
**SH-2 (SH7145) CPU Board
with LCD Controller**

CPU-339L-2P

3.5 inch QVGA 320 × 240 TFT LCD with touch panel
LMTM035QVGNCA series (DENSITRON)
GVTQ35SPAD series (SGD)

Instruction Manual

05/01/2011 First Edition

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Table of Contents

■ Safety Precautions	
· Safety Precautions	· · · · · P3
· Installation and Software Design Precautions	· · · · · P5
· Warranty and Disclaimer	· · · · · P7
■ Overview and Features of Product	
1. List of Accessories	· · · · · P8
2. Name and Function for the Circuit Board Connectors	· · · · · P8
3. Intended Purpose of Product	· · · · · P10
4. Main Features	· · · · · P11
■ Basic Specifications (SPEC)	
1. Electrical Specifications	· · · · · P12
2. Specifications for Short Pins and Switches, etc.	· · · · · P13
3. CN1 Signal Table	· · · · · P15
4. CN2 Signal Table	· · · · · P15
5. CN3 Signal Table	· · · · · P15
6. CN5 Signal Table	· · · · · P16
7. CN6 Signal Table	· · · · · P16
8. CN7 Signal Table	· · · · · P17
9. CN8, 10 Signal Table	· · · · · P17
10. CN9 Signal Table	· · · · · P17
11. Address Map	· · · · · P18
12. Selection and Preparation of Peripheral Parts	· · · · · P19
13. Technical Documentation about the Product	· · · · · P19
14. Dimensional Drawing of the Board	· · · · · P20

■ Safety Precautions

In order to prevent physical harm and property damage to those using and/or installing this circuit board device (the “Product”), the manual describes below the necessary safety precautions.

- The severity of harm and damage caused by incorrect usage or installation stemming from ignoring the directions herein are indicated by the following symbols and warnings.



This symbol indicates that the possibility of death or serious injury is imminent.



This symbol indicates that death or serious injury is possible.



This symbol indicates that minor injury or damage to only property is possible.

- The types of necessary precautions are classified according to the following symbols.
(The symbols below are an example)



This symbol indicates "Prohibited" actions.



This symbol indicates "Mandatory" actions.



Danger



Do not breathe in or swallow the liquid crystal if the LCD is damaged and leaking. If the liquid crystal is sticking to your hands or clothes, wipe with alcohol etc., and wash thoroughly with water.



Warning



Always use a rated power supply device as per this manual.
Other devices may cause burnout and fire.



When installing, select a well-ventilated and dry area with no risk of water spillage. Otherwise, electrocution, electrical leakage, burnout, or fires may result.

■ Installation and Software Design Precautions

This section covers the precautions when installing the Product (CPU-339L-2P and accompanying LCD panel and touch panel)

Installing the LCD and the PCB

- In order to protect the polarization plate and LCD, place the guard plate on the panel whenever possible.
- Avoid applying external pressure on the LSI when installing.
- Be careful not to warp or contort the LCD panel and PCB.
- When designing your product, assure that the size of the window frame is within the effective display area.
- When using a frame beyond the effective display area for the external appearance of your product, any non-uniform appearance of the product is beyond the scope of the warranty.
- It is possible that there is a burr on the frame edge of the LCD module.
When designing your product, be careful of any contact with cables so as to prevent damage to the cable insulation.

Static Electricity Precautions

- As CMOS-IC is used in the device, take proper measures to deal with static electricity when handling.
- Consider grounding for workers handling the device. For example, the use of an anti-static wrist strap/mat is recommended.

Handling Precautions

- Avoid placing in areas with high humidity for long periods of time. Be particularly careful of high humidity when the temperature is over 40 degrees Celsius.
- As the LCD polarization plate is easily damaged, be careful when handling. Avoid contact with hard objects.
- When cleaning the LCD surface, wipe lightly with a soft cloth (chamois leather, absorbent cotton etc.) and a drop of petroleum benzene.

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- When saliva or a drop of water remains on the LCD polarization plate for a long time, deformation, discoloration, staining, or fading may occur. Wipe away quickly.
 - As the LCD contains glass, chipping and cracking can occur when dropped or hit with a hard object.
 - When testing, avoid condensation in the device in order to avoid staining of the polarization plate.

