

FEATURES

- ◆ Black on White Film STN Type
- ◆ Transmissive Mode
- ◆ High Brightness CFL Backlight

MECHANICAL DATA

Item	Value	Unit
Module Dimensions	159.4*101*11	mm
Viewing Area	123*68	mm
Resolution	240*128	dots
Dot Size	0.47*0.47	mm
Dot Pitch	0.5*0.5	mm
Weight	180	g

OPTICAL DATA

Item	Symbol	Condition	Min	Typ	Max	Unit
Contrast Ratio	K	Ø=10°, Q=0°, Note 1	-	18	-	-
Brightness	-	T=25°C, IL=5mA, Note 8	70.0	90.0	-	cd/m ²
Viewing Direction	-	-	6			o'clock
Viewing Angle	Ø2 - Ø1	K=2, Note 1	30	40	-	degree
Response Time (Rise)	t _R	Ø=10°, Q=0°, Note 1	-	(160)	(210)	ms
Response Time (Fall)	t _F	Ø=10°, Q=0°, Note 1	-	(110)	(160)	ms

ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Min	Max	Unit
Supply Voltage (Logic)	V _{DD} - V _{SS}	-	0	6.5	V
Supply Voltage (LC Drive)	V _{DD} - V _{EE}	-	0	20.5	V
Input Voltage	V _I	-	-0.3	0.3+V _{DD}	V
Operating Temperature	T _{OP}	Note 5,6	0	50	°C
Storage Temperature	T _{ST}	Note 7	-20	60	°C

DATA INTERFACE PIN ASSIGNMENT

Pin No	Symbol	Level	Function
A1	VSS (0V)	-	Ground
A2	VDD (+5V)	-	Power supply for logic circuit
A3	V0	-	Power supply for LCD drive
A4	RS	-	Register select
A5	R/W	-	Read / Write
A6	E	-	Enable
A7-A14	DB0 - DB7	-	Display data
A15	Not CS	-	Chip select
A16	RES	-	Reset
A17	VEE (-15V)	-	Power supply for LCD drive
A18	Not Disp OFF	-	NC for Display ON, GND for Display OFF
A19-A20	NC	-	No connection

CFL INTERFACE PIN ASSIGNMENT

Pin No	Symbol	Level	Function
1	GND	-	CFL Ground
2	NC	-	No connection
3	NC	-	No connection
4	HV	-	Power supply for CFL

Note1: Definition of optical data, see page 84

Note 2: f_{FRAME}=75Hz, V_{DD}-V₀=15.7V, T_a=25°C

Note 3: Recommended LCD driving may fluctuate about +/- 1.0V by each module.

Note 4: Need to make sure of flickering and rippling of display when setting the FRAME Frequency in your set.

- ◆ High Contrast LC Material
- ◆ Built-in LCD Controller HD61830B

	I _{EE}	Note 2	-	2.5	4.0	mA
Input Voltage (High Level)	V _{IH}	High Level	0.8* V _{DD}	-	V _{DD}	V
Input Voltage (Low Level)	V _{IL}	Low Level	0	-	0.2* V _{DD}	V
Frame Frequency	f _{FLM}	Note 4	-	75	-	Hz
Duty Ratio	-	-	-	1/128	-	-
Recommended LC Drive Voltage	V _{DD} - V ₀	Duty=1/128 T=0°C, Ø=10°, Note 3	-	16.9	-	V
		Duty=1/128 T=25°C, Ø=10°, Note 3	-	15.8	-	V
		Duty=1/128 T=40°C, Ø=10°, Note 3	-	15.4	-	V
Backlight Lamp Voltage	V _{BL}	T=25°C	-	360	-	Vrms
Backlight Lamp Frequency	f _{BL}	T=25°C	30	70	85	kHz
Backlight Lamp Current	I _{BL}	T=25°C	2.5	5.0	5.5	mA
Lamp Start Voltage	V _S	T=25°C, Note 9	(1000)	-	-	V

