RoHS Compliant

GMF32024ABTW

OVERVIEW

GMF32024ABTW is a graphic LCD module with 320 x 240 dots resolution.
It is a transmission-mode, blue-mode STN LCD. And a graphic patterns, numbers, alphabets, symbols, etc. can displayed by connecting the circuit composed of MPU, RAM and control LSI outside.

FEATURES

STN liquid crystal panel with wide viewing angle
Low power consumption
Display off terminal
CCFL backlight
Temperature compensation circuit is built in

compliance with the RoHS directive (issued on February 2003).

PRODUCT SPECIFICATIONS

Item	Specification	Unit
Number of dots	320(width) x 240(height)	dots
Dimensions *1	150(width) x 96(height) x 14Max(thickness)	mm
Effective display area	103(width) x 79(height)	mm
Dot display area	95.97(width) x 71.97(height)	mm
Dot size	0.27(width) x 0.27(height)	mm
Dot pitch	0.30(width) x 0.30(height)	mm
Display color *2 Blue mode (negative image)	display data "H" : White	
	display data "L" : Blue	
Backlight	CCFL / white	
Duty ratio	1/240	duty
Screen configuration		screen
Data transfer method	4-bit parallel data transfer	
Weight	approx. 200	g

*1: See drawings of each product for further details.
*2: A property of liquid crystal, as seen in this LCD panel, is that it's color tone changes with variations in ambient temperature.

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ABSOLUTE MAXIMUM RATINGS

ENVIRONMENTAL CONDITIONS

Item		Minimum	Maximum	Remarks
Ambient temperature	Operating	0	50	
	storage	20	70	
Humidity				There must be no condensation
Vibration		In accordance with JIS C 60068-2-6:1999		Refer to RELIABILITY TESTING
Mechanical Shock		In accordance with JIS C 60068-2-27:1995		Refer to RELIABILITY TESTING
Corrosive gas		There must be no corrosive gas		

*1: Ta +40   90%RH MAX.

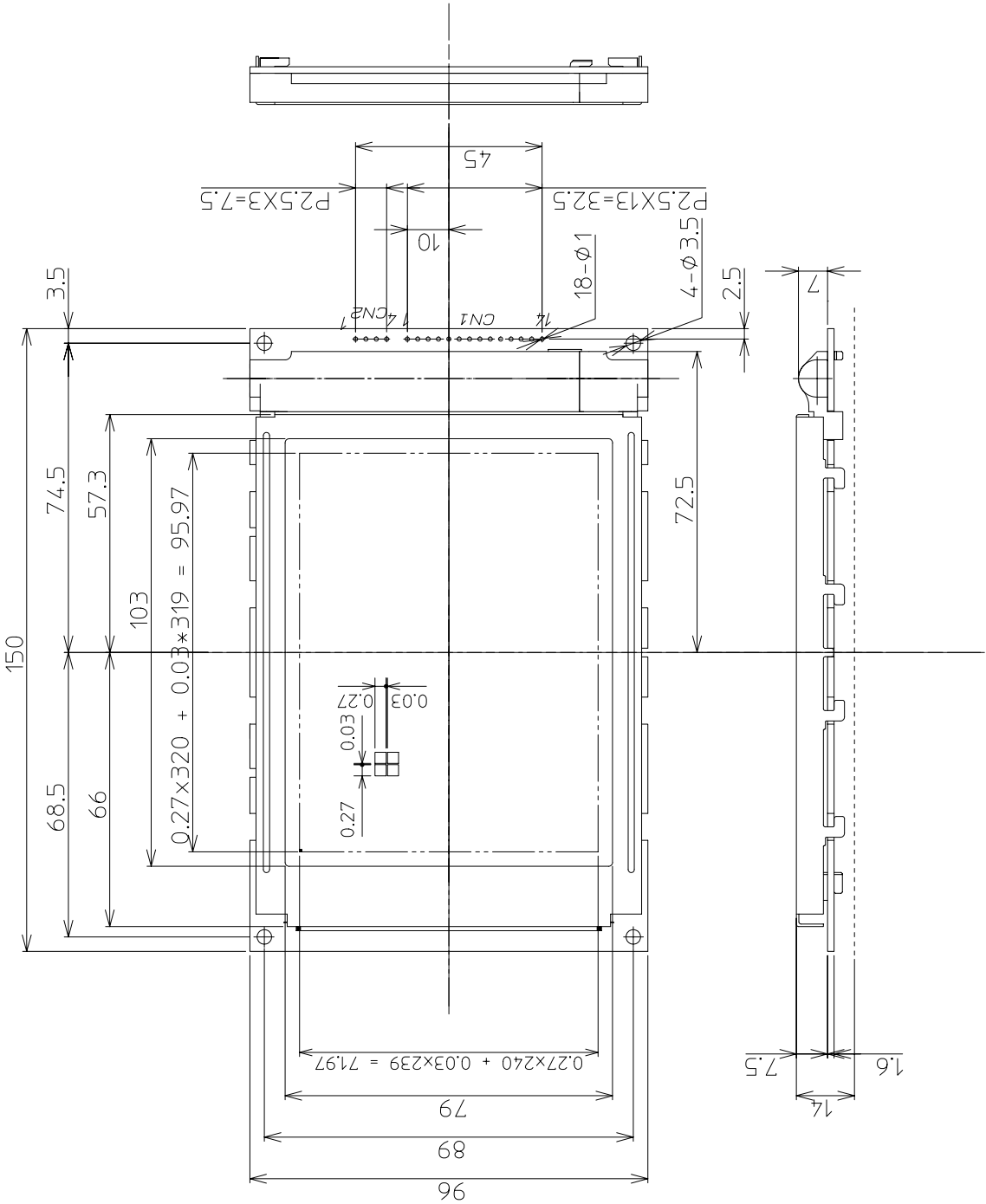Ta +40   The absolute humidity must be less than 90%RH at Ta = +40°C.