Operating Precautions

- The LCD controller mounted on this CPU board is a type that forwards configuration data from the flash memory inside the device to the SRAM.
After powering on, it starts quickly after disengaging the reset. However, the hard fill starts soon after powering on. When designing software, ensure that it checks the completion of the hard fill in the hard fill register before allowing read-write access.
- Use of the Product in non-intended, off-specification conditions can cause a decrease in lifespan and a deterioration of visual quality. Always use within specifications.
- Use of the Product in conditions below the rated temperature can cause deterioration of visual quality and/or the formation of air bubbles. Use of the Product in non-intended, off-specification temperatures, can lead to an irreversible change in LCD characteristics. Always use within specifications.
- When the display is subjected to a strong push, a warning light comes on. However, it will return back to normal when left for a while, or if it is rebooted.
- D.C. application causes deterioration of the LCD. Be particularly careful with the connection of the CN6 (interface connector to the LCD), to make sure the contact is complete and not partial.

Storage Precautions

- Store the LCD in a cool, dry place. When keeping the LCD in long-term storage, place in a dark area away from sunlight and fluorescent lighting.
- When storing the LCD and PCB individually, make sure the polarization plate or LSI does not come in contact with other objects.

■ Warranty and Disclaimer

Warranty

- From a manufacturing standpoint, in order to warrant the functionality and reliability of the Product, Kenic System (the “Company”) may issue a delivery specification to the purchaser of the Product (the “Customer”). The warranty covers the items outlined in the delivery specification.
- Any modifications to the Product by the Customer will not be covered by the warranty.

Disclaimer

The Customer agrees that the Company shall not be held liable for accidents and damages caused by the Product under the following circumstances.

- Use of the Product in conditions not specified in this instruction manual (the “Manual”).
- Breakdown or damage to the Product caused by third-party products not approved and provided by the Company.
- Maintenance and repair work using parts not approved by the Company.
- The Customer did not follow the precautions or operating instructions as set forth in the Manual.
- Use of the Product in situations where the power source, installation environment, and other conditions are beyond the specifications as outlined in the Manual.
- Accidents and damages caused by natural disasters such as fires, earthquakes, floods, and lightning storms.

※Component specifications and external appearance may change without notice. However, if previously agreed to installation dimensions and electrical interface need to be changed due to unforeseen circumstances, the Company will contact the Customer to resolve the issue.

