SOM-4450 ETX Module

NS Geode 586-Level SOM-ETX CPU Module with SVGA/LCD/ LVDS/LAN/SSD Interface

User's Manual

Copyright notice

Acknowledgements

SOM and DTOS are trademarks of Advantech Co., Ltd.
AMD is a trademark of Advanced Micro Devices, Inc.
Award is a trademark of Award Software International, Inc.
Cyrix is a trademark of Cyrix Corporation.
IBM, PC/AT, PS/2 and VGA are trademarks of International Business Machines Corporation.
Intel and Pentium are trademarks of Intel Corporation.
Microsoft Windows® is a registered trademark of Microsoft Corp.
RTL is a trademark of Realtek Semiconductor Co., Ltd.
C&T is a trademark of Chips and Technologies, Inc.
UMC is a trademark of United Microelectronics Corporation.
Winbond is a trademark of Winbond Electronics Corp.
STPC is a trademark of SGS Thomson Corp.

For more information on this and other Advantech products, please visit our website at: **http://www.advantech.com**

For technical support and service, please visit our support website at: **http://www.advantech.com/support**

This manual is for the SOM-4450

Part No. 2006445000

1st Edition Printed in Taiwan Sept. 2001

Packing list

Before you begin installing your card, please make sure that the following materials have been shipped:

- 1 SOM-4450 System On Module CPU module
- CD-ROM or Disks for utility, drivers, and manual (in PDF format)

If any of these items are missing or damaged, contact your distributor or sales representative immediately.

Contents

Figures

Tables

CHAPTER 1

General Information

This chapter gives background information on the SOM-4450 CPU System On Module.

Sections include:

- Introduction
- Specifications
- Board Dimensions

1.1 Introduction

Advantech's SOM-ETX form factor System On Module provides a scalable solution that meets customers' advanced CPU and application development needs. The SOM-4450 incorporates a low power, fanless GX1-300 MHz processor that has become the embedded integrators' processor of choice. It uses a NS CS5530A chipset as its VGA/LCD controller, with single 18 bit LVDS interface and 64-bit graphics engine. The CS5530A display controller (LCD and CRT display support) allows sharp and clear LCD screen resolutions up to 1024 x 768 and CRT resolutions up to 1280 x 1024 @ 16 colors. Combined with the CS5530A system chipset is a RealTek RTL 8139 ethernet chipset. It supports all functions of an AT-compatible industrial computer. There is one SODIMM socket that supports 16 MB to 128 MB synchronous DRAM. The small size (95 mm x 114 mm) and use of four high capacity connectors based on the proven ETX form factor, allow the SOM-ETX modules to be easily and securely mounted onto a customized solution board or our standard SOM-DB4400 development board.

Many gains were made by using the Geode™ GX1 processor. The GX1 processor provides the lowest power consumption combined with high speed 586 processing power. This GX1 processor also supports most popular web plug-ins and leverages existing software and hardware investments. Onboard features include an ethernet interface, socket for CompactFlash™ card , Enhanced IDE interface capable of Ultra DMA transfer protocol, one parallel port, two serial ports and a PS/2 keyboard/mouse interface.

1.2 Specifications

1.2.1 Standard System On Module SBC functions

- **CPU**:
  Embedded Low power NS Geode GX1-300 MHz 2.0 V processor
- **BIOS**: 2 Mbit Flash BIOS, supports Plug & Play, APM 1.2 Support Ethernet boot ROM Support, boot from CD-ROM* Support, boot from LS-120, ZIP DriveSupport, wake on LAN support, wake on Modem support, turn off LCD back light function, Optional customer icon
- **System memory**: 1 SODIMM socket, supports 16 MB to 128 MB, accept 16/32/64/128 MB Synchronous DRAM.
- **Enhanced IDE interface**: Supports up to four EIDE devices. BIOS auto-detect, PIO Mode 3 or Mode 4 transfer
- **FDD interface**: Share with Parallel port FDD interface
- **Serial ports**: 2 serial port interfaces COM1: RS-232; COM2: RS-232 (TTL Output)
- **Parallel port**: One parallel port interface, supports EPP/ECP parallel mode
- **Infrared port**: One 115 Kbps infrared port, IrDA 1.0 compliant
- **Keyboard/mouse connector**: PS/2 keyboard and mouse interface
- **USB interface**: Two USB ports, USB open HCI compliant
- **Power management**: APM 1.2 compliant
- **Watchdog timer**: 62 levels timer interval, reset to system or IRQ11 by jumper on carry board