ELECTRICAL CONDITIONS

(Ta=0   +50)

Item	Symbol	Minimum	Maximum	Unit	Remarks
Voltage of the logic power supply	VDD-VSS	0	7	V	
Voltage to be input to a logic circuit	VI	VSS	VDD 0.3	V	
Voltage of the power supply for driving the LCD	VDD-VEE	0	35	V	
Voltage for driving LCD	VDD-Vo	0	26	V	VEE Vo
Circuit voltage for CCFL	VS	750	2000	Vrms	
CCFL Lamp current	IL	3	15	mArms	
Operating frequency for CCFL	fCCFL	20	200	kHz	

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OUTDIMENSION

tolerance without instruction is ± 0.5mm

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ELECTRICAL SPECIFICATIONS

BLOCK DIAGRAM

LCD driving section

FLM ————→ IC1 ——→ Y1

CL1 ————→

M generator ——→ IC2

LCD (320X240dots)

IC3 ——→ Y240

X1   X320

D0
D1
D2
D3
CL2

IC4   IC5   IC6   IC7

VDD
VSS
VEE
Vo

dividing circuit ——→ IC 1~7

D·OFF

Backlight section

CCFL1 ————→ CCFL backlight

CCFL2 ————→

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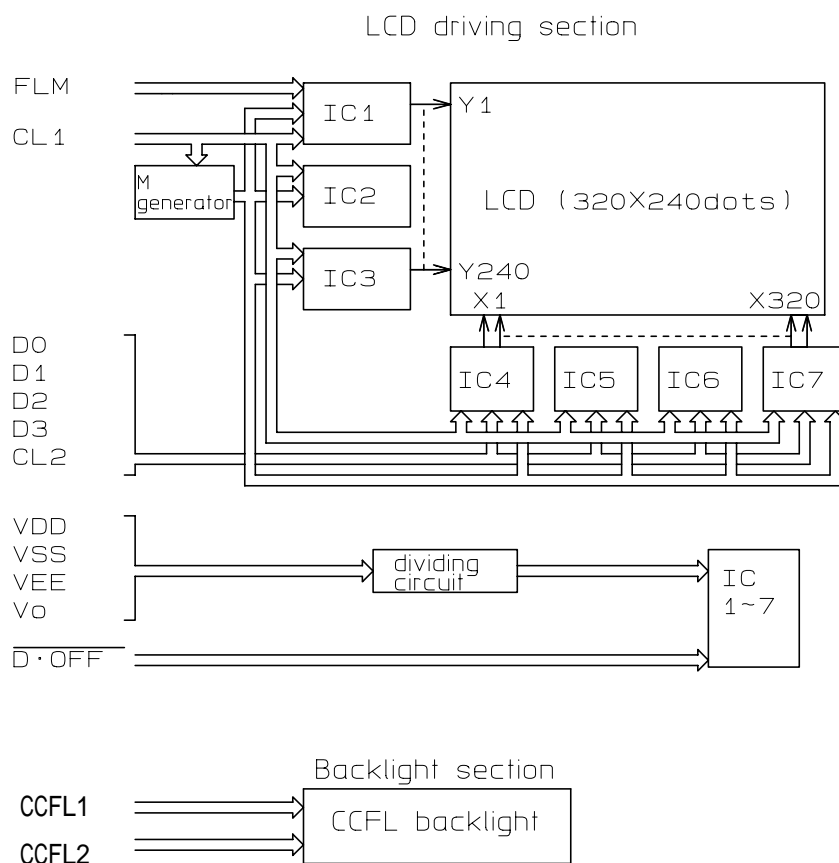
ELECTRICAL CHARACTERISTICS - LCD OPERATION

(Ta=+25 ,VEE=-24V, duty=1/240)

Item	Symbol	Minimum	Typical	Maximum	Unit	Remarks
Voltage of the power supply	VDD-VSS	4.5	5	5.5	V	-
	VDD-VEE	-	-	-	V	-
Current of the power supply VDD-Vo = 23.3V fCL1 = 18kHz	IDD	-	9	18	mA	-
	Io	-	-	-	mA	
	IEE	-	10	20	mA	
Input H-level voltage	VIH	0.7VDD	-	VDD	V	-
Input L-level voltage	VIL	VSS	-	0.3VDD	V	-
Voltage of LCD driving	VDD-Vo	-	23.3	-	V	*1
Latch pulse frequency	fCL1	14.4	18	21.6	kHz	-

*1: The display contrast of this product varies depending on the LCD supply voltage (VDD-Vo). Please adjust your supply voltage to optimize the contrast to Ta = 25°C (the above chart is for reference only). For information on the power supply circuit, refer to Examples of Power Supply.
This product has a built-in temperature compensating circuit.