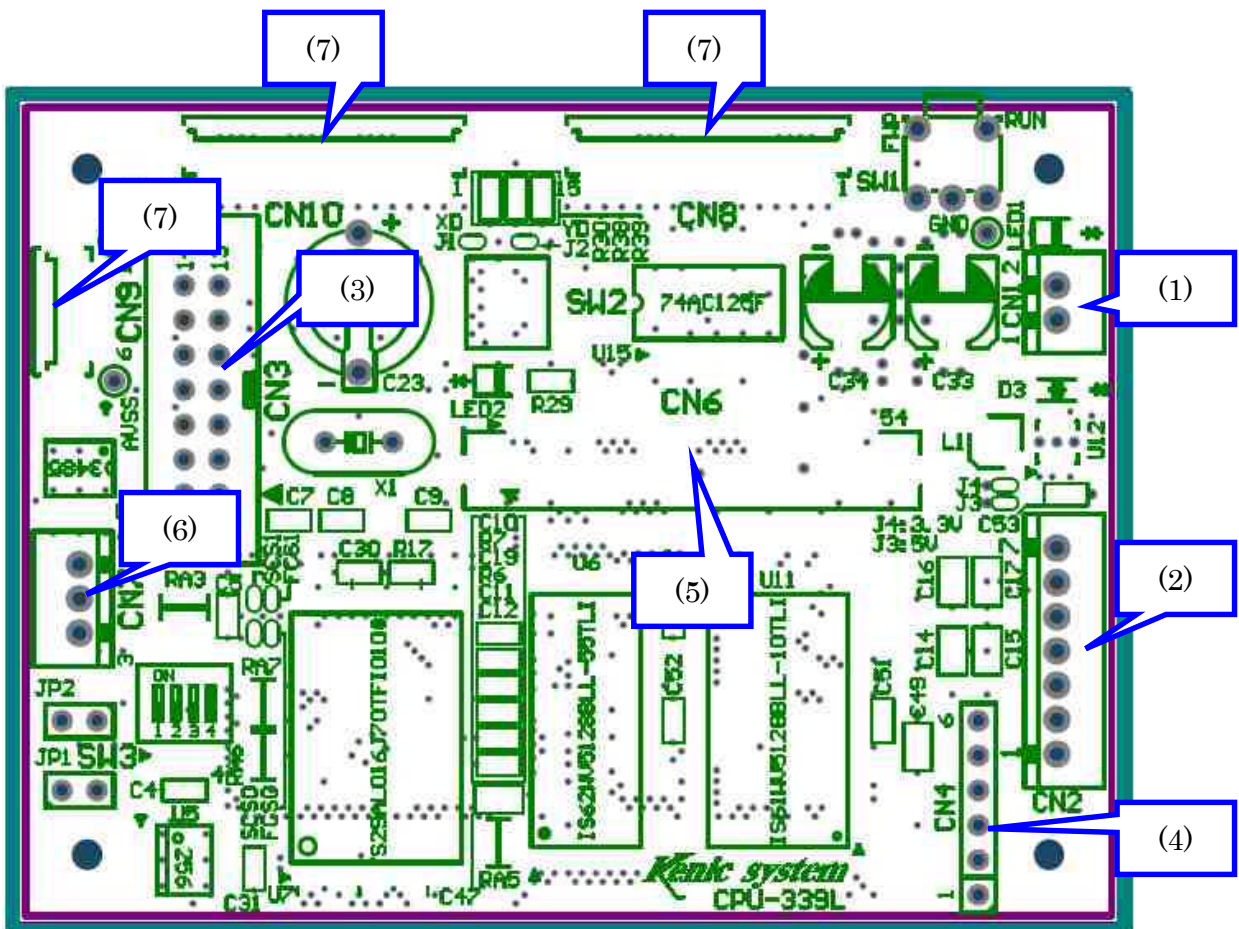
Overview and Features of the Product

1. List of Accessories

2-pin cable for power supply	(For CN1)	CPU339-EL2CB
RS-232C cable	(For CN2)	CPU339-232CB
RS-485 cable	(For CN7)	CPU339-485CB
15-pin generic I/O cable× 2	(For CN8,10)	CPU339-IO15CB(225)
6-pin analog input cable	(For CN9)	CPU339-IO6CB(225)

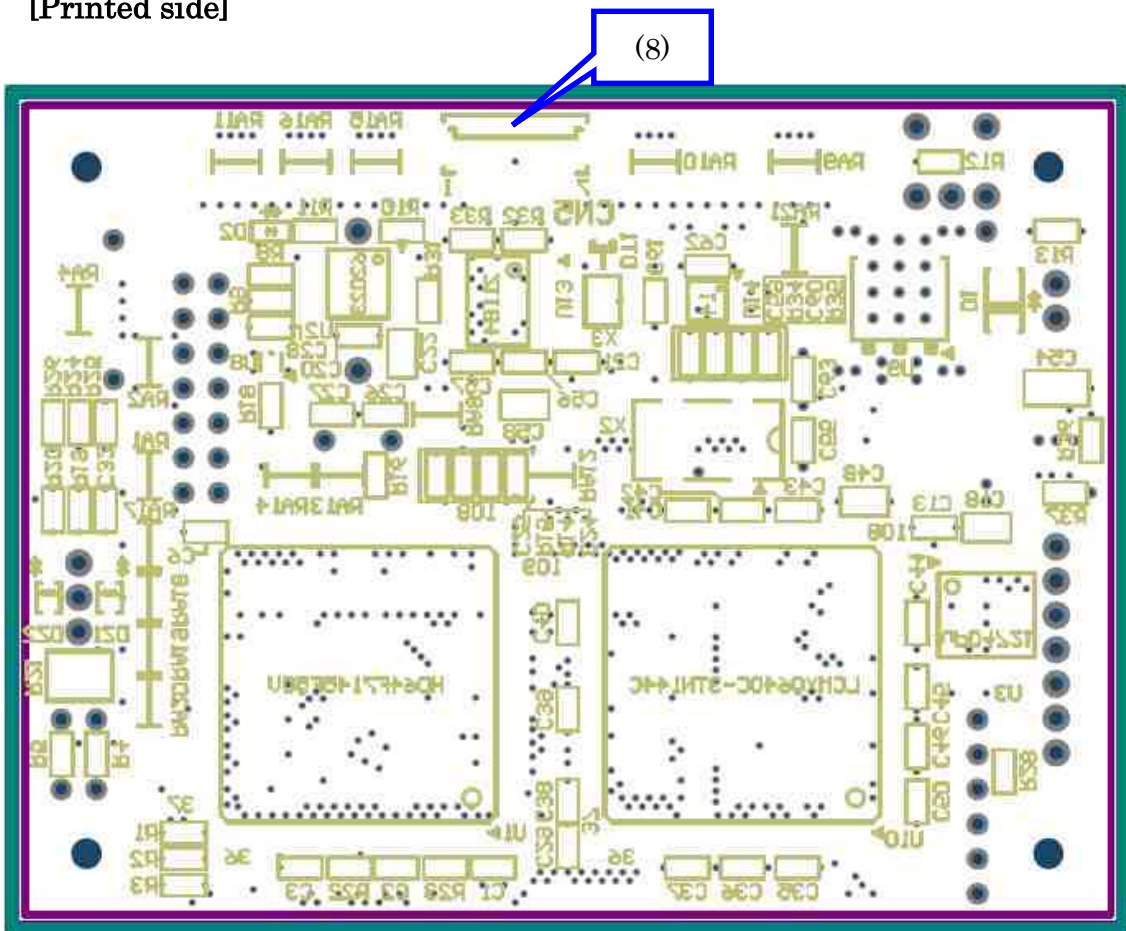
2. Name and Function for the Circuit Board Connectors

