ROCKY – 328E
386SX with Ethernet
SBC

User Manual

Version 2.1

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1. Introduction

Welcome to the ROCKY-328E 386SX with Ethernet Single Board Computer. The ROCKY-328E is an ISA with PC/104 form factor board, which comes equipped with ALI 6117 (includes 386SX CPU) and advanced high-performance multi-mode I/O, designed for the system manufacturers, integrators, or VARs that want to provide all the performance, reliability, and quality at a reasonable price.

An advanced high performance super AT I/O chip SMC FDC37C669 or equivalent chip is used in the ROCKY-328E board. The UART is compatible with the NS16C550. The parallel port and IDE interface are compatible with IBM PC/AT and XT architecture's, as well as EPP and ECP. The FDC37C669 incorporates sophisticated power control circuitry(PCC). The PCC supports multiple low power down modes.

The most outstanding feature in the ROCKY-328E is built-in PC/104 expansion bus. Based on the PC/104 bus, you could easily install over thousands of PC/104 modules from hundreds' vendors in the world. The ROCKY-328E has external power connector that could let it connects with power supply directly. It is more suitable for your standalone applications.

In addition, the ROCK-328E provides one 72-pin SIMM (Single In-line Memory Module) socket to install max. 32MB memory(single side RAM). The board also designed 4MB DRAM on board for OEM customer.

1.1 Specifications :

The ROCKY –328E 386SX with Ethernet Single Board Computer provides the following specification:

- **System :**
  - ✓ **CPU** : ALI 6117,includes 386SX CPU
  - ✓ **DMA channels** : 7
  - ✓ **Interrupt levels** : 15
  - ✓ **Real-time clock/calendar** : Uses Li-battery backup

- **Memory :**
  - ✓ **RAM memory** : 512KB to 32MB,only support single side SIMM
  - ✓ **Shadow RAM** memory : C0000h ~ DFFFFh
  - ✓ **System BIOS :** 0E0000h ~ 0FFFFFh

- **Input/Output :**
  - ✓ **IDE hard disk drive interface** : Supports up to two IDE hard disk drives. Can be disabled through system BIOS Setup.
  - ✓ **Floppy disk drive interface** : Supports two 2.88 MB, 1.44MB, 1.2MB, 720KB, or 360KB floppy disk drives. Can be disabled through system BIOS Setup.
  - ✓ **Two high speed Series ports** : NS16C550 compatible UARTs with send/receive 16-byte FIFOs, data rates are independently programmable from 115.2K baud down to 50 baud. Modem controls the circuitry.
  - ✓ **Multi-mode Parallel Port** :

    Standard mode - IBM PC/XT, PC/AT, PS/2 compatible bi-directional parallel port.

    Enhanced mode - Enhanced parallel port (EPP) compatible with IEEE 1284 specification.

    High speed mode - Microsoft and Hewlett Packard extended capabilities port (ECP), compatible with IEEE 1248 specification.

- **Industrial features :**

  - ✓ **Watch-dog timer** : Can be set to 1,2,10,20,110,or 220 seconds per period. Reset or NMI was generated when CPU did not periodically trigger the timer. Your program use hex 043 and 443 to control the watch-dog and generate a system reset.

  - ✓ **PC/104 expansion bus** : A 64-pin and 40-pin, industrial embedded-PC bus standard.

  - ✓ **External power connector** : 8-pin male connector

  - ✓ **Keyboard connector** : A 5-pin header on board and 6-pin mini-DIN keyboard connector is located on the mounting bracket.

- **General :**

  - ✓ **Power Consumption** : +5V @ 1A (40MHz,4MB RAM)

  - ✓ **Operating Temperature** : 0◦ ~ 60◦ C (CPU needs Cooler)

  - ✓ **Humidity** : 5% ~ 95%, non-condense

  - ✓ **Dimension**: 180mm(W) x 122mm(L), standard AT form factor

1.2 Package Contents

In addition to this *User's Manual*, the ROCKY-328E package includes the following items:

- One ROCKY-328E 386SX with Ethernet Single Board Computer

- One Printer Cable

- One FDD/HDD Cable

- One 6-pin Mini-Din to Keyboard/Mouse Adapter Cable

If any of these items is missing or damaged, contact the dealer from whom you purchased the product. Save the shipping materials and carton in case you want to ship or store the product in the future.

2. Installation

This chapter describes how to install the ROCKY-328E. First, the layout of ROCKY-328E is shown, then comes the unpacking information that you should be careful with is illustrated. After that is jumpers and switches setting for ROCKY-328E's configuration, with information such as CPU type selection, system clock setting, and interrupt IRQ setting for serial ports and parallel port.