ELECTRICAL CHARACTERISTICS - CCFL BACKLIGHTING

(fCCFL 60kHz,Ta=+25)

Item	Symbol	Condition	Minimum	Typical	Maximum	Unit
Circuit voltage for CCFL	VS		750			Vrms
Lamp voltage for CCFL	VL		200	230	260	Vrms
CCFL Lamp current	IL		6.5	7	7.5	mArms
Operating frequency for CCFL	fCCFL		50	60	70	kHz
Power consumption	PCCFL			(1.61)		Wrms

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ELECTRICAL CHARACTERISTICS - TERMINAL FUNCTIONS
(LCD drive section)

Pin No.	Symbol	Effective signal level	Function
	FLM	H/L	Scan start signal
	NC		Not connected
	CL1	H L	Display scan line shift Signal
	CL2	H L	Display data receive Signal
	/D off	H/L	Display-off signal(H:on L:off) *1
	D0	H/L	
	D1	H/L	4-bit parallel data
	D2	H/L	(refer to
	D3	H/L	"DISPLAYED DATA RELATIVE TO THE LCD PANEL(SCREEN)")
	VDD		Logic power supply(5V)
	VSS		Ground(GND)
	VEE		Power supply for driving the LCD (-24V)
	Vo		Contrast adjustment voltage *2
	FG		Frame ground *3

*1: The /D off terminal is pulled up to VDD inside the LCD module.
   (The pull-up resistance value is 100 kΩ.)
*2: Refer to "EXAMPLES OF POWER SUPPLY".
*3: FG terminal is connected to metal frame and PWB pattern of an installation hole.

CCFL backlighting section

Pin No.	Symbol	Effective signal level	Function
	CCFL1	AC	Power supply for CCFL (high-voltage side)
	NC		Not connected
	NC		Not connected
	CCFL2		Ground for CCFL

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EXAMPLES OF POWER SUPPLY

LCD module

*1：VR=30~50KΩ
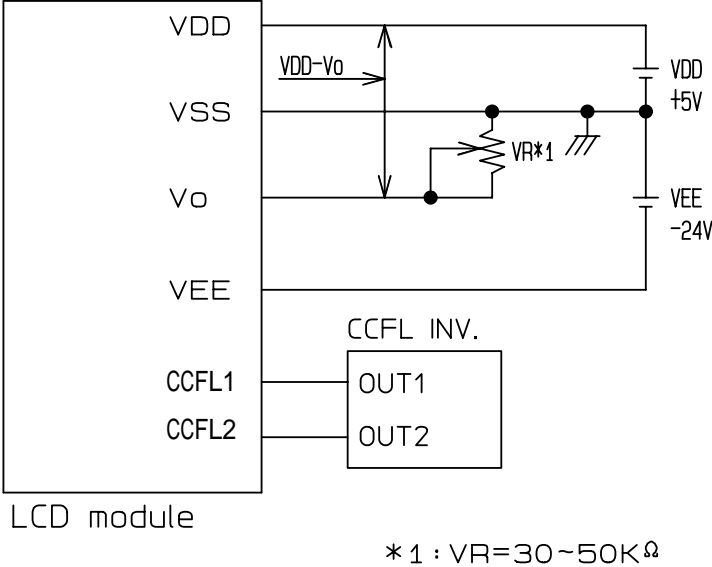
DISPLAYED DATA RELATIVE TO THE LCD PANEL(SCREEN)

	X1	X2	X3	X4		X317	X318	X319	X320
Y1	D3	D2	D1	D0		D3	D2	D1	D0
Y2	D3	D2	D1	D0		D3	D2	D1	D0
Y3	D3	D2	D1	D0		D3	D2	D1	D0
Y239	D3	D2	D1	D0		D3	D2	D1	D0
Y240	D3	D2	D1	D0		D3	D2	D1	D0

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ELECTRICAL CHARACTERISTICS — INTERFACE TIMING CHARACTERISTICS

Item	Symbol	Minimum	Typical	Maximum	Unit
Shift clock cycle	tCYC2	167			nsec
Shift clock "H" pulse width	tCWH2	50			nsec
Shift clock "L" pulse width	tCWL2	50			nsec
Data setup time	tDS	30			nsec
Data hold time	tDH	30			nsec
Latch pulse "H" pulse width	tCWH1	63			nsec
Latch pulse "L" pulse width	tCWL1	1			μsec
Latch setup time	tCLS	80			nsec
Latch hold time	tCLH	110			nsec
Latch pulse cycle time	tCYC1	46.3	55.6	69.4	μsec
Frame setup time	tFLS	100			nsec
Frame hole time	tFLH	100			nsec
Rise time of input signal *1	tr1			50	nsec
Fall time of input signal *1	tf1			50	nsec
Rise time of /D OFF signal	tr2			200	nsec
Fall time of /D OFF signal	tf2			200	nsec