[Component side]



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- (1) CN1: Connector for +5V power supply.
 - (2) CN2: Connector for RS-232C and +5V power supply.
 - (3) CN3: Connector for H-UDI.
 - (4) CN4: LCDC software write connector. (not mounted)
 - (5) CN6: Connector for TFT LCD (QVGA).
 - (6) CN7: Connector for RS-485
 - (7) CN8, CN9, CN10: System expansion connectors for the CPU I/O signal.

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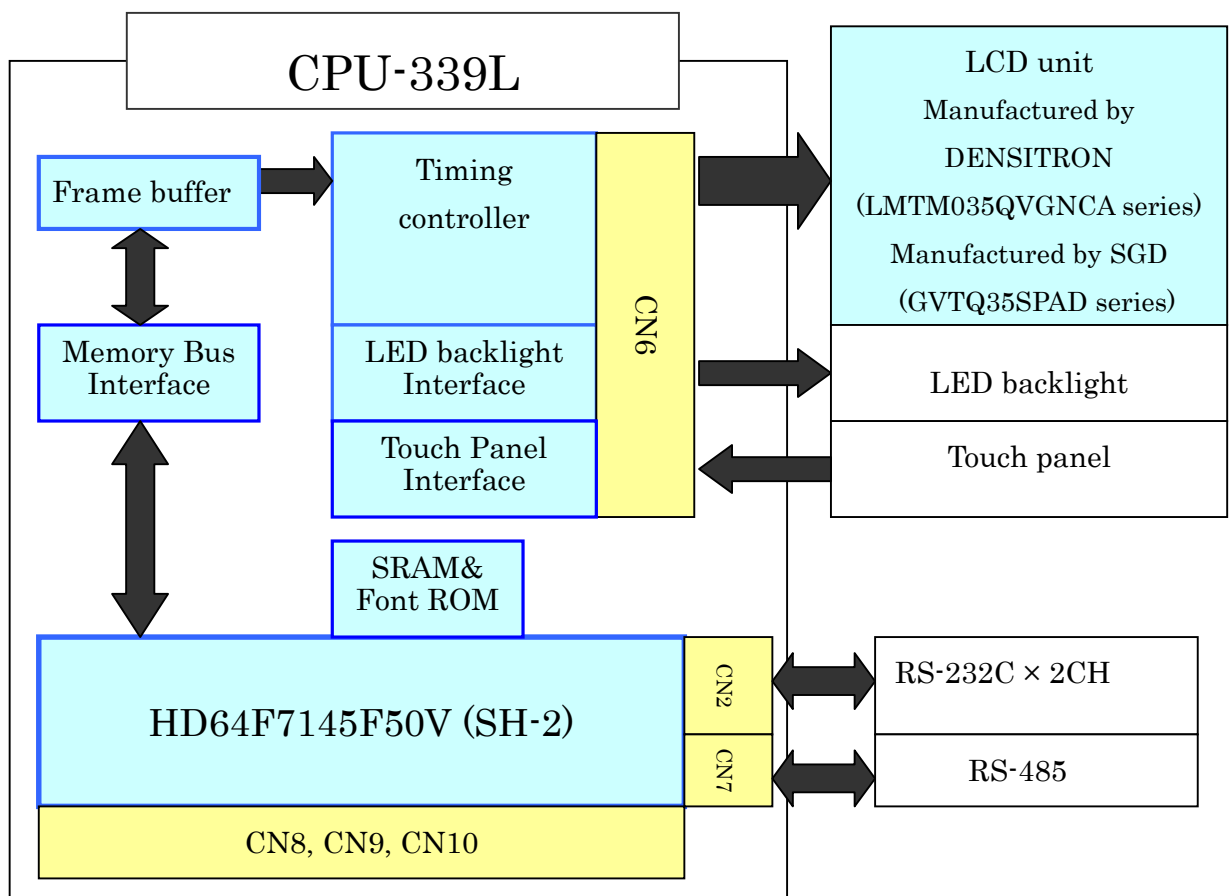


