

FRYE ELECTRONICS CONFIDENTIAL PURCHASED ITEM MANUFACTURER LIST

Date: 7-17-96 By: RADU G

Frye Part No. 093-0552-00

Eng. Part No:

DESCRIPTION: LCD DISPLAY 640 X 200 BLACK & WHITE

Nr.	Status	Manufacturer	Manufacturer Part Number	Initial Price \$
1	OK	STANLEY	GMF64020ABTW	171.50 ea
2				
3				
4				
5				
6				
7				
8				

Status Code: OK = OK : D= Disqualified: O = Obsolete: L = Last Time Buy
 NE = Not evaluated. Evaluate before production purchase
 E = Emergency - use in production may cause problems.
 notify engineering and production before purchasing!

For a sole source part, what is the recovery plan if unavailable?

Comments or vendors info:

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____
- 8) _____

NEW PART INFORMATION:

First parts manufacturer and part #: _____

First parts obtained from: _____

First P.O. number: _____ or [] free samples

Cost at time of part introduction: \$ _____ @ _____ qty

\$ _____ @ _____ qty

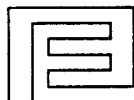
\$ _____ @ _____ qty

Purchased in units of: [] ea, [] foot, [] inch, [] pound, [] other

Used in units of: [] ea, [] foot, [] inch, [] pound, [] other

REV	REF	DESCRIPTION OF CHANGE	CHK BY	DATE

PART NUMBER
093-0552-00



FRYE ELECTRONICS, INC.®

P.O. Box 23391 • 9826 S.W. Tigard St. • Tigard, Oregon 97223 • USA
 Phone (503) 620-2722 1-800-547-8209 FAX (503) 639-0128

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DRAWING BY <i>Radu Ghinea</i>	DATE 7-10-96	DIMENSIONS ARE IN INCHES / MM TOLERANCES UNLESS OTHERWISE SPECIFIED		
EVALUATOR	DATE			
INSTRUMENT DESIGNER	DATE	DEC	ANLR	-----
		SCALE	FIRST USED ON	
MATERIAL				
FINISH				
TITLE LCD FP40 STANLEY				
SHT OF		SIZE A	PART NUMBER 093-0552-00	REV

I I Stanley
Los Angeles Sales Office
2660 Barranca Parkway, Irvine, CA 92714
Telephone: 714-222-0777 (Toll Free) 800-LED-LCD1
Fax: 714-222-0555

June 12, 1995

Mr. Robert Doherty
Frye Electronics
9826 S. W. Tigard St.
Tigard, OR 97223

Dear Robert:

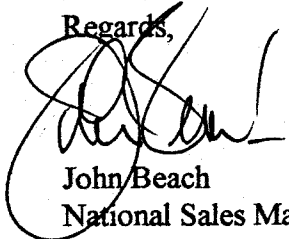
It was a pleasure meeting with you last week.

In response to Frye's request, please find accompanying this memo the data on CFL half life, forward current and brightness. If you have any questions regarding this material, do not hesitate to call me.

With regard to the future production of the GMF64020ABTW, Stanley Electric Ltd. plans to produce this display for the foreseeable future (3-5 yrs). Be assured, that if Stanley should discontinue production of this product that they will give customers ample notice (3-6 months) and an opportunity for a last or lifetime buy.

We appreciate your business and look forward to supplying your GMD64020ABTW requirements.

Regards,



John Beach
National Sales Manager

cc: N. Heartt
B. Roth
T. Turnell, Westek

ORIGINAL IN SAFE
DOUG'S OFFICE

CFL life , Forward current, brightness

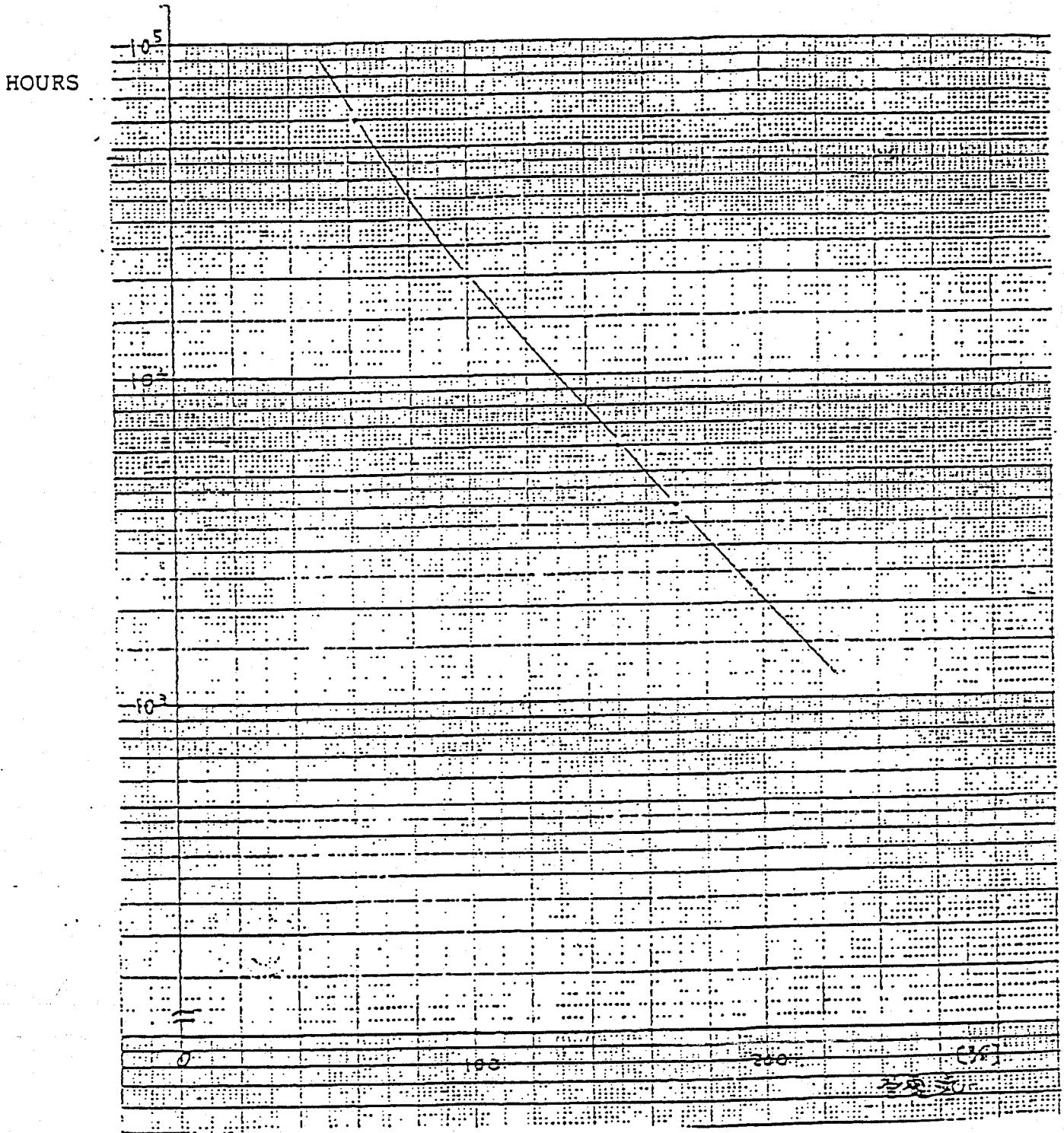
CFL lamp lifetime is inversely related to the forward current flowing through the tube. That means that as the current through the tube increases, the lifetime decreases. This relationship is logarithmic, not linear. This means that a slight increase over normal current (100% current) considerably shortens the lifetime, and a slight decrease in the forward current (90% current) considerably increases the lifetime.