*1: Rise time of input(tr) and fall time of input(tf) have to satisfy both the following
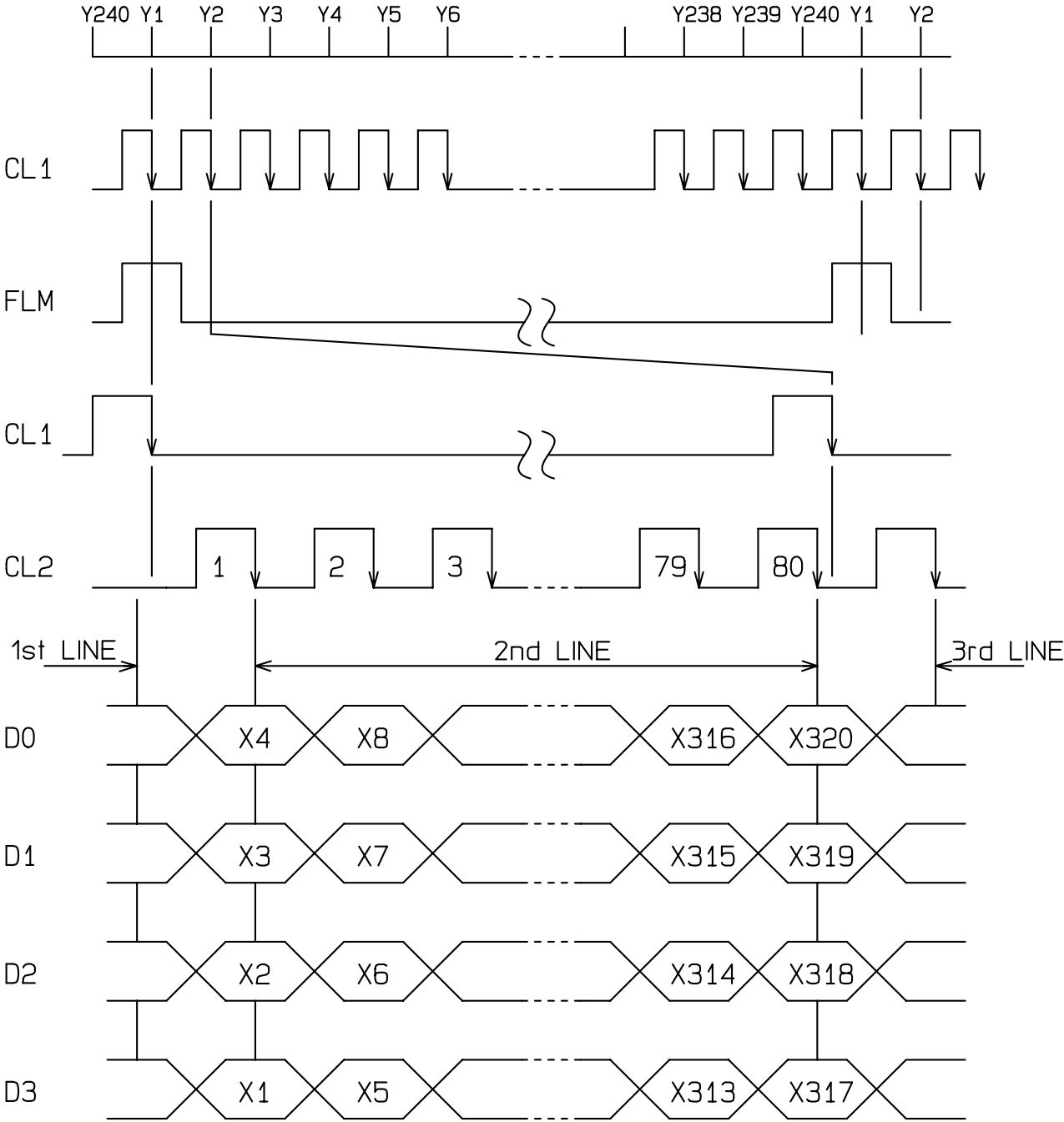   (1) and (2) at the same time.
   (1): $tr1, tf1 < (tCYCx - tCWHx - tCWLx)/2$ x=1 and 2
   (2): $tr1, tf1 < 50nsec$