1.2.2 Local-bus VGA interface

- **Chipset**: NS CS5530A
- **Display memory**: 1 ~ 4 MB share memory, set in BIOS
- **Display type:** Supports CRT and TTL LCDs. Able to display both

CRT and flat panel simultaneously

- **TTL LCD panel display mode**: Panel resolution supports up to 1024 x 768 @ 18 bpp. Supports 18-bit TTL LCD panel
- **CRT display mode**: Non-interlaced CRT monitor resolutions up to 1280 x 1024 @ 256 colors or 1024 x 768 @ 16 bpp

1.2.3 Ethernet function

- **Chipset**: RealTek RTL 8139
- **Ethernet interface**: PCI 10/100 Mbps Ethernet. IEEE 802.3u protocol compatible
- **Support 10/100 Mbps Tx (Transformer on carrier board)**
- **Wake-on-Lan function**

1.2.4 LVDS (Low Voltage Differential Signal) interface

- **Chipset**: TI SN75LVDS84
- **Performance**: 18 low-voltage TTL data channels plus clock-in and 3 low-voltage differential data channels plus clock-out. 3.3 V and 250 mW (typical). Meets ANSI/EIA/TIA-644

Note: LVDS only on SOM-4470FL

1.2.5 Audio function

- **Chipset**: NS CS5530A
- **Audio controller**: AC97 version 2.0 compliant interface
- **Audio interface**: Microphone in, Line in, CD audio in, Line out, Speaker L, Speaker R
- **Power**: Accepts +12 V source for improved audio quality

1.2.6 TV-out function

- **Chipset**: CHRONTEL CH7003C
- **Supports**: NTSC, NTSC-EIA (Japan) and PAL TV formats, provides composite, S-video and SCART (optional) outputs via RCA (composite) connector and S-video connector.

- Supports 640 x 480 and 800 x 600 input resolutions
- Supports Windows 95/98 and Windows NT drivers
- Over-scan, under-scan and postion adjustable (Windows 95/98 only)
- Auto detection of TV presence

1.2.7 SSD Support

- 1 CompactFlash socket on board expandable by chipDisk and external HDD (Bootable CFC HDD)
- 16 MB DOC2000 on board (optional)

1.2.8 Mechanical and environmental

- **Dimensions: (L x W):** 95 mm x 114 mm (3xx" x xxx")
- **Weight:** 74 g
- **Operating temperature:** 0° ~ 60° C (32 ~ 140° F)*
- **Storage temperature:** -40° ~ 85° C (-40 ~ 185° F)
- **Operating humidity:** 0% to 95% relative humidity, noncondensing
- **Power supply voltage:** +5 V ± 5 %
- **Power requirements:** 2.0 A @ 5 V, Max w/GX1-300 MHz CPU & 64 MB