Yet the brightness increases at an even (linear) rate as the current through the tube increases.

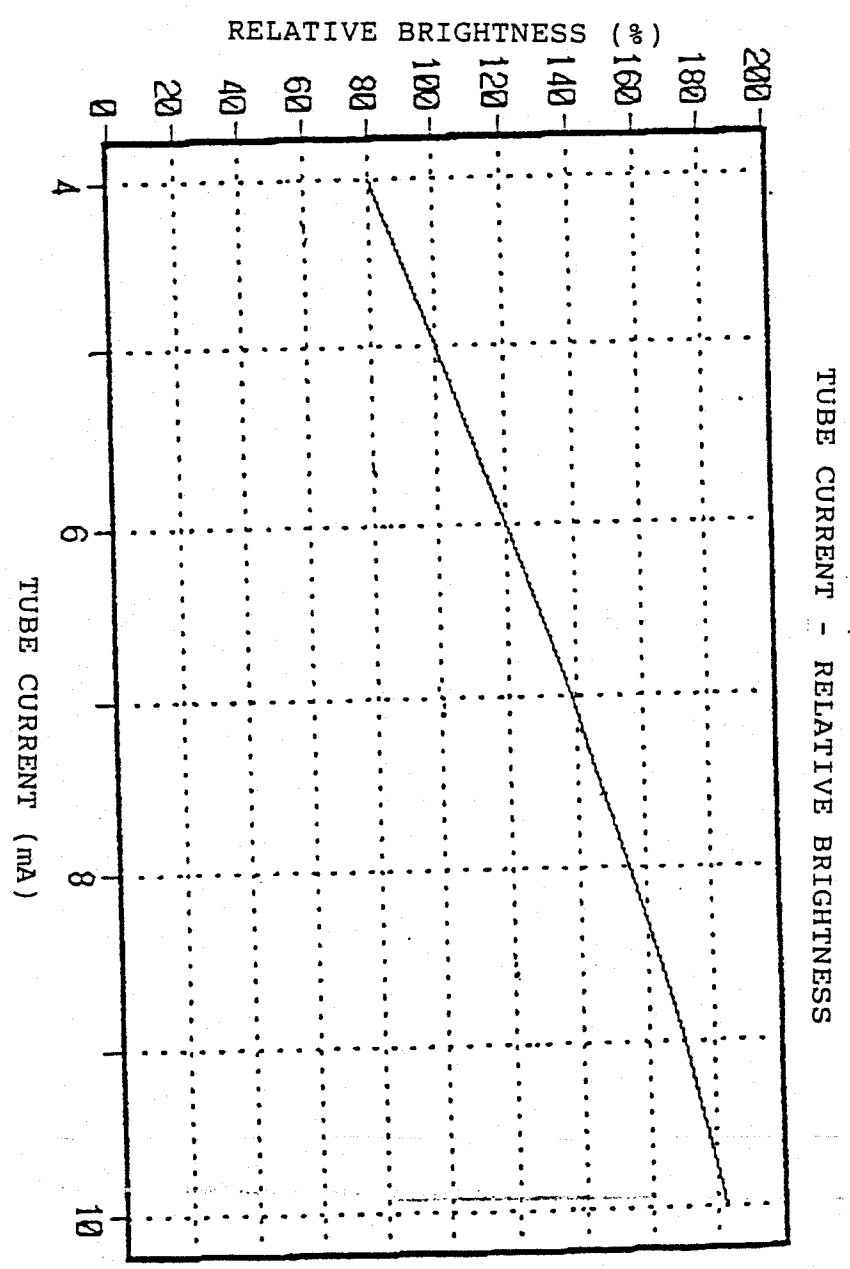
These two factors tell us that slightly decreasing the CFL current will greatly extend the life of the tube, with only a small decrease in the tube brightness. The approximate lifetime at various percentages of normal current is listed below:

150% current	gives	5,000	hour	life
110% current	gives	12,000	hour	life
100% current	gives	20,000	hour	life
90% current	gives	32,000	hour	life
80% current	gives	49,000	hour	life

TUBE CURRENT AVERAGE LIFE



TUBE CURRENT



2/1

2/2

ON/OFF OPERATION TEST

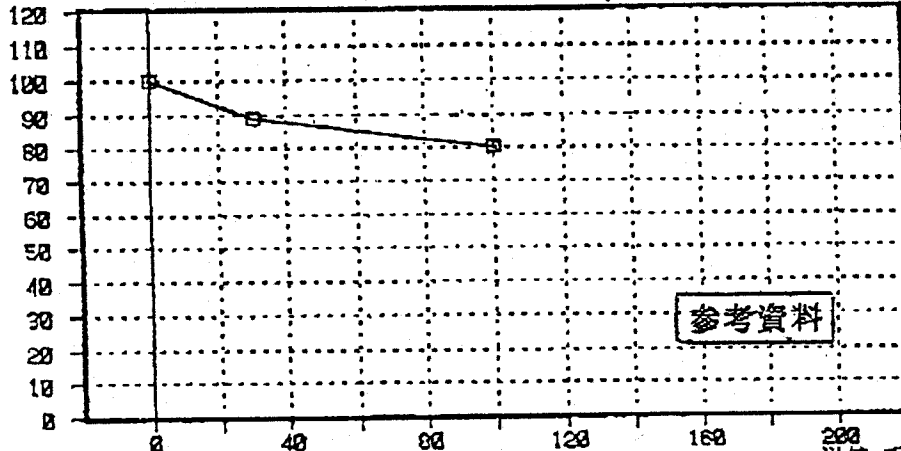
'93年 10月 19日
スタンレー電気株式会社
自動車機器開発部電球技術課

ON-OFF作動試験
1min 1min 5mA

rate of change
(brightness)