ELECTRICAL CHARACTERISTICS − INTERFACE TIMING CHART

FLM

0.7VDD
0.3VDD

tFLS   tFLH

tf1   tCWL1   tr1   tCWH1   tf1   tCYC1

CL 1

0.7VDD
0.3VDD

tCYC2

tr1   tCWH2   tCWL2   tCLS   tCLH

CL 2

0.7VDD   tf1   0.3VDD

tDH

tDS

D0~3

0.7VDD
0.3VDD

tr2   tf2

D.off

0.7VDD   0.7VDD
0.3VDD   0.3VDD
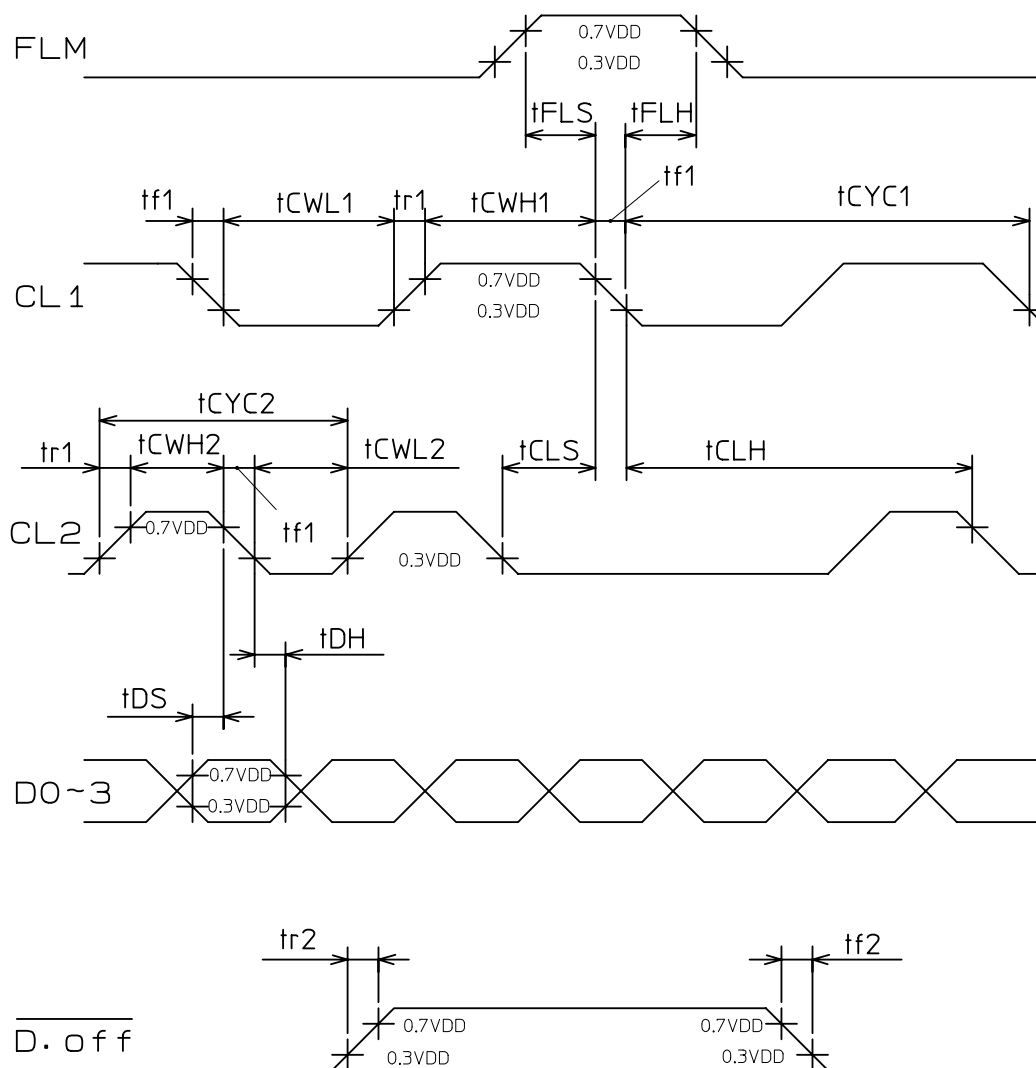
ELECTRICAL CHARACTERISTICS — DATA IMPORT TIMING CHART

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OPTICAL CHARACTERISTICS – INTERFACE TIMING

CHARACTERISTICS OF THE LCD PANEL

(duty=1/240)

Item	Symbol	Temperature	Minimum	Typical	Maximum	Unit	Remarks
LCD drive voltage value (Recommended)	VLCD	0		24			*1
		+25		22.7			
		+50		20.5			
Range of viewing angles		+25	-30		+30	°	*2
			-40		+40		
Contrast ratio		+25	2.5				*3
Rise response time		+25		200	300	msec	*4
Fall response time		+25		250	400		

Note: Above values were measured by using general non-selected condition waveforms as liquid crystal drive waveforms.

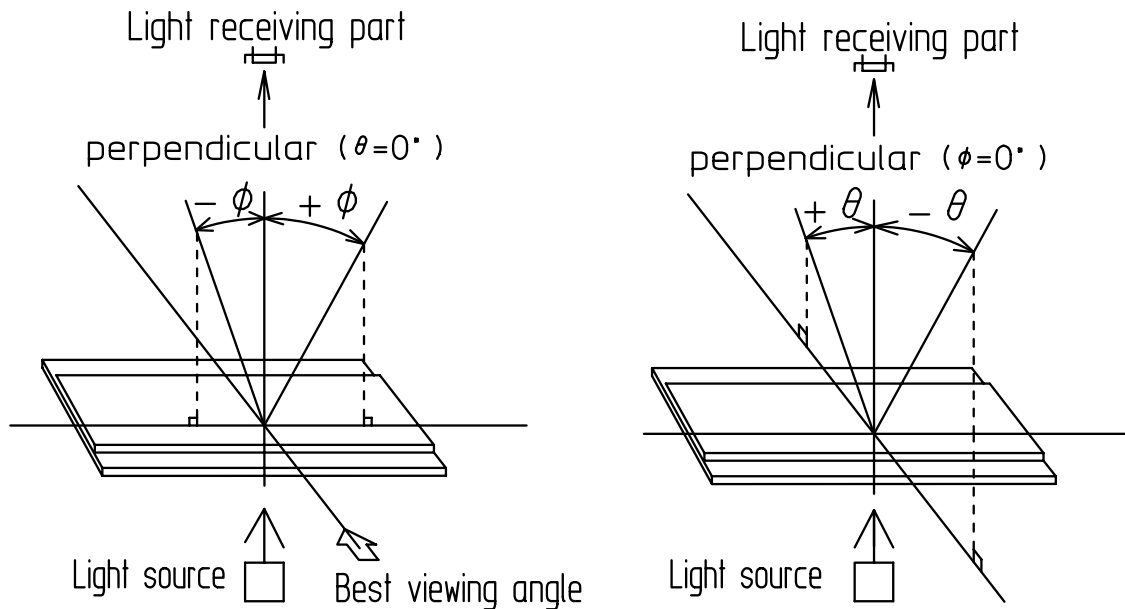Outline of the system used to measure electro-optical characteristics
   Measuring equipment : LCD-5200 made by Otsuka Electronics Co., Ltd.
   Items to measure   : Viewing angle, contrast ratio, and response time (rise and fall) characteristics.