- (8) CN5: Touch panel controller (KS-R8TPC) write connector.

3. Intended Purpose of Product

The CPU-339L-2P is an exclusive controller board for the “LMTM035QVGNCA series” TFT color LCD display module manufactured by DENSITRON, and for the “GVTQ35SPAD series” TFT color LCD display module manufactured by SGD.

Please refer to the following block diagram.



4. Main Features

- As the SH-2 (HD64F7145F50V) CPU by Renesas Technology is included as standard equipment, it is possible for the Customer's entire system to be completed with this single board.
- The SRAM for the CPU (512KB) is included as standard equipment. Furthermore, with the 0.1F Gold Capacitor, the SRAM is capable of over one week's backup.
- Two RS-232C lines are included as standard equipment.
- One RS-485 line is included as standard equipment.
- There is no lag for write to from the CPU at intervals of 200ns or longer.
There is no lag for read out at intervals of 300ns or longer.
Even under DMA with SH-2, there is plenty of latitude for access.
- 64 colors and 65,000 colors can be displayed per pixel.
- There is a complete, one-to-one correlation between the mapping coordinates of the pixels and addresses as seen from the Customer's CPU.
- Touch position data from the touch panel can be directly read out as 8-bit data.
- It is possible to set two different inverted color blink controls (two patterns).
- Full-screen wipe is supported by the hardware.
It is possible to specify the color for wiping.
- As the CS0 area can be switched from the Flash-ROM area to the SRAM area using short pin, it is possible to debug by E10A, ICE, etc.
- As EEPROM is included, it is possible to hold data for memory.
- Compact and lightweight, the Product dimensions are 80mm×60mm (not including protruding cables).

■ Basic Specifications

1. Electrical Specifications

———— LCD Section ————

- Intended LCD module LMTM035QVGNCA series (DENSITRON)
GVTQ35SPAD series (SGD)
- Intended touch panel The above LCD is included as standard equipment.
- Intended LCD controllers KS-LETQ-2P (Kenic system)
- Intended backlight inverter As LED is used, it is unnecessary.
- Frame buffer Two pages or one page
- Color representation 64 colors/ 4,096 colors or 65,000 colors

———— CPU Section ————

- CPU HD64F7145F50V (Renesas)
- SRAM IS62WV5128BLL-55TLI (ISSI) etc.
- Flash-ROM S29AL016J70TFI010# (SPANSION) etc.
- EEPROM 24LC256-I/SN-G (Microchip)
- Chinese character fonts JIS level-1, JIS level-2 (16 dot font)
- RS-232C 2CH already mounted
- RS-485 1CH already mounted

———— I/O Specifications ————

- CN8,CN9,CN10 For generic I/O

———— Others ————

- Power supply Specifications 5V single supply 1.0A MAX
Rated voltage of CPU board 5V±0.4V
Consumption current of CPU board
350mA

*Not including LCD.
- Operating environment 0 °C ~ 50 °C
- External dimensions and weight 80 × 60 × 15mm
(not including protruding cables)
About 30g