輝度変化率

%



サイクル数

Cycle

単位:千

UNIT: 1000

ON/OFF OPERATION TEST

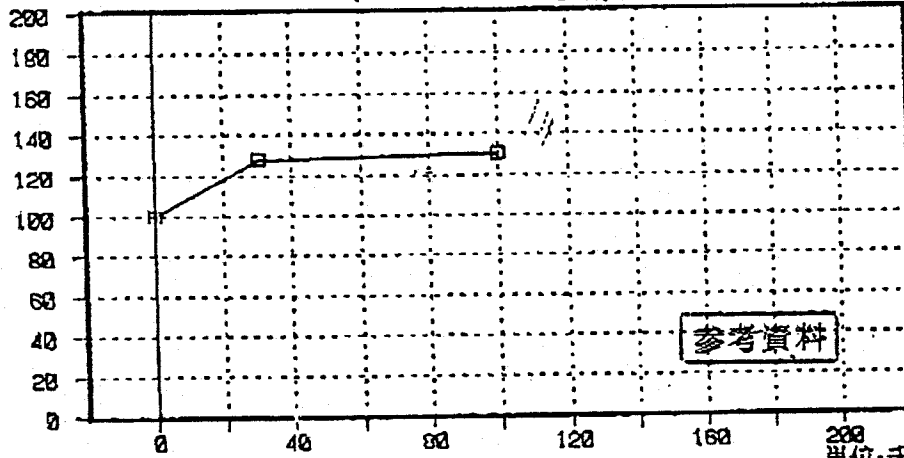
ON-OFF作動試験
1min 1min 5mA

放電電圧変化率

%

rate of change

(Firing potential)



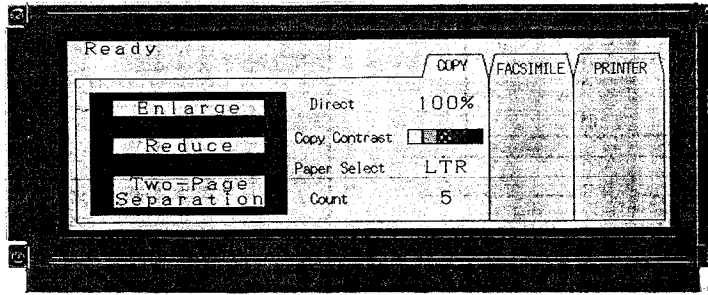
サイクル数

Cycle

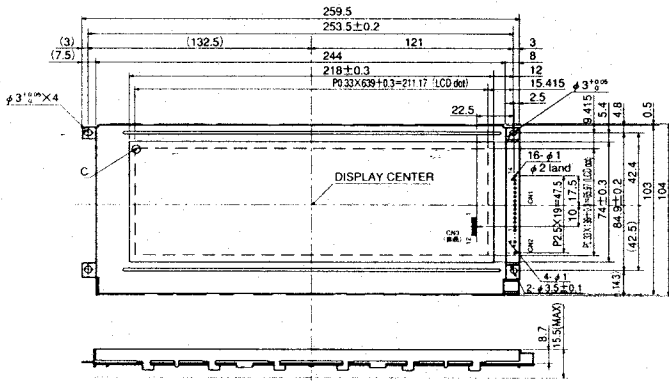
単位:千

UNIT: 1000

GMF64020ABTW 640 × 200 Dots 1/200 Duty



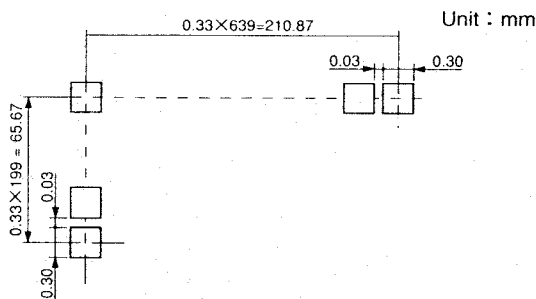
● Module Dimensions (with CFL Backlighting)



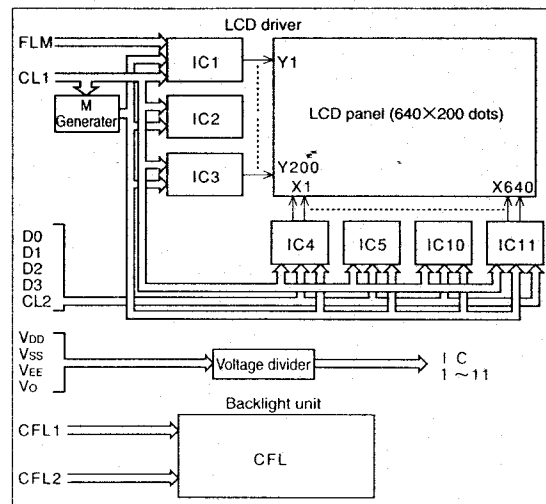
Unit : mm

* Brightness : Approximately 140 nit (panel surface)

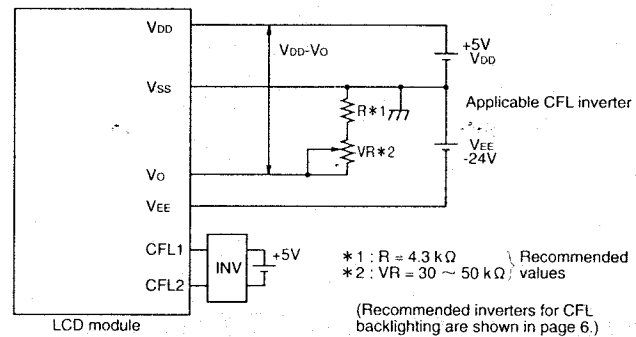
● Display Pattern



● Block Diagram



● Example of Power Supply Circuit



● Data Transmission

	X1	X2	X3	X4		X637	X638	X639	X640
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
...									
Y199	D3	D2	D1	D0		D3	D2	D1	D0
Y200	D3	D2	D1	D0		D3	D2	D1	D0