Personal Computer

DATA Controller

Temperature Control Bath

Pre Processor

LCD Driver

Light Source

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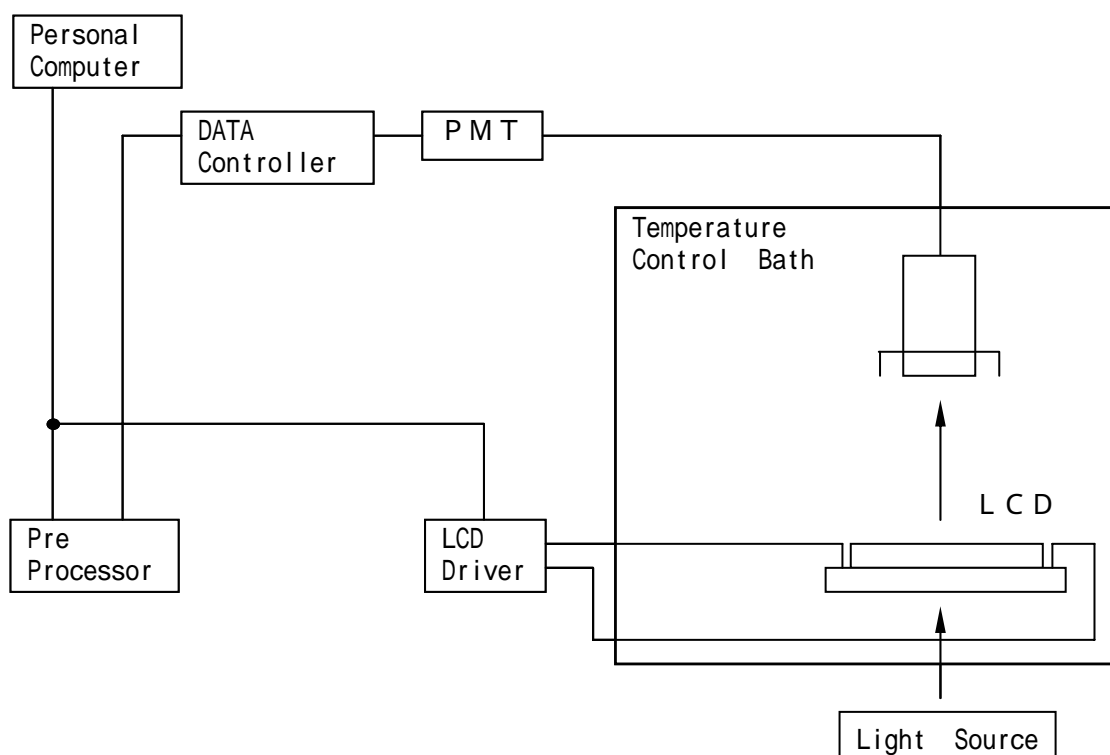
*1: The LCD drive voltage varies depending on ambient temperatures or viewing angles.
    Adjust it to an optimum drive voltage before operating the LCD module.

*2: Definition of and conditions for the range of viewing angles.

Light receiving part

Light receiving part

perpendicular (θ=0°)

perpendicular (ϕ=0°)

$-\phi$ $+\phi$

$+\theta$ $-\theta$

Light source   Best viewing angle

Light source

Conditions
    a) Contrast ratio (K): K ≥ 1.4
    b) LCD drive voltage (VLCD) = 22.7 V

*3: Definition of and conditions for the contrast ratio
    Contrast ratio = on(transmission factor)   off(transmission factor)

    Conditions
        a) Angle θ = 0°
                    ϕ = 0°
        b) LCD drive voltage (VLCD) = 22.7 V

*4: Definition of and conditions for the response time
The transmission factor at application of an off signal is defined as 0%, and the transmission factor at application of an on signal is defined as 100%.
The rise time from when an on signal is applied to when the transmission factor reaches 90% is defined as τr.
The fall time from when an off signal is applied to when the transmission factor reaches 10% is defined as τd.

Transmission factor

90%

10%

τr
Rise

τd
Fall

OFF   ON   OFF

Conditions
a) Angle   θ = 0°
            φ = 0°
b) LCD drive voltage (VLCD) = 22.7 V

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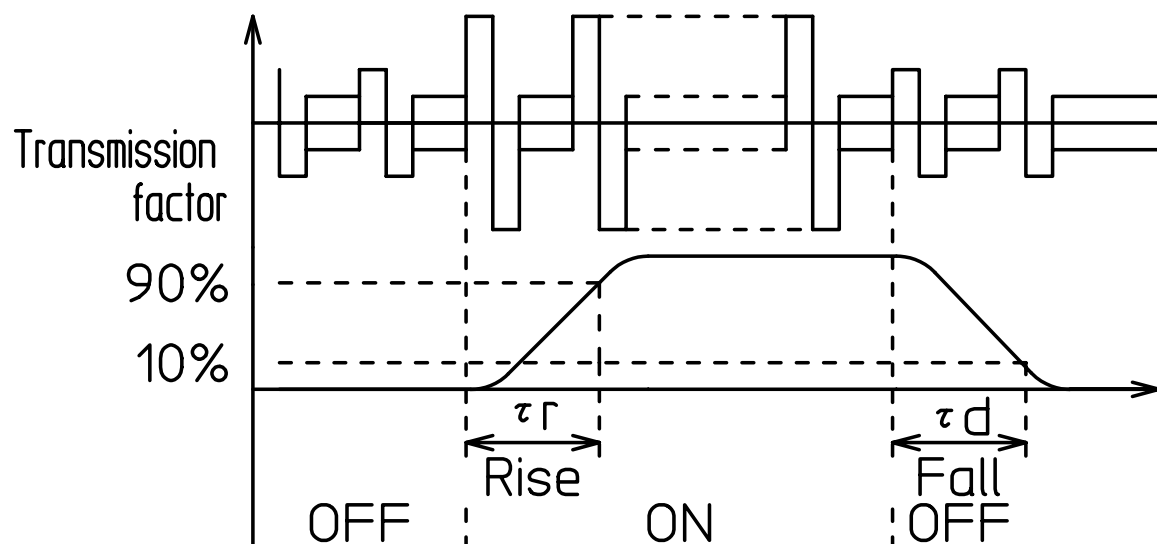
CHARACTERISTICS OF CCFL BACKLIGHTING