* applied conditions

1.3 Board dimensions

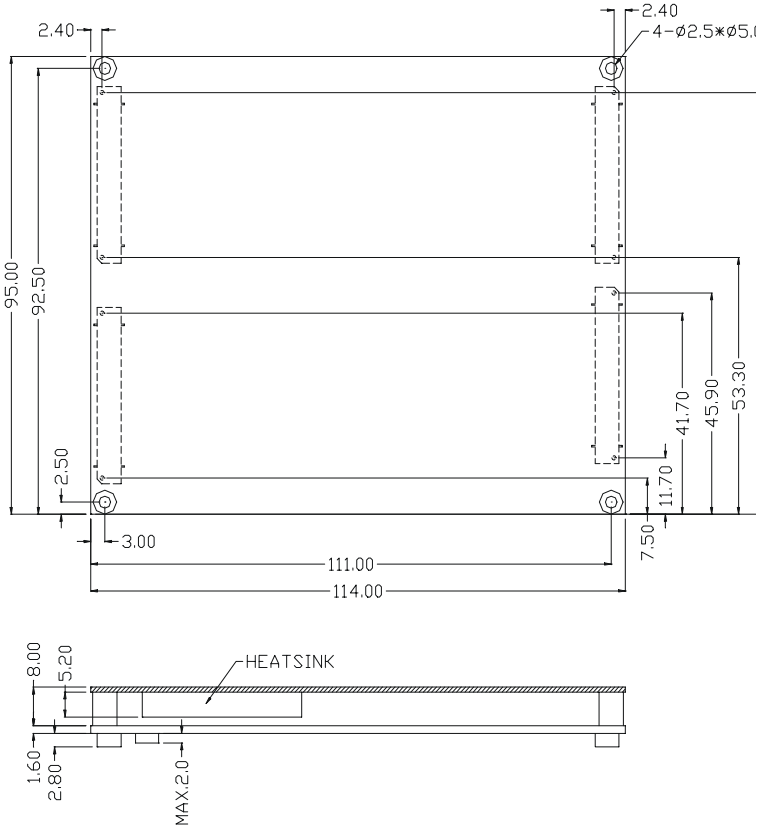


Figure 1-1: SOM-4450 dimensions

Figure 1-2: SOM-4450 Top view

CHAPTER 2

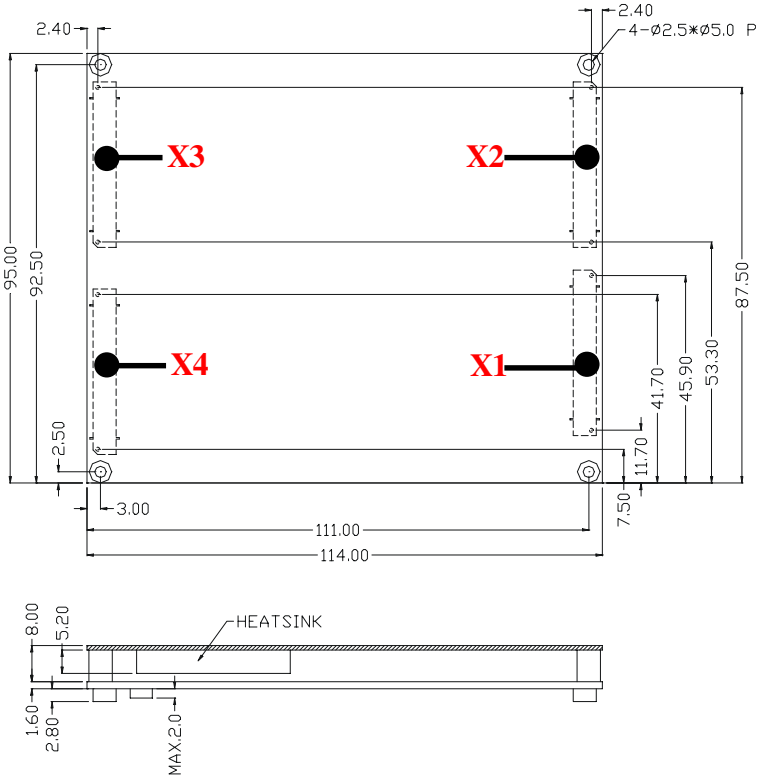
Connector Assignments and Descriptions

This chapter tells how to set up the SOM-4450 hardware. It includes instructions on connecting peripherals, switches and indicators. Make sure you read all the safety precautions before you begin the installation procedure.