Absolute Maximum Ratings

LCD Driver (Ta = 25°C)

Item	Symbol	MIN.	MAX.	Unit
Power supply for logic	VDD-VSS	0	7.0	V
Power supply for LCD drive	VDD-Vo	0	26	V
Input voltage	V	VSS	VDD+0.3	V
Operating temperature	Top	0	50	°C
Storage temperature	Tstg	-20	70	°C

Backlight Unit (Ta = 25°C)

Item	Symbol	MIN.	MAX.	Unit
Circuit voltage	Vs	1400	—	Vrms
Lamp current	IL	4.5	5.5	mA _{rms}
Frequency	f	20	60	kHz

Electrical Characteristics

LCD Driver (VEE=-24V, VDD=5V, Ta=25°C)

Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage	VDD-VSS	4.75	5.0	5.25	V
Supply current VDD-Vo=22.7V fCL1=18KHz.	IDD	—	9	18	mA
	IEE	—	10	20	mA
Input voltage "High" level	VIH	0.7VDD	—	VDD	V
Input voltage "Low" level	VIL	VSS	—	0.3VDD	V
Supply voltage for LCD drive	VDD-Vo	—	24.5	—	V
Latch pulse frequency	fCL1	10	20	22	KHz

Backlight Unit (Ta = 25°C)

Item	Symbol	MIN.	TYP.	MAX.	Unit
Circuit voltage	Vs	1400	—	—	Vrms
Lamp voltage	VL	490	525	560	Vrms
Lamp current	IL	4.5	5.0	5.5	mA _{rms}
Frequency	P	—	(2.62)	—	W

Optical Characteristics (Please refer to Page 77 for definition of optical characteristics.)

Liquid Crystal Characteristics (VDD-Vo=22.7V if not specified)

Item	Symbol	Temp.	MIN.	TYP.	MAX.	Unit
Recommended operating voltage for LCD 1/200 duty 1/13 bias	VDD-Vo	0°C	—	25.4	—	V
		25°C	—	24.5	—	V
		50°C	—	23.9	—	V
Viewing angle	θ	25°C	-20	~	30	deg.
			φ	-35	~	
Contrast ratio	K	25°C	2.5	—	—	—
Rise time	τr	25°C	—	380	530	ms
Fall time	τd	25°C	—	350	530	ms

Interface Pin Functions

CN-1 Please contact us if you have questions about Pin Functions of CN-3.

Pin No.	Symbol	Effective pulse level	Function
1	FLM	H/L	Scan start pulse
2	NC	—	—
3	CL1	H→L	Display data latch pulse
4	CL2	H→L	Display data fetch pulse
※ 5	DOFF	H/L	Display data OFF pulse
6	D0	H/L	Display data 0
7	D1	H/L	Display data 1
8	D2	H/L	Display data 2
9	D3	H/L	Display data 3
10	VDD	—	Power supply for logic (+5V)
11	VSS	—	GND for logic (0V)
12	VEE	—	Power supply for LCD driving (-24V)
13	Vo	—	Operating voltage for LCD driving (Input for adjustment VEE & Vo > VDD)
14	FG	—	GND for frame

※ No. 5 pin (DOFF) is pulled up to VDD through 100kΩ in the module.

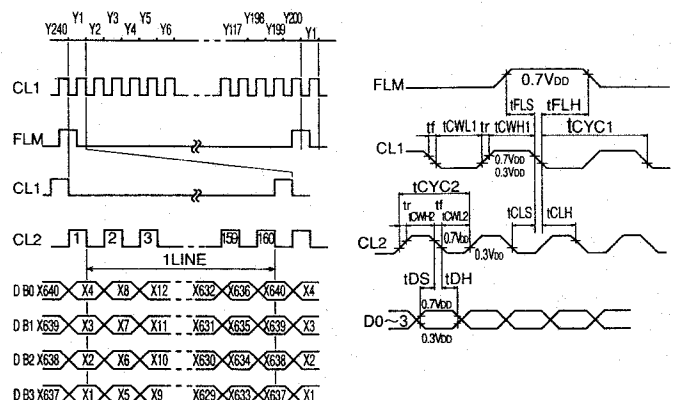
CN-2

Pin No.	Symbol	Function
1	CFL 1	Power supply for CFL Connected to inverter OUT
4	CFL 2	

Interface Timing Chart

Interface Timing Chart

Item	Symbol	MIN.	TYP.	MAX.	Unit
Shift clock cycle	tCYC2	125	—	—	ns
Shift clock pulse width (H level)	tCWH2	45	—	—	ns
Shift clock pulse width (L level)	tCWL2	45	—	—	ns
Data set up time	tDS	20	—	—	ns
Data hold time	tDH	20	—	—	ns
Latch pulse width (H level)	tCWH1	50	—	—	ns
Latch pulse width (L level)	tCWL1	1	—	—	μs
Latch set up time	tCLS	80	—	—	ns
Latch hold time	tCLH	80	—	—	ns
Latch pulse time	tCYC1	45.4	50.0	100	μs
FLM set up time	tFLS	100	—	—	ns
FLM hold time	tFLH	100	—	—	ns
Rise time	tr	—	—	30	ns
Fall time	tf	—	—	30	ns



Stanley Graphic Dot Matrix LCD Module

GMF64020ABTW-□□ Specification

1. Application

This specification applies to LCD modules shown in the table below.

2. LCD module types

Type No.	LCD type	Metal frame	Connector
GMF64020ABTW (Dimensions: Refer to 10-1)	STN Blue mode	SPCC t=0.6 Uni-chromate, silver	None
GMF64020ABTW-01 (Dimensions: Refer to 10-2)	STN Blue mode	SPCC t=0.6 Chromate, black	None
GMF64020ABTW-02 (Dimensions: Refer to 10-1)	STN Blue mode	SPCC t=0.6 Uni-chromate, silver	Attached *1

*1: Attached connector

CN-1 : S14B-EH
(JAPAN SOLDERLESS TERMINAL MFG CO.,LTD)

CN-2 : S4B-EH
(JAPAN SOLDERLESS TERMINAL MFG CO.,LTD)

*2: Attached connector

CN-3 : FH10A-12S-1SH
(HIROSE CO.,LTD)

3. Product outline

GMF 64020ABTW-□□ are the graphic type LCD dot modules with 320 x 240 dots. These modules consist of mainly LCD panels, C-MOS driver LSIs and CFLs for back lighting. The display of graphic patterns, numbers, alphabets and symbols is possible by connecting to the external MPU, RAM or LSI controlled circuit.