Item	Minimum	Typical	Maximum	Unit	Remarks
Brightness	60	80		cd/m²	

■Measurement conditions
    a) Point of measurement : At the center of the display
    b) CCFL power supply   : Lamp voltage for CCFL = 230 Vrms
                              Lamp current for CCFL =   7 mArms
                              Operating frequency for CCFL = 60kHz
    c) Display state   : LCD panel all dots on
                              (displayed data D0 to D3 = H)
                              LCD drive voltage (VDD-Vo) = 23.3 V
    d) Ambient temperature : Ta = +25℃
    e) Start of measurement : After more than 30 minutes from when the LCD panel
                              is lit.
    f) Measuring equipment : BM-5A (made by Topcon)
    g) Measuring environment : in the dark room
    h) Brightness is initial measurement brightness.

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RELIABILITY TESTING

Items of Reliability Testing

No.	Test item	Test condition	Test hours
	Operation in high temperature	Ta = +50°C all display on (standard operation)	240hours
	Shelf test in high temperature	Ta = +70°C (no operation)	240hours
	Shelf test in low temperature	Ta = -20°C (no operation)	240hours
	High-temperature, high-humidity test	Ta = +40°C,RH=90% (no operation)	240hours
	Temperature cycle test	-20 (30min.) +25 (5min.) +70 (30min.) ← +25 (5min.) ← (no operation)	10cycles
	Vibration test	Frequency range:10～55Hz Total amplitude:1.5mm Sweep ratio 10～55～10 about 1 minute Standard JIS C 60068-2-6:1999 (no operation)	2 hours for each direction of x, y and z (total 6 hours)
	Mechanical shock	Peak acceleration 50 x 9.8 m/s2 Length of impact application: 11msec Half sine wave Standard JIS C 60068-2-27:1995 (no operation)	3 times for each direction of ±X, ±Y and ±Z

Criteria
  Visually check the display quality using an LCD module inspection tool.
    a) Miss or no function of display.
    b) Damaging or deforming of components.

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Instruction of use

Handling precautions

Extra care must be exercised to protect it from a mechanical impact or shock.
Because the LC panel is made of glass, it may be broken if a strong impact is applied
to it.
The polarizer on the surface of the display gets scratched easily. Do not press such as
tweezers, tools or other hard materials against the polarizer, and do not scratch the
polarizer with them.
The polarizer may be damaged if it comes into contact with an organic solvent.
If the display surface becomes stained, remove the stain by applying cellophane tape,
or wipe the display surface lightly using a soft cloth, such as an absorbent cotton cloth
with diluted neutral detergent.
If water drops adhere to the display surface for a long time, they cause discoloring or
will become unremovable stains. If these are found on the display surface, wipe them off
immediately.
The liquid (liquid crystal) inside the liquid crystal panel is a harmful substance.
If the liquid crystal panel is broken, do not put the spilled liquid crystal in the mouth,
and if adhere to the skin or clothes, apply soap and wash is away.
To prevent damage of LSI and LED by static electricity, do electrostatic measures such
as earth bands when you remove the protection film from LCD panel.
This product is designed for use in air-conditioned, no vibrated and no impacted indoors.
And this product has to be used above condition.
Films such as heat seal and TCP(Tape Carrier Package) are used in the LCD module.
When using the LCD module, pay extra attention to avoid damaging the films.
If film is damaged, it causes malfunction display.
The following LCD modules uses rubber connector (conducting elastomer).
Do not warp or twist at handling.
Pertinent products:
      GMD1620B, GMD1621B, GMD1620BLY, GMD1621BLY, GMD1620BSLY, GMD1621BSLY,
      GMD2020B, GMD2021B, GMD2020BLY, GMD2021BLY, GMD2020BSLY, GMD2021BSLY,
      GMF32024ABTW,GMF32024BSLY, GMF64020ABTW

Storage precautions

Do not storage or use the LCD module at high temperature and high humidity.
If stored or used at high temperature and humidity, air bubbles may occur or the polarizer
may peel off from the surface. When storing the LCD module, put it in an
electrically-conductive plastic bag or delivered package, and store it at low temperature
(+5 to +30), at low humidity (RH= 30 to 70%) and not in direct sunlight or fluorescent
light.
Use the pure water or distilled water when you use the humidifier to prevent dryness.
Do not use tap water because it includes chlorine and it may damage module.
Do not store at high temperature such as in direct sunlight or near heating facility.
Do not store at rapid temperature change's place such as in direct sunlight or strong
lightings, because it causes condensation. Pleas store it in constant temperature place.
Store at no dust, no corrosive gas (exhausting, smoke, NOx and SOx included in chemical,
and so on) and no salinity condition.
Do not expose to radiation, static electricity and strong magnetic field.