2. Specifications for short pins, switches, etc.

- (1) FCS0, SCS0 For selecting CS0 area
Shorting FCS0: CS0 is set in Flash-ROM area.
Shorting SCS0: CS0 is set in SRAM area.
Caution) To avoid damage, do not set in the same area as CS1.
- (2) FCS1, SCS1 For selecting CS1 area
Shorting SCS1: CS1 is set in SRAM area.
Shorting FCS1: CS1 is set in Flash-ROM area.
Caution) To avoid damage, do not set in the same area as CS0.
- (3) JP1 For H-UDI
When open, CPU operates normally.
When short, it is the setting for H-UDI.
- (4) JP2 RS-485 terminator
When short, it is the setting for RS-485 terminal.
- (5) J1 [XD] For switching the X axis data of the touch panel.
When short, the X axis data of the touch panel is reversed.
- (6) J2 [YD] For switching the Y axis data of the touch panel.
When short, the Y axis data of the touch panel is reversed.
- (7) J3 [5V] Power supply setting for LED backlight circuit.
When short, the power supply of the LED backlight circuit is 5V.
Caution) As the factory default setting is already short, it is unnecessary for the
Customer to short it.
Caution) Do not short J3 and J4 at the same time.
- (8) J4 [3.3V] Power supply setting for LED backlight circuit.
When short, the power supply of the LED backlight circuit is 3.3 V.
Caution) When using, disengage J3 before shorting J4.
Caution) Do not short J3 and J4 at the same time.
- (9) SW1 For switching modes.
When switched towards a lit LED1, CPU changes to boot mode.
When switched towards an unlit LED1, CPU operates normally.

(10) SW2 Reset switch

When pressing SW2, set the RESET pin for the CPU, LCD controller, etc. to LOW.

(11) SW3 4-bit DIP switch

Connected to the CPU I/O ports PF4~7.

3. CN1 Signal Table for Power Supply Connector

Pin number	Name of signal	Function
1	VIN	+5.0V
2	GND	GND pin

Connector used: B2B-XH-A (LF) (SN) (JST Mfg. Co., Ltd.)

Compatible connector: XHP-2 (JST Mfg. Co., Ltd.)

4. CN2 Signal Table for RS-232C Connector

Pin number	Name of signal	Function
1	VCC	Power supply pin +5V
2	TxD3	RS-232C three sending lines
3	TxD1	RS-232C one sending line (in conjunction with program download)
4	RxD3	RS-232C three receiving lines
5	RxD1	RS-232C one receiving line (in conjunction with program download)
6	GND	RS-232C signal ground
7	GND	Power supply pin GND pin

Connector used: B7B-XH-A (LF) (SN) (JST Mfg. Co., Ltd.)

Compatible connector: XHP-7 (JST Mfg. Co., Ltd.)

5. CN3 Signal Table for H-UDI Connector

Pin number	Name of signal	Function
1	TCK	H-UDI connection
2	GND	
3	TRST	
4	GND	
5	TDO	
6	GND	
7	ASEBRKA K	
8	NC	
9	TMS	
10	GND	
11	TDI	
12	GND	
13	RESET	
14	GND	

Connector used: XG4C-1431 (Omron)

6. CN5 Signal Table for Touch Panel Controller Write Connector

Pin number	Name of signal	Function
1	VCC	+3.3V power supply pin
2	RESET	Already connected to /RES pin of R5F211B4SP
3	N.C	No connection
4	MODE	Already connected to MODE pin of R5F211B4SP
5	P4-5	Already connected to P4-5 pin of R5F211B4SP
6	P3-7	Already connected to P3-7 pin of R5F211B4SP
7	GND	GND pin

Connector used: 53261-0771 (Molex)