★ Features

- ① STN LCD panel with wide viewing angle is used.
- ② Bright display (approx. 80 nit for the panel surface) with the use of thin (15 mm max.) CFL back lighting unit.
- ③ Operation with very low power consumption.
- ④ Temperature compensation circuit is built in.
- ⑤ Display off terminal is built in.

4. Product specification

Item	Specification	Unit
Outer dimension #1	252(width)×104(height)×15(thickness) Max	mm
Effective display area	218 (width) × 72 (height)	mm
Dot configuration	640 (width) × 200 (height)	dot
Dot dimension	0.30 (width) × 0.30 (height)	mm
Dot pitch	0.33 (width) × 0.33 (height)	mm
Display color #2 Blue mode (Negative image)	When dots are ON (Display data "H") White When dots are OFF (Display data "L") Blue	-
Back light unit	CFL: emitting color, white	-
Duty ratio	1/200	duty
Screen	I (Screen)	-
Data transmission method	4 bit parallel data transmission	-
Weight	Approximately 420	g
Recommended controller	HD 63645 HD 64645 (HITACHI) HD 64646	-

*1: Connector dimension is not included.

*2: Color tone on LCD varies according to the ambient temperature changes.

5. Absolute maximum ratings

5-1: Environmental conditions

Item		Minimum	Maximum	Remarks
Ambient temperature	Operating	0°C	50°C	—
	Storage	-20°C	70°C	—
Humidity		*1		No condensation
Vibration		Conforms to JIS-C-7021A-10		Refer to 9.
Mechanical shock		Conforms to JIS-C-0041		Refer to 9.
Corrosive gas		None		—

*1: $T_a \leq 40^\circ\text{C}$ ----- 90% RH MAX.
 $T_a > 40^\circ\text{C}$ ----- Absolute humidity should not exceed 90% RH at $T_a = 40^\circ\text{C}$.

5-2: Electrical absolute maximum ratings

a) LCD driving

($T_a = 0 \sim +50^\circ\text{C}$)

Item	Symbol	Min	Max	Unit	Remarks
Power supply for logic	VDD-VSS	0	7.0	V	—
Input voltage for logic	V _I	VSS	VDD+0.3	V	—
Power supply for LCD drive	VDD-VEE	0	5.5	V	—
LCD driving voltage	VDD-V _o	0	2.6	V	$VEE \leq V_o$

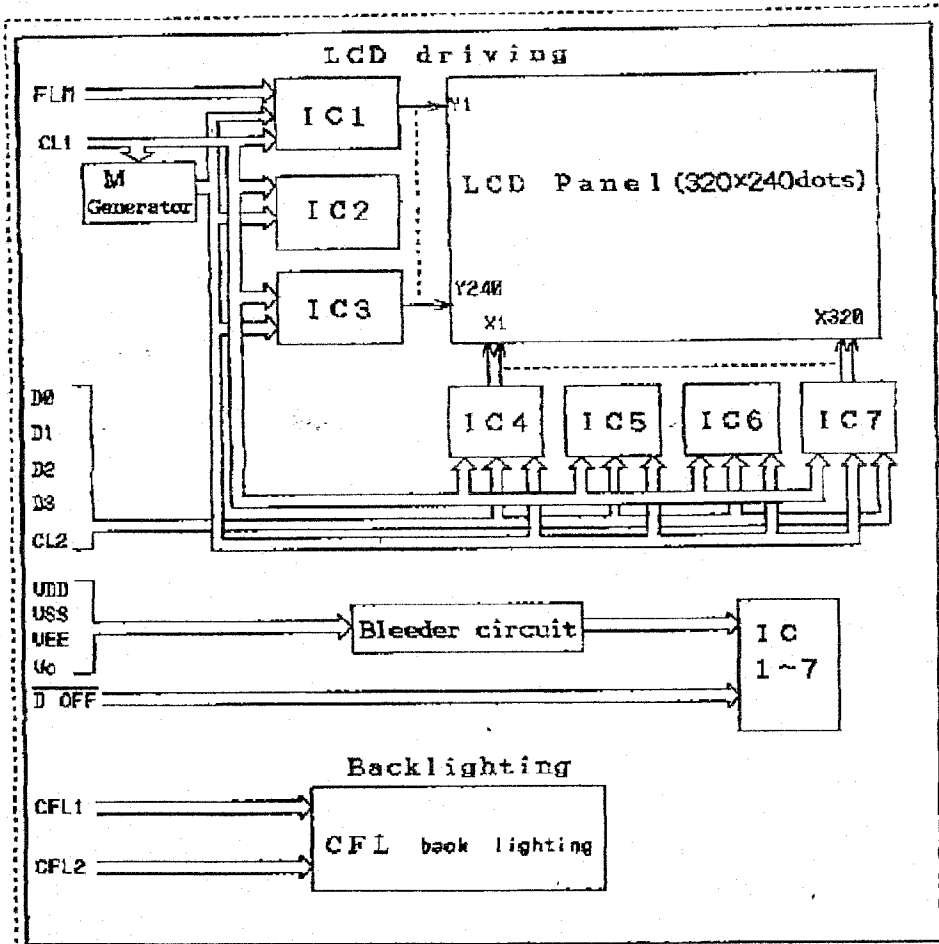
b) CFL backlighting

($T_a = 0 \sim +50^\circ\text{C}$)

Item	Symbol	Min	Max	Unit	Remarks
Circuit voltage	V _S			V _{rms}	—
Lamp current	I _L			mA _{rms}	—
Operating frequency	f			KHz	—

6. Electrical specification

6-1: Block diagram



6-2: Electrical characteristics

a) LCD driving

(Ta=25°C, VDD=5V, VEE=-24V)

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	VDD-VSS	4.5	5.0	5.5	V
Supply current VDD-Vo=12.5(V) fCL1 =18(KHz)	IDD	-	9	18	mA
	IEE	-	10	20	mA
Input "high" voltage	VIH	0.7VDD	-	VDD	V
Input "low" voltage	VIL	VSS	-	0.3VDD	V
LCD driving voltage *1	VDD-Vo	-	12.5	-	V
Latch pulse frequency	fCL1	14.4	18	21.6	KHz

*1: The above value of power supply voltage are as reference at T=25°C.
Please adjust actual voltage individually to get the best contrast ratio at 25°C. (Refer to article 6-4 Power supply example)
LC driving voltage will be adjusted automatically by temperature compensating circuit at over and/or less 25°C.