2.1 ROCKY-328E's Layout

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ROCKY-328E's LAYOUT:
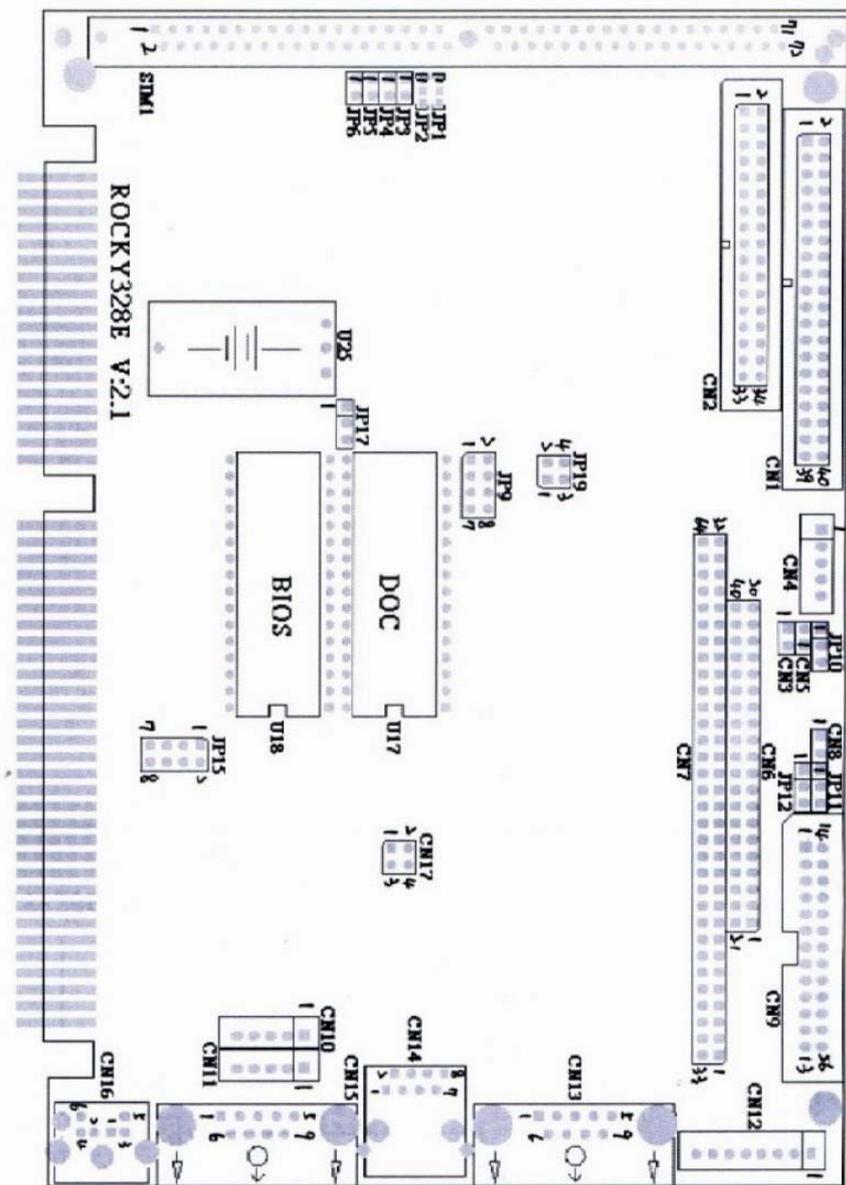
2.2 CPU Operation Speed Setting

● **CPU SPEED SETTING**:

The system clock is generated by the ICS650-01, and the different CPU clock frequency can be selected utilizing JP19 as shown in the following table:

JP19	1-2	3-4
33Mhz	OPEN	OPEN
25MHz	CLOSE	CLOSE
40MHz	**CLOSE**	**OPEN**

2.3 System Memory DRAM

The system DRAM on board is divided into two banks, bank 0 and 1. Bank 0 is the on board optional 2/4MB DRAM while Bank 1 is the one 72-pin SIMM. Based on chipset function, the 72-pin SIMM only support single side DRAM. There have two jumpers related to this setting.

● **JP3/JP6 : 2/4MB DRAM and 72-pin SIMM selection**

Function	JP3	JP6
On Board 2/4MB	CLOSE	CLOSE
72-pin SIMM	**OPEN**	**OPEN**

2.4 Watch-Dog Timer

The Watch-Dog Timer is enabled by reading port 443H. It should be triggered before the time-out period ends, otherwise it will assume the program operation is abnormal and will issue a reset signal to start again, or else activate NMI to CPU. The Watch-Dog Timer is disable by reading port 043H. The Watch-Dog Timer time-out period can be set 1,2,10,20,110 or 220 sec. by jumper JP9.

