautions for handling the module

a) As the electrostatic discharges may break the LCD module, handle the LCD module with care against electrostatic discharges.

b)  As the LCD panel and backlight element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.

c) As the surface of polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.

d) Do not pull the interface connectors in or out while the LCD module is operating.

e) Put the module display side down on a flat horizontal plane.

f) Handle connectors and cables with care.

g) When the module is operating, do not lose CLK, Hsync or Vsync signal. If any one or more of these signals is lost, the panel would be damaged.

h) The torque to mounting screw should never exceed 0.392 N·m (4 kgf·cm).

i) Don't push or rub the surface of the module. If you do it, the scratches or the rubbing marks may be left on the module surface.

(3) Cautions for the atmosphere

a) Dew drop atmosphere should be avoided.

b) Do not store and/or operate the module in a high temperature and/or high humidity atmosphere. Storage in an anti-static pouch and under the room temperature atmosphere is recommended.

c) This module uses cold cathod fluorescent lamps. Therefore, the life time of the lamps become short if the module is operated under the low temperature environment.

d) Do not operate the module in a high magnetic field.

(4) Caution for the module characteristics

a) Do not apply fixed pattern data signal for a long time to the module. It may cause image sticking. Please use screen savers if the display pattern is fixed more than one hour.

b) This module has the retardation film which may cause the variation of the color hue in the different viewing angles. The ununiformity may appear on the screen under the high temperature operation.

c) The light vertical stripe may be observed depending on the display pattern. This is not defects or malfunctions.

d) The noise from the inverter circuit may be observed in the luminance control mode. This is not defects or malfunctions.

(5) Other cautions

a) Do not disassemble and/or reassemble LCD module.

b) Do not readjust variable resistors or switches in the module.

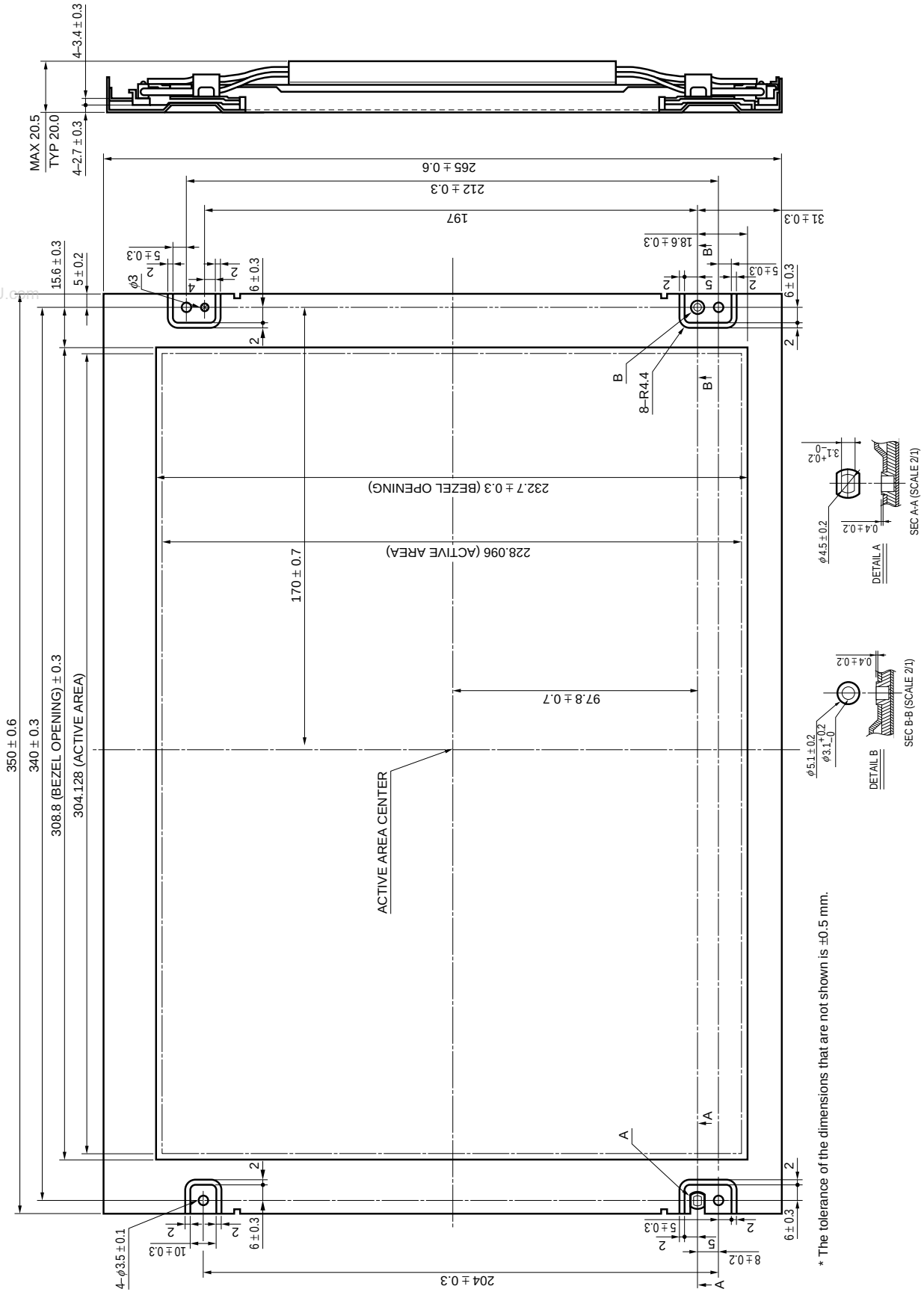
c) When returning the module for repair etc., please pack the module properly to avoid any damages. We recommend using the original shipping packages.