b) CFL backlighting

(Ta=25°C)

Item	Symbol	Min	Typ	Max	Unit
Circuit voltage	VS		-	-	Vrms
Lamp voltage	VL				Vrms
Lamp current	IL				mA rms
Power consumption	P	-	()	-	W

6-3: Pin function

a) CN-1

Pin No	Symbol	Effective signal level	Function
1	FLM	H/L	Scan start signal
2	NC	-	No connection
3	CL1	H→L	Display data latch signal
4	CL2	H→L	Display data receive signal
5	$\overline{\text{Doff}}$	L	Display OFF signal * 1
6	D0	H/L	Display data 0
7	D1	H/L	Display data 1
8	D2	H/L	Display data 2
9	D3	H/L	Display data 3
10	VDD	-	Power supply for logic (+5V)
11	VSS	-	GND for logic (0V)
12	VEE	-	Power supply for LCD drive(-24V)
13	Vo	-	LCD driving voltage * 2
14	FG	-	Frame ground * 3

*1: $\overline{\text{Doff}}$ line was pulled up for VDD line.
Resistor 100K Ω

*2: Refer to article 6-4 Power supply example.

b) CN-2

Pin No	Symbol	Function	
1	CFL	CFL	Connected to the inverter "OUT"
2	CFL GND	Power -supply	Connected to the inverter "OUT GND"

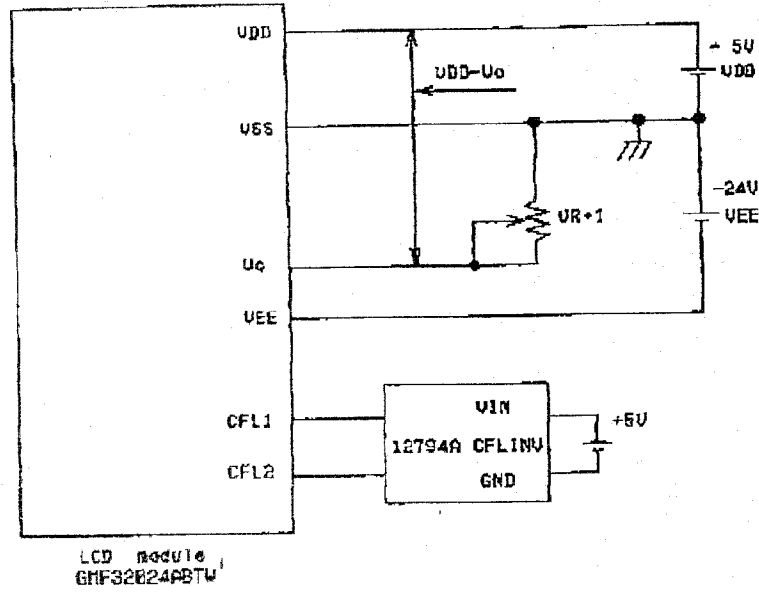
c) CN - 3

Pin No	Symbol	Effective signal level	Function
1	Vo	-	Scan start signal
2	VEE	-	No connection
3	D0	H/L	Display data latch signal
4	D1	H/L	Display data receive signal
5	D2	H/L	Display OFF signal * 1
6	D3	H/L	Display data 0
7	$\overline{\text{Doff}}$	H/L	Display data 1
8	VSS	-	Display data 2
9	VDD	-	Display data 3
10	CL2	H→L	Power supply for logic (+5V)
11	CL1	H→L	GND for logic (0V)
12	FLM	H/L	Power supply for LCD drive(-24V)

*1: $\overline{\text{Doff}}$ line was pulleped for VDD line.
Resistor 100K Ω

*2: Refer to article 6-4 Power supply example.