● **JP10 : Watch-Dog Active Type Setting**

JP10	DESCRIPTION
2-3	**RESET WHEN WDT TIME-OUT**
1-2	ACTIVATE NMI TO CPU WHEN WDT TIME-OUT
OPEN	DISABLE WDT

● **JP9 : WDT TIME-OUT PERIOD**

JP9	1-2	3-4	5-6	7-8
1sec	OPEN	OPEN	CLOSE	OPEN
2sec	OPEN	OPEN	CLOSE	CLOSE
10sec	**OPEN**	**CLOSE**	**OPEN**	**OPEN**
20sec	OPEN	CLOSE	OPEN	CLOSE
110sec	CLOSE	OPEN	OPEN	OPEN
220sec	CLOSE	OPEN	OPEN	CLOSE

2.5 DiskOnChip™ Flash Disk

The DiskOnChip™ Flash Disk Chip(DOC) is produced by M-Systems. DOC (MD-2200-xMB) is 32-pin DIP package. As DOC is 100% compatible to hard disk and DOS system, users don't need to install any extra software utility to operate. "Plug and play" function is not only easy but also reliable.

● **JP15 : DiskOnChip™ Memory Address Setting**

Address	1-2	3-4	5-6
CE000	CLOSE	OPEN	OPEN
D6000	**OPEN**	**CLOSE**	**OPEN**
DE000	OPEN	OPEN	CLOSE

2.6 Clear CMOS Setup

If the user wants to clear the CMOS Setup(for example you forgot the password, then you should clear setup and reset the password), you should close the JP17 pin 2-3 for about 3 seconds, then open it again. To set back to normal operation mode, please take off the jumper. .

● **JP17 : Clear CMOS Setup (Reserve Function)**

JP17	DESCRIPTION
1-2	**Normal Operation**
2-3	Clear CMOS Setup

3. Connection

This chapter illustrates how to connect peripherals, switches and indicators to the ROCKY-328E board. You can access most of the connectors from the top of the board while it is installed in the chassis.

3.1 Floppy Disk Drive Connector

ROCKY-328E board comes equipped with a 34-pin daisy-chain driver connector cable. The detailed pin assignment of the connector is specified as following table:

● **CN2 : FDC CONNECTOR**

PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	GROUND	2	REDUCE WRITE CURRENT#
3	GROUND	4	N/C
5	GROUND	6	N/C
7	GROUND	8	INDEX#
9	GROUND	10	MOTOR ENABLE A#
11	GROUND	12	DRIVE SELECT B#
13	GROUND	14	DRIVE SELECT A#
15	GROUND	16	MOTOR ENABLE B#
17	GROUND	18	DIRECTION#
19	GROUND	20	STEP#
21	GROUND	22	WRITE DATA#
23	GROUND	24	WRITE GATE#
25	GROUND	26	TRACK 0#
27	GROUND	28	WRITE PROTECT#
29	GROUND	30	READ DATA#
31	GROUND	32	SIDE 1 SELECT#
33	GROUND	34	DISK CHANGE#

3.2 IDE Disk Drive Connector

You can attach two IDE(Integrated Device Electronics) hard disk drives to the ROCKY-328E internal controller. The board comes equipped with a 40-pin flat-cable

connector. The detailed pin assignment of the connector is specified in the following table:

● **CN1: IDE Interface Connector**

PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	RESET#	2	GROUND
3	DATA 7	4	DATA 8
5	DATA 6	6	DATA 9
7	DATA 5	8	DATA 10
9	DATA 4	10	DATA 11
11	DATA 3	12	DATA 12
13	DATA 2	14	DATA 13
15	DATA 1	16	DATA 14
17	DATA 0	18	DATA 15
19	GROUND	20	N/C
21	N/C	22	GROUND
23	IOW#	24	GROUND
25	IOR#	26	GROUND
27	N/C	28	BALE - DEFAULT
29	N/C	30	GROUND - DEFAULT
31	INTERRUPT	32	IOCS16#-DEFAULT
33	SA1	34	N/C
35	SA0	36	SA2
37	HDC CS0#	38	HDC CS1#
39	HDD ACTIVE#	40	GROUND

3.3 Parallel Port

This port is usually connected to a printer, The ROCKY-328E includes an on-board parallel port that can be accessed through a 26-pin flat-cable connector CN9. The detailed pin assignment of the connector is specified in the following table:

● **CN9 : Parallel Port Connector**

PIN NO.	DESCRIPTION	PIN NO.	DESCRIPTION
1	STROBE#	2	DATA 0
3	DATA 1	4	DATA 2
5	DATA 3	6	DATA 4
7	DATA 5	8	DATA 6
9	DATA 7	10	ACKNOWLEDGE
11	BUSY	12	PAPER EMPTY
13	PRINTER SELECT	14	AUTO FORM FEED #
15	ERROR#	16	INITIALIZE