2.1 Connector Locations

The board has a number of connectors that allow you to configure your system to suit your application.

The tables below shows the function of each of the board's connectors:



SOM-4450 Locating Connectors

2.2 Pin Assignments for X1, X2, X3, X4 connectors

Please refer to SOM-ETX Design and Specification Guide, Chapter 2

2.3 Safety precautions

Warning! *Always completely disconnect the power cord from your board whenever you are working on it. Do not make connections while the power is on, because sensitive electronic components can be damaged by a sudden rush of power.*

Caution! *Always ground yourself to remove any static charge before touching the board. Modern electronic devices are very sensitive to static electric charges. Use a grounding wrist strap at all times. Place all electronic components on a static-dissipative surface or in a static-shielded bag when they are not in the chassis.*

CHAPTER 3

Software Configuration (optional for SOM-4450)

This chapter details the software configuration information. It shows you how to configure the SOM-4450 card to match your application requirements. Award system BIOS is covered in Chapter 4.

Sections include:

- LCD display configuration
- Connections for two standard LCDs

3.1 Introduction

The SOM-4450 system BIOS and custom drivers are located in a 256 KB, 32-pin Flash ROM device, designated U17. A single Flash chip holds the system BIOS and VGA BIOS. The display type can be configured via software. This method minimizes the number of chips and eases configuration. You can change the display BIOS simply by reprogramming the Flash chip.

3.2 Utility CD disk

The SOM-4450 is supplied with a software utility on CD-ROM. This disk contains the necessary file for setting up the VGA display. Directories and files on the disk are as follows:

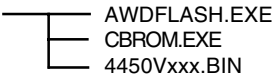


Figure 3-1: Contents of the SOM-4450 Series utility disk

AWDFLASH.EXE
This program allows you to update the BIOS Flash ROM.

4450110.BIN
This binary file contains the system BIOS.

CBROM.EXE
This program allows you to combine your own VGA BIOS with system BIOS (4450V110.BIN).

3.3 VGA display software configuration

The SOM-4450 on-board VGA/LCD interface supports an 18-bit TFT LCD, flat panel displays and traditional analog CRT monitors. The interface can drive CRT displays with resolutions up to 1024 x 768 in 24 bpp. It is also capable of driving color panel displays with resolutions of 1024 x 768 in 18 bpp. The LCD type is configured completely via the software utility, so you do not have to set any jumpers. Configure the LCD type as follows:

1. Apply power to the SOM-4450 application with a color TFT display attached. This is the default setting for the SOM-4450 series. Make sure that the AWDFLASH.EXE and *.BIN files are located in the working drive.

Note: Make sure that you do not run AWDFLASH.EXE while your system is operating in EMM386 mode.

2. At the prompt, type AWDFLASH.EXE and press <Enter>. The VGA configuration program will then display the following:

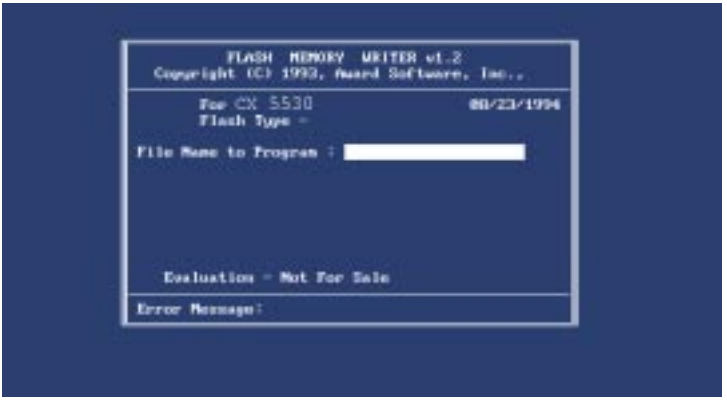


Figure 3-2: BIOS VGA setup screen

3. At the prompt, type in the BIN file which supports your display. When you are sure that you have entered the file name correctly press <Enter>. The screen will ask “Do you want to save?” If you wish to continue press Y. If you change your mind or have made a mistake press N.