6-4: Power supply example



*1: VR=30~50KΩ

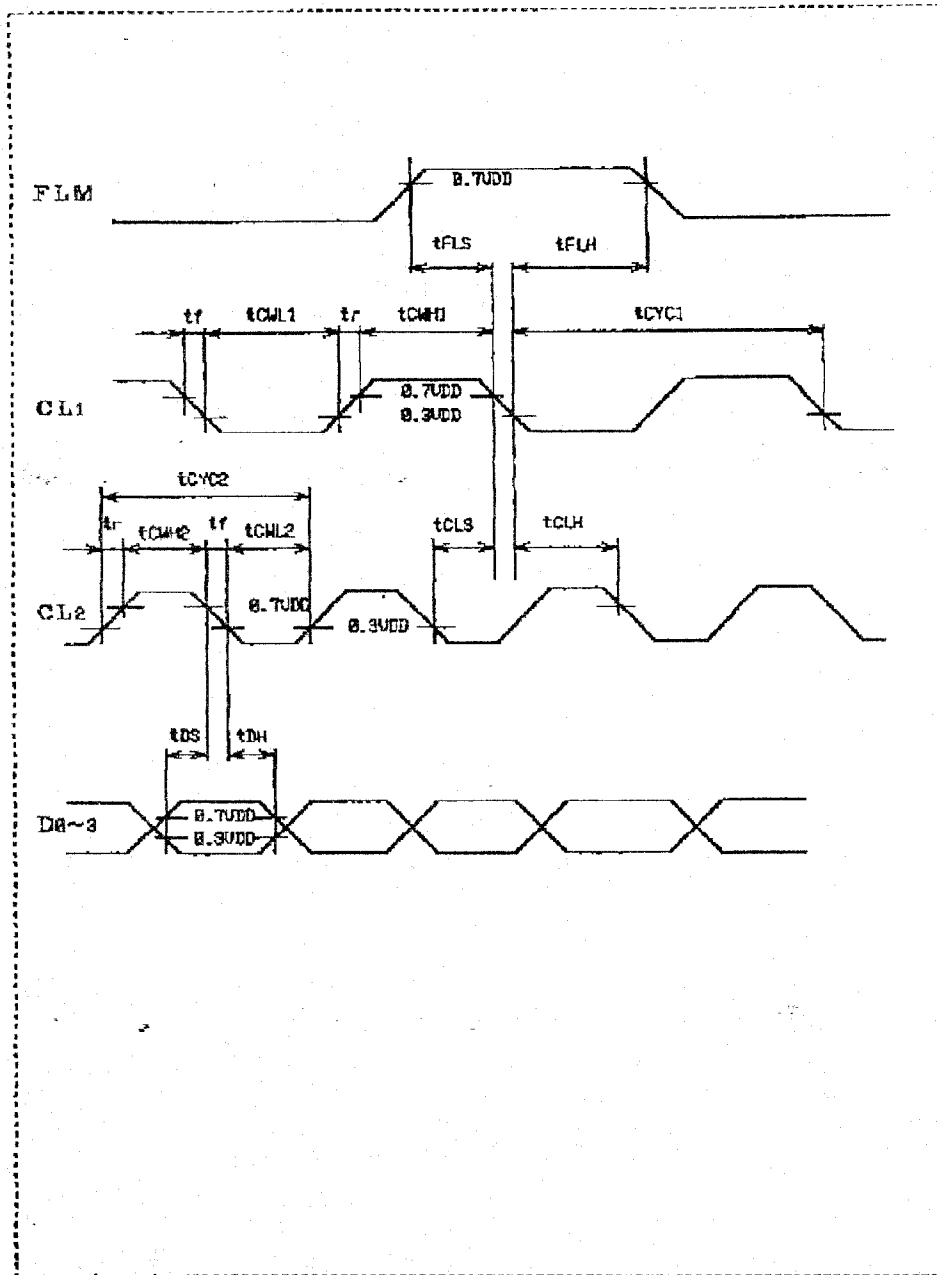
6-5: Correspondence of data and screen

	X1	X2	X3	-----				X6S9	X640	
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
⋮										
Y199	D3	D2	D1	D0			D3	D2	D1	D0
Y200	D3	D2	D1	D0			D3	D2	D1	D0

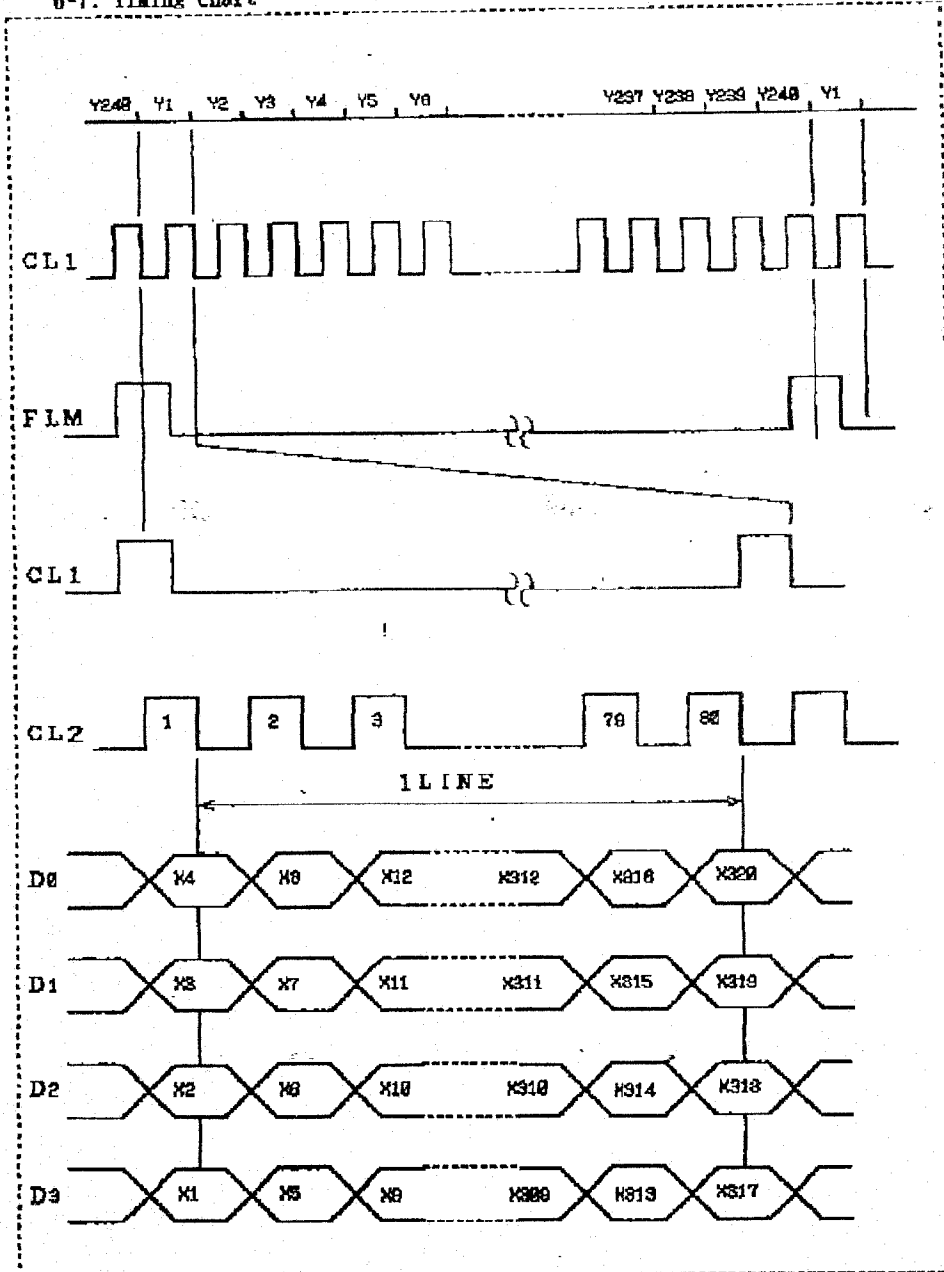
6-6: Interface timing characteristics

Item	Symbol	Min	Typ	Max	Unit
Shift clock frequency	tCYC2	125	—	—	ns
Shift clock pulse width (H level)	tCWH2	45	—	—	ns
Shift clock pulse width (L level)	tCWL2	45	—	—	ns
Data set up time	tDS	20	—	—	ns
Data hold time	tDH	20	—	—	ns
Latch pulse width (H level)	tCWH1	50	—	—	ns
Latch pulse width (L level)	tCWL1	1	—	—	μ s
Latch set up time	tCLS	80	—	—	ns
Latch hold time	tCLH	80	—	—	ns
Latch pulse frequency	tCYC1	46.3	55.6	69.4	μ s
FLM set up time	tFLS	100	—	—	ns
FLM hold time	tFLH	100	—	—	ns
Input signal delay time	tr	—	—	30	ns
Input signal rise time	tr	—	—	30	ns