7. CN6 Signal Table for LCD Connector

Pin number	Name of signal	Function	Pin number	Name of signal	Function
1	LED K	LED backlight cathode	28	R0	Red data signal (LSB)
2	LED K	LED backlight cathode	29	R1	Red data signal
3	LED A	LED backlight anode	30	R2	Red data signal
4	LED A	LED backlight anode	31	R3	Red data signal
5	N.C	No connection	32	R4	Red data signal
6	N.C	No connection	33	R5	Red data signal
7	N.C	No connection	34	R6	Red data signal
8	/RESE T	Reset signal	35	R7	Red data signal (MSB)
9	N.C	No connection	36	HSYN C	HSYNC signal
10	N.C	No connection	37	VSYN C	VSYNC signal
11	N.C	No connection	38	DCLK	Dot clock signal
12	B0	Blue data signal (LSB)	39	N.C	No connection
13	B1	Blue data signal	40	N.C	No connection
14	B2	Blue data signal	41	VCC	Power input (+3.3V)
15	B3	Blue data signal	42	VCC	Power input (+3.3V)
16	B4	Blue data signal	43	N.C	No connection
17	B5	Blue data signal	44	N.C	No connection
18	B6	Blue data signal	45	YU	Touch panel signal YU
19	B7	Blue data signal (MSB)	46	XR	Touch panel signal XR
20	G0	Green data signal (LSB)	47	YL	Touch panel signal YL
21	G1	Green data signal	48	XL	Touch panel signal XL
22	G2	Green data signal	49	N.C	No connection
23	G3	Green data signal	50	N.C	No connection
24	G4	Green data signal	51	N.C	No connection
25	G5	Green data signal	52	N.C	No connection
26	G6	Green data signal	53	VSS	GND pin
27	G7	Green data signal (MSB)	54	VSS	GND pin

Connector used: 04-6240-054-005-800+ (Kyocera ELCO)

8. CN7 Signal Table for RS-485 Connector

Pin number	Name of signal	Function
1	A	RS-485 sending/receiving (non-inverted)
2	B	RS-485 sending/receiving (inverted)
3	GND	GND signal

Connector used: B3B-XH-A (LF) (SN) (JST Mfg. Co., Ltd.)

Compatible connector: XHP-3 (JST Mfg. Co., Ltd.)

9. CN8, 10 Signal Table for I/O Connector

CN8			CN10		
Pin number	Name of signal	Function	Pin number	Name of signal	Function
1	VCC	Pin for power. +3.3V supply pin.	1	VCC	Pin for power. +3.3V supply pin.
2	CK(PA15)	CPU I/O port PXXX	2	D8(PD8)	CPU I/O port PXXX
3	PE0		3	D9(PD9)	
4	PE1		4	D10(PD10)	
5	PE2		5	D11(PD11)	
6	PE3		6	D12(PD12)	
7	PE6		7	D13(PD13)	
8	PA5		8	D14(PD14)	
9	PE7		9	D15(PD15)	
10	PA23		10	PA8	
11	PE14		11	PB5	
12	PA22		12	PA18	
13	PA21		13	PA19	
14	PE15		14	PA20	
15	GND		Ground connection pin.	15	

Connector used: 53261-1571 (Molex)

Compatible connector: 51021-1500 (Molex)

10. CN9 Signal Table for Analog Input

Pin number	Name of signal	Function
1	AVCC	Analog power supply pin (+3.3V)
2	PF0	CPU input port PXXX
3	PF1	
4	PF2	
5	PF3	
6	AVSS	Analog ground connection pin.

Connector used: 53261-0671 (Molex)

Compatible connector: 51021-0600 (Molex)

11. Address Map

**The on board CPU is preset so as to operate by mode2 (MD0=0 MD1=1).*

**The Chinese character ROM area, external RAM area, and LCD controller areas have not been decoded in the CS space.*

** For more details, refer to the Renesas SH7145 series hardware manual.*

0000 0000H	ROM with built-in CPU	
0003 FFFFH	Free (Reserved for CPU)	
0020 0000H	Chinese character ROM	CS0 area
003F FFFFH	Image	
0040 0000H	External RAM	CS1 area
0047 FFFFH	Image	
0080 0000H	Frame buffer for LCD controller	CS2 area
0081 DFFFH	Free	
:		
0081 FFF9H	Various registers for LCD controller	
0081 FFFFH	Image	
:		
00C0 0000H	Free space	CS3 area
00FF FFFFH		

12. Selection and Preparation of Peripheral Parts

(1) Selection of the main power supply device

Power-supply voltage: $5V \pm 0.4V$

Consumption current: 1.0A MAX

Boot speed: within 300mS

Ripple noise: within 150mV

(2) Connection of each unit

Refer to the starter kit manual for connecting each of the units.

Use only the minimum length necessary for cables. Unnecessarily long cables may cause a decrease in transmission speeds and/or introduce noise.

(3) Powering on the Product

Before powering on, carefully check all connections first. Loose connections may cause damage to parts.

13. Technical Documentation about the Product

Technical information about the Product is continually updated and posted on the Kenic system website. Please feel free to browse at the URL below.

<http://www.kenic.co.jp/>

14. Dimensional Drawing of the Board

