

## FEATURES

- ◆ Black on White Film STN Type
- ◆ Transmissive Mode

- ◆ High Brightness CFL Backlight
- ◆ High Contrast LC Material

## MECHANICAL DATA

Item	Value	Unit
Module Dimensions	167.0*109*8.5	mm
Viewing Area	120*89	mm
Resolution	320*240	dots
Dot Size	0.345*0.345	mm
Dot Pitch	0.36*0.36	mm
Weight	160	g

## OPTICAL DATA

Item	Symbol	Condition	Min	Typ	Max	Unit
Contrast Ratio	K	∅=10°, Q=0°, Note 1	-	20	-	-
Brightness	-	T=25°C, Note 7	-	80.0	-	cd/m <sup>2</sup>
Viewing Direction	-	-	6			o'clock
Viewing Angle	∅2 - ∅1	K=2, Note 1	-	40	-	degree
Response Time (Rise)	t <sub>R</sub>	∅=10°, Q=0°, Note 1	-	120	-	ms
Response Time (Fall)	t <sub>F</sub>	∅=10°, Q=0°, Note 1	-	150	-	ms

## ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Min	Max	Unit
Supply Voltage (Logic)	V <sub>DD</sub> - V <sub>SS</sub>	-	0	6	V
Supply Voltage (LC Drive)	V <sub>DD</sub> - V <sub>EE</sub>	-	0	27.5	V
Input Voltage	V <sub>I</sub>	Note 2	-0.3	0.3+V <sub>DD</sub>	V
Operating Temperature	T <sub>OP</sub>	Note 5,6	0	50	°C
Storage Temperature	T <sub>ST</sub>	Note 5,6	-20	60	°C

## DATA INTERFACE PIN ASSIGNMENT

Pin No	Symbol	Level	Function
1-4	D0 - D3	H/L	Display data
5	Not DISP OFF	H/L	High for ON / Low for OFF
6	FRAME	H	First Line Marker
7	NC	-	Do not connect
8	LOAD	H->L	Data latch
9	CP	H->L	Data shift
10	VDD	-	Power supply for logic circuit
11	VSS	-	Ground
12	VEE	-	Power supply for LC drive circuit
13	V0	-	Operating voltage for LC driving
14	FGND	-	Front panel ground

## CFL INTERFACE PIN ASSIGNMENT

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

## ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage (Logic)	V <sub>DD</sub> - V <sub>SS</sub>	-	4.75	5.0	5.25	V
Supply Voltage (LC Drive)	V <sub>EE</sub> - V <sub>SS</sub>	-	-20.9	-22.0	-23.1	V
Supply Current	I <sub>DD</sub>	Note 3	-	6	-	mA
	I <sub>EE</sub>	Note 3	-	5	-	mA
Input Voltage (High Level)	V <sub>IH</sub>	High Level, Note 2	0.8* V <sub>DD</sub>	-	V <sub>DD</sub>	V
Input Voltage (Low Level)	V <sub>IL</sub>	Low Level, Note 2	0	-	0.2* V <sub>DD</sub>	V
Frame Frequency	f <sub>FLM</sub>	-	70	75	80	Hz
Duty Ratio	-	-	-	1/240	-	-
Recommended LC Drive Voltage	V <sub>DD</sub> - V <sub>O</sub>	Duty=1/240, T=0°, ∅=10°, Note 4	-	23.0	-	V
		Duty=1/240, T=25°C, ∅=10°, Note 4	-	22.0	-	V
		Duty=1/240, T=40°C, ∅=10°, Note 4	-	21.0	-	V
Backlight Lamp Voltage	V <sub>BL</sub>	T=25°C	-	300	-	V <sub>rms</sub>
Backlight Lamp Frequency	f <sub>BL</sub>	T=25°C	-	70	85	kHz
Backlight Lamp Current	I <sub>BL</sub>	T=25°C	4	5	6	mA <sub>rms</sub>
Lamp Start Voltage	V <sub>S</sub>	T=25°C	1000	-	-	V
Backlight Lamp Lifetime	T <sub>L</sub>	T=25°C	15.000	20.000	-	hrs

## TIMING CHARACTERISTICS

Item	Symbol	Min	Typ	Max	Unit
Clock frequency	f <sub>CP</sub>	-	-	6.5	MHz
Clock pulse width	t <sub>w</sub>	63	-	-	ns
Rise, Fall time	t <sub>r</sub> , t <sub>f</sub>	-	-	20	ns
Data set up time	t <sub>DSU</sub>	50	-	-	ns
Data hold time	t <sub>DHD</sub>	50	-	-	ns
LOAD set up time	t <sub>LSU</sub>	80	-	-	ns
LOAD -> Clock time	t <sub>LC</sub>	80	-	-	ns
FRAME set up time	t <sub>setup</sub>	100	-	-	ns
FRAME hold time	t <sub>hold</sub>	100	-	-	ns
LOAD pulse width	t <sub>wc</sub>	125	-	-	ns

## INVERTER AND CONNECTORS

Recommended Inverter	Starter Kit
HITACHI INVC132, INVC196	START691x
Lamp Connector	Lamp Housing Connector
JAE IL-G-4S-S3C23	-

- Note1: Definition of optical data, see page 84
- Note 2: Applied to NotDISP.OFF, FRAME, LOAD, CP, D0-D3
- Note 3: FRAME=75Hz, D0-D3=0.1.0.1...VDD-VEE=23.7V, T=25°C
- Note 4: Recommended LC driving voltage may fluctuate about +/-1.0V by each module
- 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: Storage at -20°C < 48 hr, at 60°C < 168 hr
- Note 7: Measurement after 10 minutes of CFL operating. Brightness control at 100 %