Interface timing



6-7: Timing chart



7. Optical characteristics

7-1: Liquid crystal characteristics

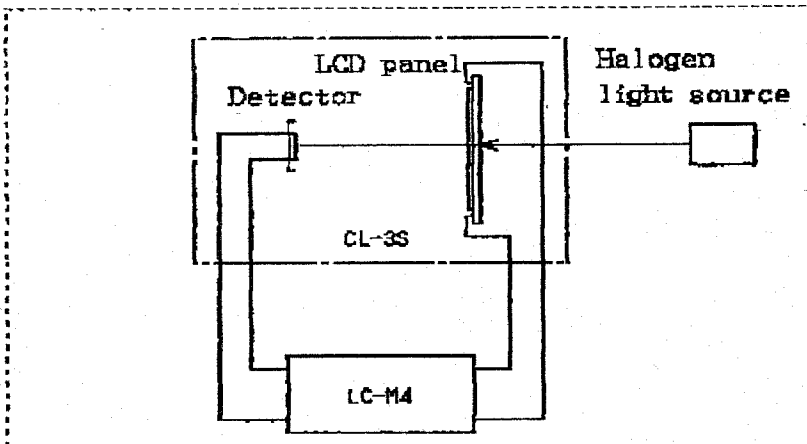
Item	Symbol	Temp	Min	Typ	Max	Unit	Remarks
LCD driving voltage (recommended) 1/200 duty 1/15 bias	VLCD	0°C	-	24.5	-	V	#1
		25°C	-	22.5	-	V	
		50°C	-	21.5	-	V	
Viewing angle	θ	25°C	-30	~	30	[°]	#2
	ϕ		-40	~	40		
Contrast ratio	K	25°C	2.5	-	-	-	#2
Rise time	τ_r	25°C	-	250	500	ms	#2
Fall time	τ_d	25°C	-	250	500	ms	

* 1 : VLCD means the voltage which is supplied to LCD panel.

■ Optical characteristics measuring system outline

Measuring instruments: CL-3S and LC-M4 (Canon)

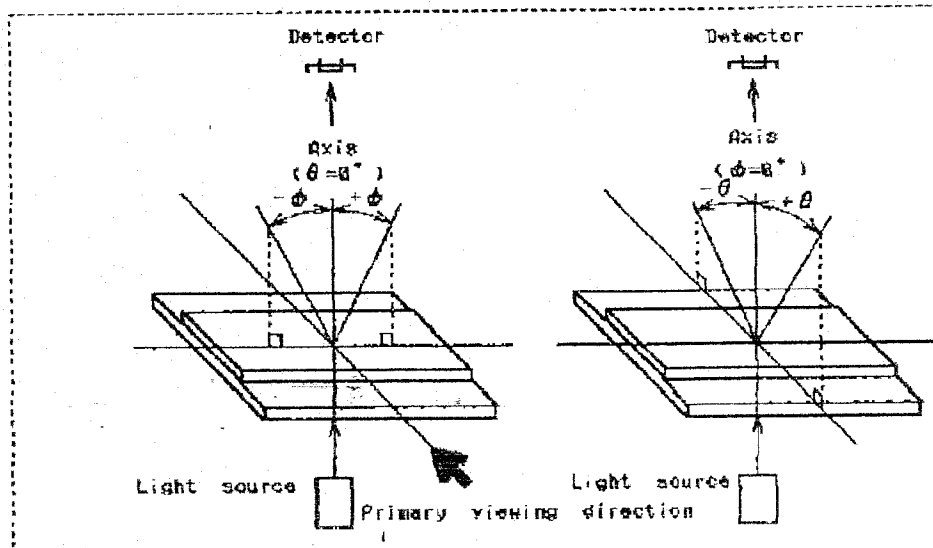
Measured items: Response time, contrast ratio and viewing angle



#1: The LCD driving voltage varies according to the ambient temperature changes or viewing angle. So please adjust to show the best contrast.

*2: The definition of the viewing angle and the condition

■ Definition



■ Condition

- a) Contrast ratio range (K): $K \geq 1.4$
- b) LCD driving voltage (VLCD) = (23)V

*3: Definition of the contrast ratio and the condition

■ Definition

- a) Blue mode

$$\text{Contrast ratio} = \frac{\text{(Transmittance of ON dot)}}{\text{(Transmittance of OFF dot)}}$$

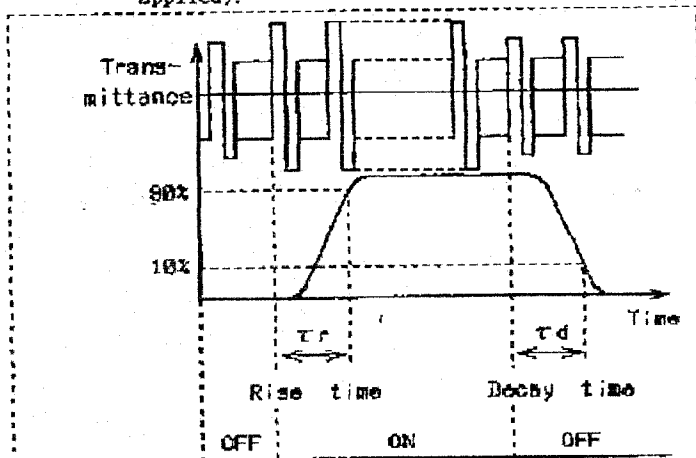
■ Condition

- a) Viewing angle: $\theta = 0^\circ$
 $\phi = 0^\circ$
- b) LCD driving voltage (VLCD) = (23)V

*4: Definition of the response time (rise and fall) and the condition

■ Definition

Suppose the transmittance of OFF dots (when OFF signal is applied) is 0% and the transmittance of ON dots (when ON signal is applied) is 100%. The rise time is defined as (τ_r) which is the time taken to reach 90% transmittance of ON dots and the fall time (τ_d) is defined as the time taken to reach 10% transmittance of OFF dots (after OFF signal is applied).



■ Condition

- a) Viewing angle: $\theta = 0^\circ$
 $\phi = 0^\circ$
- b) LCD driving voltage (VLCD)=(23)V

7-2: Backlighting characteristics

Item	Min	Typ	Max	Unit
Brightness	(90)	(110)	-	cd/m ²

■ Measuring condition

- a) Portion to be measured: Center of display part
- b) CFL power supply: Inverter (Stanley)
(CFL-INV)
Input voltage : V (CFL lamp current = mA)
- c) Display mode: Blue mode
LC panel all ON (display data = H)
LCD driving voltage (VDD-Vo) = (23)V
- d) Ambient temperature: Ta = 25°C
- e) Measuring time: 30 minutes after the lamp is ON.
- f) Measuring instrument: TOPCON BM-5 (TOKYO OPTICAL Co.,Ltd)