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Operating precautions

Do not connect it to or disconnect it from the main system when the LCD module is powered on.
If the LCD module is stored at temperatures below or above the specified storage temperature limits, it may be malfunction and it may not be restored even after the temperature is adjusted to the specified storage temperature.
Optical characteristics (viewing angle and contrast ratio) are depended on LCD driving voltage. Please adjust it to achieve optimum contrast ratio in each module.
　　Driving voltage (VDD-Vo):
　　　　　　　　　　　GMF32024ABTW, GMF32024BSLY, GMF32024HBTW,
　　　　　　　　　　　GMF32024HFTW, GMF64020ABTW
　　Driving voltage (VEE-VSS):
　　　　　　　　　　　GMF32024JBTW, GMF32124JBTW, GMF32024JFTW,
　　　　　　　　　　　GMF32124JFTW, GMF32024KFTW, GMF32124KFTW
Do not use the module in dewy, a lot of moisture, or other solutions.
If even slight condensation occurs or splashes solutions at the terminals of LCD panel, electrochemical reactions will occur on the terminals, and terminal may be damaged and disconnected. Please note to prevent rapid temperature changes, because it may causes condensation.
Do not touch the connector terminals, PWB, and electronic components when the LCD module is operating. Especially CCFL connectors are applied high voltage, and there is a danger of the electric shock.
Touching them may also cause malfunction of LCD module.
Each product is designed to operate at specified driving duty ratio. If it is operated at a different duty ratio, it may be malfunction.
　　1/200 duty drive: GMF64020ABTW
　　1/240 duty drive: GMF32024ABTW, GMF32024BSLY, GMF32024HBTW, GMF32024HFTW,
　　　　　　　　　　　GMF32024JBTW, GMF32124JBTW, GMF32024JFTW, GMF32124JFTW,
　　　　　　　　　　　GMF32024KFTW, GMF32124KFTW
When LC panel is applied the DC voltage, its lifetime is shortened rapidly by electrochemical reaction. When using the GMF series LCD module, keep following power supply sequence to prevent the DC voltage being applied to the panel and to prevent the latch-up of CMOS-LSI in the module.
If the LC driving voltage or various signals are input before the logic power supply is stabilized, the internal LSI may be damaged due to floating or latch-up phenomena.

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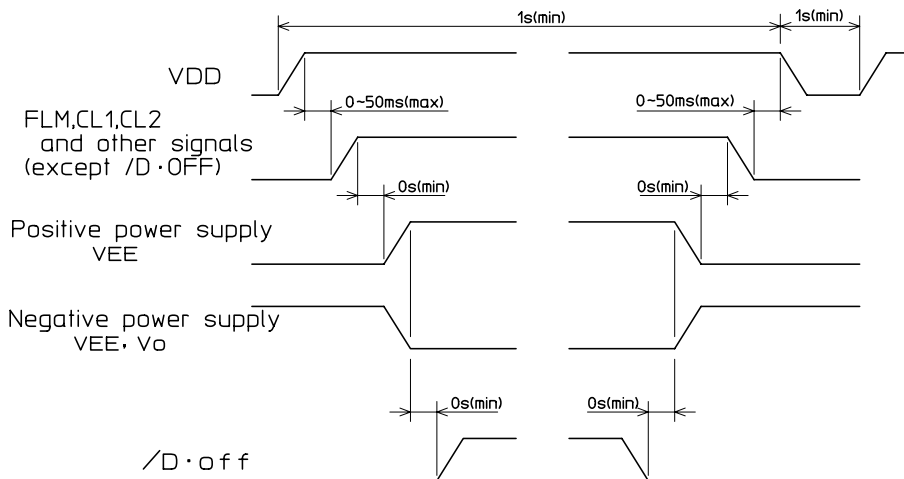
Installation precautions

Do not remodel or disassemble the LCD module. If it malfunctions after being remodeled or disassembled and assembled again, Stanley electric is not liable for such malfunctions.
Workers have to be grounded by such as earth-bands and put antistatic cloths, to prevent electrifying, because CMOS-LSI are used in the module.
The LCD module is designed to be installed using mounting holes at the four corners. Make sure that the display surface is completely flat after it is installed in position. When mounting and installing it, do not warp or twist it and do not apply stress to it. If it is warped or twisted or stress is applied to it, discoloring may occur, or the LCD may be damaged.
To protect the polarizer and the LC panel, install a protective panel, such as a clear acrylic plate. And keep a clearance between the protective panel and the module to prevent stress to the module.
If dirt or dust enters the inside of the LCD module, the display quality may be adversely affected. If the LCD module is used in a dusty place, take precautionary measures to protect it from dust.
The metal frame or plastic frame of module is not visual inspection subject. It might have some scratches. Please design to cover or conceal the metal frame or plastic frame when it is installed.
Lighting source such as CCFL/LED backlight in the module, is heated. To note the heat radiation and do not exceed the ambient temperature in the specification when it is operating.
Do not arrange the parts which is damaged by light, because a LCD module has some light leaking at the back and side.
GMF32024HBTW and GMF32024HFTW are available to exchange its CCFL. When you exchange the CCFL, please note handling and prevent CCFL cracking and impact to the module. And CCFL have to be exchanged after turn off the power supply, because it is applied high voltage.
GMF32024ABTWFG terminal or PWB's installation hole has to be grounded to prevent the LSI malfunction or damage by static electricity.

Precautions for safety

There might be some burr at the edge of the metal frame, be care of the injury.
When designing of the installation, the cable for the connector must not come in contact with the metal part such as a metal frame.
There is no protection circuit for short-circuit trouble in the module. For safety measures, please built in fuse or shut-down circuit in system power supply.

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