4. If you decide to continue, the screen will issue a prompt which will then ask “Are you sure to program (Y/N)?” If you wish to continue, press Y. Press N to exit the program.

The new VGA configuration will then write to the ROM BIOS chip. This configuration will remain the same until you run the AWDFLASH.EXE program and change the settings.

3.4 Connections for two standard LCDs

3.4.1 Connections for Toshiba LTM10C042(640 x 480 TFT color LCD)

Table 3-1: Connections for Toshiba LTM10C042

LTM10C042		SOM-4450	
Pin	**Name**	**Pin**	**Name**
1	GND	3	GND
2	CLK	35	SHFCLK
3	GND	4	GND
4	R0	27	PD12
5	R1	28	PD13
6	R2	29	PD14
7	GND	8	GND
8	R3	30	PD15
9	R4	31	PD16
10	R5	32	PD17
11	GND	33	GND
12	G0	19	PD6
13	G1	20	PD7
14	G2	21	PD8
15	GND	33	GND
16	G3	22	PD9
17	G4	23	PD10
18	G5	24	PD11
19	GND	34	GND
20	ENAB	37	M
21	GND	34	GND
22	B0	11	PD0
23	B1	12	PD1
24	B2	13	PD2
25	GND	39	GND
26	B3	14	PD3
27	B4	15	PD4
28	B5	16	PD5
29	GND	39	GND
30	VDD	5	+5 V
31	VDD	6	+5 V

3.4.2 Connections for Toshiba LTM12C275A (800 x 600 TFT color LCD)

Table 3-2: Connections for Toshiba LTM12C275A

LTM12C275A		SOM-4450	
Pin	**Name**	**Pin**	**Name**
1	GND	3	GND
2	NCLK	35	SHFCLK
3	NC	-	NC
4	NC	-	NC
5	GND	4	GND
6	R0	27	PD12
7	R1	28	PD13
8	R2	29	PD14
9	R3	30	PD15
10	R4	31	PD16
11	R5	32	PD17
12	GND	8	GND
13	G0	19	PD6
14	G1	20	PD7
15	G2	21	PD8
16	G3	22	PD9
17	G4	23	PD10
18	G5	24	PD11
19	GND	33	GND
20	B0	11	PD0
21	B1	12	PD1
22	B2	13	PD2
23	B3	14	PD3
24	B4	15	PD4
25	B5	16	PD5
26	ENAB	37	M/DE
27	GND	34	GND
28	VCC	5	+5 V
29	VCC	6	+5 V
30	GND	39	GND

APPENDIX A

Programming the Watchdog Timer

The SOM-4450 is equipped with a watchdog timer that resets the CPU or generates an interrupt if processing comes to a standstill for any reason. This feature ensures system reliability in industrial standalone or unmanned environments.

A.1 Programming the watchdog timer

To program the watchdog timer, you must write a program which writes I/O port address 443 (hex). The output data is a value of time interval. The value range is from 01 (hex) to 3E (hex), and the related time interval is 1 sec. to 62 sec.

Data	Time Interval
01	1 sec.
02	2 sec.
03	3 sec.
04	4 sec.
• •	
• •	
• •	
3E	62 sec.

After data entry, your program must refresh the watchdog timer by rewriting the I/O port 443 (hex) while simultaneously setting it. When you want to disable the watchdog timer, your program should read I/O port 443 (hex).