TIMING CHARACTERISTICS

Item	Symbol	Min	Typ	Max	Unit
Enable cycle time	t _{CYC}	1.0	-	-	µs
Enable pulse width (High level)	t _{WEH}	0.45	-	-	µs
Enable pulse width (Low level)	t _{WEL}	0.45	-	-	µs
Enable rise time	t _{Er}	-	-	25	ns
Enable fall time	t _{Ef}	-	-	25	ns
Set up time of CS, R/W, RS	t _{AS}	140	-	-	ns
Set up time of Input Data	t _{DIS}	225	-	-	ns
Data delay time	t _{DD}	-	-	225	ns
Hold time of Data	t _H	10	-	-	ns
Hold time of CS, R/W, RS	t _{AH}	10	-	-	ns
Data hold time	t _{DH}	20	-	-	ns

INVERTER AND CONNECTORS

Recommended Inverter	Starter Kit
HITACHI INV6191	STARTLMG74xx
Lamp Connector	Lamp Housing Connector
mitsumi M63M83-04	M61M73-04 , M60-04-30-114P or M60-04-30-134P

Note 5: Background colour of the LCD changes depending on temperature. Between 40-50°C optical characteristics of the LCD like contrast and viewing angle change but the display remains readable.

Note 6: Higher starting voltage of CFL and higher LCD driving voltage are needed while operating at 0°C. The lifetime of CFL will be reduced at 0°C

Note 7: Storage at -20°C < 48 hr, T_a at 60°C < 168 hr

Note 8: Measurement after 10 minutes of CFL operating. Brightness control 100%

Note 9: Starting discharge voltage is increased when LCM is operating at lower temperature. Please check the characteristics of inverter before applying.

ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage (Logic)	V _{DD} - V _{SS}	-	4.75	5.0	5.25	V
Supply Voltage (LC Drive)	V _{EE} - V _{SS}	-	-14.5	-15.0	-15.5	V
Supply Current	I _{DD}	Note 2	-	9.7	12.0	mA

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POWER SUPPLY / POWER UP TIMING DIAGRAM

The diagram illustrates the power supply and power up timing for the LCM. It includes a circuit schematic and two timing waveforms.

Circuit Schematic:

- The LCM is connected to VDD, VSS, V0, and VEE.
- VDD is connected to a +5V supply.
- VSS is connected to ground.
- V0 is connected to a variable resistor (VR) and a -15.0V supply.
- VEE is connected to ground.
- The variable resistor (VR) has a value of 10-20K Ω .
- The timing parameter VDD-V0 : LCD DRIVING VOI is indicated.

Timing Waveforms:

The timing waveforms show the relationship between VDD, SIGNAL, and VEE during power on and power off.

- POWER ON:** VDD rises from 0V to 4.75V. The time from VDD reaching 4.75V to the SIGNAL becoming valid is 0-50 ms. The time from VDD reaching 4.75V to VEE falling to -15.0V is 0 ms min.
- POWER OFF:** VDD falls from 4.75V to 0V. The time from VDD falling to 0V to the SIGNAL becoming invalid is 0-50 ms. The time from VDD falling to 0V to VEE rising to 0V is 0 ms min.

INTERFACE TIMING DIAGRAM

The diagram illustrates the timing relationships between various signals during an interface operation. The main timing window is defined as $52.1\text{ms} < T < 59.5\text{ms}$. A minimum delay of $1.4\mu\text{s}$ is specified for the FRM signal. The FRM signal is shown as a series of pulses, with a period of $240 \cdot T$ indicated. The signals are labeled as follows:

- LOAD
- CP
- D3
- D2
- D1
- D0
- FRM
- LOAD
- FRM

The diagram also shows specific signal transitions and delays, such as $X240$, $X1$, $X2$, $Y1$, $Y5$, $Y317$, $Y2$, $Y6$, $Y318$, $Y3$, $Y7$, $Y319$, $Y4$, $Y8$, $Y320$, and $Y321$.