Liquid Crystal Display has the following specific characteristics. There are not defects or malfunctions.

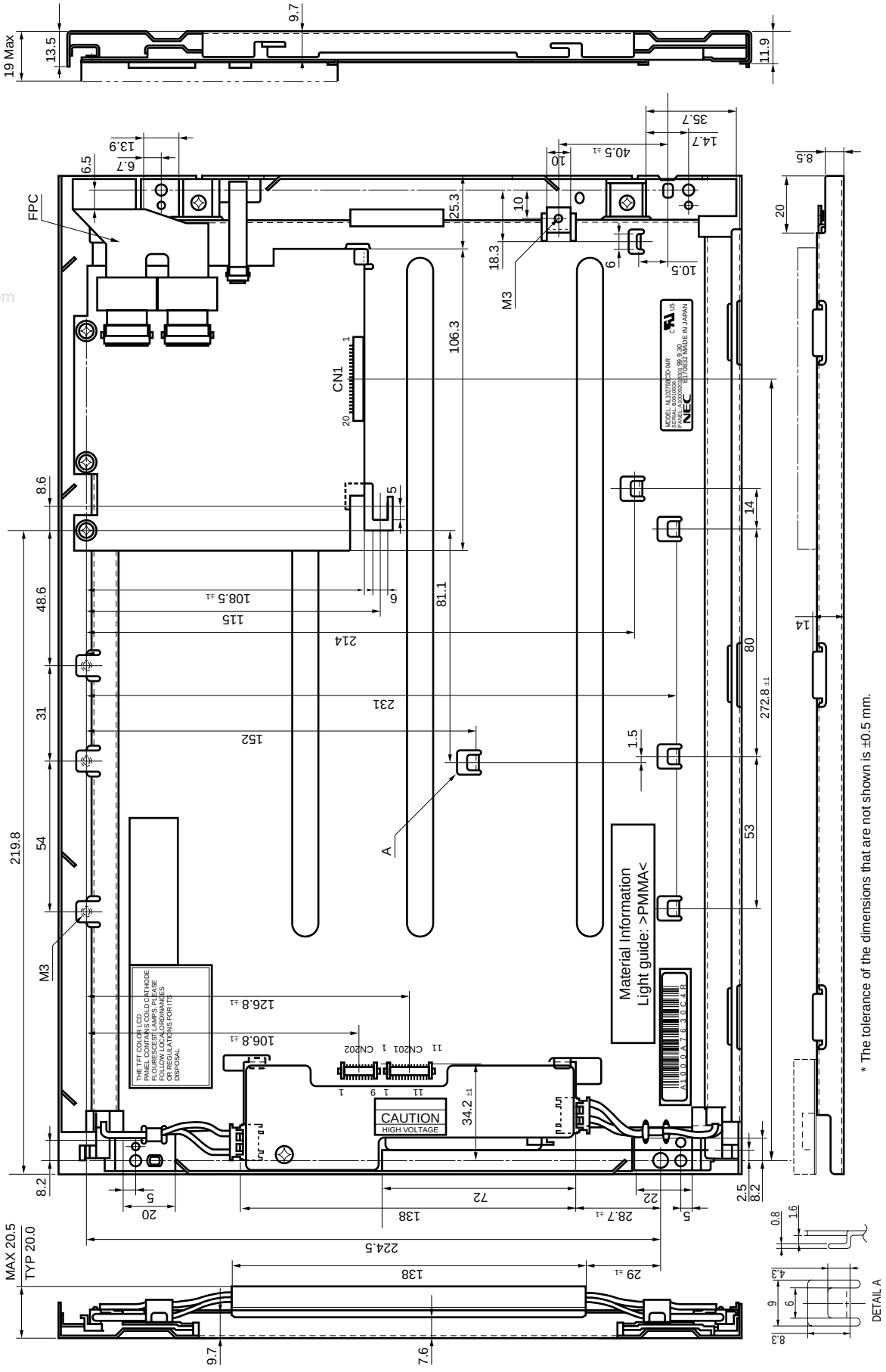
The optical characteristics of this module may be affected by the ambient temperature.
This module has cold cathode tube for backlight. Optical characteristics, like luminance or uniformity, will be changed by the progress in time.

Uneven brightness and/or small spots may be observed depending on different display patterns.

OUTLINE DRAWING (1/2): Front View (Unit: mm)



OUTLINE DRAWING (2/2): Rear View (Unit: mm)



No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents. Copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its Electronic Components, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC Electronic Components, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books.

If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.