The following example shows how you might program the watchdog timer in BASIC:

```
10      REM  Watchdog timer example program
20      OUT &H443, data REM  Start and restart the watchdog
30      GOSUB 1000 REM  Your application task #1,
40      OUT &H443, data REM  Reset the timer
50      GOSUB 2000 REM  Your application task #2,
60      OUT &H443, data REM  Reset the timer
70      X=INP (&H443) REM, Disable the watchdog timer
80      END
1000    REM  Subroutine #1, your application task
•       •
•       •
•       •
1070    RETURN
2000    REM  Subroutine #2, your application task
•       •
•       •
•       •
2090    RETURN
```

APPENDIX B

System Assignments

- System I/O ports
- DMA channel assignments
- Interrupt assignments
- 1st MB memory map

B.1 System I/O ports

Table B-1: System I/O ports

Addr. range (Hex)	Device
000-01F	DMA controller (slave)
020-03F	Interrupt controller 1, (master)
040-05F	8254 timer/counter
060-06F	8042 (keyboard controller)
070-07F mask	Real-time clock, non-maskable interrupt (NMI)
080-09F	DMA page register,
0A0-0BF	Interrupt controller 2 (slave)
0C0-0DF	DMA controller (master)
0F0	Clear math co-processor
0F1	Reset math co-processor
0F8-0FF	Math co-processor
170- 178	2nd fixed disk for CompactFlash
1F0-1F8	1st fixed disk
200-207	Game I/O
278-27F	Reserved
2F8-2FF	Serial port 2
300-31F	Ethernet**
360-36F	LPT2
378-37F	Parallel printer port 1 (LPT1)
380-38F	SDLC, bisynchronous 2
3A0-3AF	Bisynchronous 1
3B0-3BF	Monochrome display
3C0-3CF	Reserved
3D0-3DF	Color/graphics monitor adapter
3F0-3F7	Diskette controller
3F8-3FF	Serial port 1
443	Watchdog timer

** default setting

B.2 DMA channel assignments

Table B-2: DMA channel assignments

Channel	Function
0	Available
1	Available
2	Floppy disk (8-bit transfer)
3	Parallel**
4	Cascade for DMA controller 1
5	Available
6	Available
7	Available

** Parallel port DMA default setting: DMA 3

Parallel port DMA select: DMA 1, 3

B.3 Interrupt assignments

Table B-3: Interrupt assignments

Interrupt#	Interrupt source
NMI	Parity error detected
IRQ 0	Interval timer
IRQ 1	Keyboard
IRQ 2	Interrupt from controller 2 (cascade)
IRQ 3	Serial communication port 2
IRQ 4	Serial communication port 1
IRQ 5	Available
IRQ 6	Diskette controller (FDC)
IRQ 7	Parallel port 1 (print port)
IRQ 8	Real-time clock
IRQ 9	Reserve
IRQ 10	Available
IRQ 11	Reserved for watchdog timer
IRQ 12	PS/2 mouse
IRQ 13	INT from co-processor
IRQ 14	Preliminary IDE
IRQ 15	Secondary IDE for CompactFlash

USB and Ethernet IRQ is automatically set by the system

B.4 1st MB memory map

Table B-4: 1st MB memory map

Addr. range (Hex)	Device
F000h - FFFFh	System ROM
E000h - EFFFh	Unused
CC00h - DFFFh	available
C800h - CBFFh	Ethernet ROM*
C000h - C7FFh	VGA BIOS
B800h - BFFFh	CGA/EGA/VGA text
B000h - B7FFh	Reserved for graphic mode usage
A000h - AFFFh	EGA/VGA graphics
0000h - 9FFFh	Base memory

* default setting

APPENDIX C

LVDS Connection

This appendix contains information concerning the LVDS installation and pin assignments.

C.1 LVDS Introduction

When you mention the impressive data rate of 400 Mbps at 15 meters for LVDS, you immediately realize how significant the differences are between analog and digital interfaces. There are several other factors other than significantly increased data transfer rate and image quality that make LVDS (Low-Voltage Differential Signaling) very attractive to industrial users. One is that LVDS drivers and receivers maintain excellent signal levels and performance while operating on supply voltages as low as 2 V. This low voltage allows LVDSs to operate independently from the main power supply voltage. Another factor is that LVDS drivers and receivers have a low swing voltage. This voltage is typically around 345 mV. This allows LVDS devices to achieve high speeds while using relatively little power. This low differential swing voltage together with self-canceling EMI, reduces EMI problems significantly. This is especially important in space-critical applications. This is also why LVDS has already been widely used in Notebook computer panel connections.

All Digital Benefits

No matter which digital standard an end user uses for their industrial applications, it will have to provide the following criteria. Be compatible so that system and display products from different suppliers can be made available in an open market. Become a standard for the electronics and PC industry. Be able to transmit data over standard twisted pair cables as well as fiber optic. Maintain a low bit error rate for high quality image while operating at a very low power level. Be scalable.

Expanded Applications

With flat panel displays already a common part of our everyday lives at work, home and industrial/commercial settings, deciding on a standard is a monumental decision that will affect all our lives. Engineers will have to champion their cause by applying both of these digital panel technologies to many practical products. Thus enabling the end user, whether it be in an industrial setting or a consumer setting, to benefit from both of these technologiesprocessor of choice.

C.2 LVDS Pin assingments

Pin Name	LVDS signal	Channel
LCDDO0	Txout0-	first
LCDDO1	Txout0+	first
LCDDO2	Txout1-	first
LCDDO3	Txout1+	first
LCDDO4	Txout2-	first
LCDDO5	Txout2+	first
LCDDO6	Txclk-	first
LCDDO7	Txclk+	first
LCDDO8	not used	--
LCDDO9	not used	--
LCDDO10	not used	--
LCDDO11	not used	--
LCDDO12	not used	--
LCDDO13	not used	--
LCDDO14	not used	--
LCDDO15	not used	--
LCDDO16	not used	--
LCDDO17	not used	--
LCDDO18	not used	--
LCDDO19	not used	--

Connector X3 (VGA, LCD, Video, COM1, COM2, LPT/Floppy, Irda, Mouse, Keyboard)			
Pin Number	Signal	Pin Number	Signal
1	GND	2	GND
3	R	4	B
5	HSY	6	G
7	VSY	8	DDCK
9	N.C.	10	DDDA
11	LCDDO16	12	LCDDO18
13	LCDDO17	14	LCDDO19
15	GND	16	GND
17	LCDDO13	18	LCDDO15
19	LCDDO12	20	LCDDO14
21	GND	22	GND
23	LCDDO8	24	LCDDO11
25	LCDDO9	26	LCDDO10
27	GND	28	GND
29	LCDDO4	30	LCDDO7
31	LCDDO5	32	LCDDO6
33	GND	34	GND
35	LCDDO1	36	LCDD03
37	LCDDO0	38	LCDDO2
39	VCC	40	VCC
41	LTGIO2	42	LTGIO0
43	LTGIO1	44	BLON#
45	BIASON	46	DIGON
47	COMP	48	Y
49	SYNC	50	C
51	LPT/FLPY#	52	N.C.
53	VCC	54	GND
55	/STB_DRV0	56	/AFD_DENSEL
57	FIR	58	PD7
59	IRRX	60	/ERR_HDSEL#
61	IRTX	62	PD6_MOT0
63	RXD2	64	/INIT_DIR#
65	GND	66	GND
67	RTS2#	68	PD5
69	DTR2#	70	/SLIN_STEP#
71	DCD2#	72	PD4_DSKCHG#
73	DSR2#	74	PD3_RDATA#
75	CTS2#	76	PD2_WP#
77	TXD2#	78	PD1_TRK0#
79	RI2#	80	PD0_INDEX#
81	VCC	82	VCC
83	RXD1	84	/ACK_DRV1
85	RTS1#	86	/BUSY_MOT1
87	DTR1#	88	PE_WDATA#
89	DCD1#	90	/SLCT_WGATE#
91	DSR1#	92	MSCLK
93	CTS1#	94	MSDAT
95	TXD1	96	KBCLK
97	RI1#	98	KBDAT
99	GND	100	GND