17	PRINTER SELECT LN#	18	GROUND
19	GROUND	20	GROUND
21	GROUND	22	GROUND
23	IOW#	24	GROUND
25	GROUND		

3.4 Serial Ports

The ROCKY-328E offers two high speed NS16C550 compatible UARTs with Read/Receive 16 byte FIFO serial ports. These ports let you connect to serial devices or a communication network. Two DB-9 connectors are provides by the ROCKY-328E The detailed pin assignment of the connectors are specified as following tables:

● **CN13 & CN15 : Serial Port Connector(ACE0 & ACE1)**

PIN NO.	DESCRIPTION	
1	DATA CARRIER DETECT	(DCD)
2	RECEIVE DATA	(RXD)
3	TRANSMIT DATA	(TXD)
4	DATA TERMINAL READY	(DTR)
5	GROUND	(GND)
6	DATA SET READY	(DSR)
7	REQUEST TO SEND	(RTS)
8	CLEAR TO SEND	(CTS)
9	RING INDICATOR	(RI)

3.5 Keyboard / Mouse Connector

The ROCKY-328E provides two keyboard connectors. A 5-pin header keyboard connector CN11 supports passive backplane applications. Another one is a 6-pin Mini-DIN connector CN16 on the board mounting bracket for single board computer applications. The detailed pin assignment of the connector is specified in the following tables:

● **CN11 : 5-pin Header Keyboard Connector**

PIN NO.	DESCRIPTION
1	KEYBOARD CLOCK
2	KEYBOARD DATA
3	N/C
4	GROUND

PIN NO.	DESCRIPTION
5	+5V

● **CN10 : 5-pin Header PS/2 Mouse Connector**

PIN NO.	DESCRIPTION
1	MOUSE CLOCK
2	MOUSE DATA
3	N/C
4	GROUND
5	+5V

● **CN16 : 6-pin Mini-DIN Keyboard/Mouse Connector**

PIN NO.	DESCRIPTION
1	KEYBOARD DATA
2	MOUSE DATA
3	GROUND
4	+5V
5	KEYBOARD CLOCK
6	MOUSE CLOCK

3.6 Lan RJ45 Connector

The ROCKY-328E built-in a RJ45 Lan connector for 10Mbps Ethernet(NE-2000 compatible) operation.

● **CN14 : Lan RJ45 Connector**

1	TX+	5.	NC
2	TX-	6.	RX-
3.	RX+	7.	NC
4.	NC	8.	NC

● **CN17 : LED Connector(4-pin header) for Lan**

1	LED Link	2	+5V
3	LED RX	4	+5V

3.7 External Switches and Indicators

There are many external switches and indicators for monitoring and controlling your CPU board. These features

are completely optional so feel free to install them in case you need it. The detailed pin assignment of the connectors is specified in the following tables:

● **CN8 : RESET BUTTON**

PIN NO.	DESCRIPTION
1	EXTERNAL RESET
2	GROUND

● **CN3 : IDE LED Connector**

PIN-NO	DESCRIPTION
1	+5V
2	HDD ACTIVE#

● **CN4 : POWER LED & KEYLOCK**

PIN NO.	DESCRIPTION
1	POWER LED ANODE
2	KEY
3	GROUND
4	KEYLOCK
5	GROUND

3.8 External Power Connector

The ROCKY-328E has an on-board external power connector CN12. You can connect power directly to the CPU board for some types of single-board-computer (without passive backplane) application.

● **CN12 : EXTERNAL POWER CONNECTOR**

PIN NO.	DESCRIPTION
1	+5V
2	+12V
3	-12V
4	GROUND
5	GROUND
6	-5V
7	+12V
8	+5V

3.9 External Speaker

The ROCKY-328E has its own buzzer so you also can connect to the external speaker through connector CN5.

● **CN5 : SPEAKER**

PIN NO.	DESCRIPTION
1	SPEAKER SIGNAL
2	GROUND

3.10 PC/104 Connection Bus

The ROCKY-328E's PC/104 expansion bus let you connect to any kind of PC/104 modules. The PC/104 bus has already become an industrial embedded PC bus standard so you could easily install over thousands of PC/104 modules from hundreds of venders worldwide.

NOTE : ROCKY-328E allows directly plug in PC/104 module, so you don't need the PC/104 Connection Kit.

4. AMI BIOS Setup

The ROCKY-328E use AMI BIOS for system configuration, and the AMI BIOS setup program is designed to provide maximum flexibility in configuring the system by offering various options which may be selected for end-user requirements. This chapter is written to guide through proper use of these features.

4.1 Getting Start

When the system is powered on, the BIOS will enter the Power-On-Self-Test routines. These routines will be executed for System Test and Initialization and System Configuration Verification. After the POST routines are completed, the following message appears :

" Hit < Del>, if you want to run SETUP"

To access AMI BIOS Setup program, press <Del> key.

4.2 Standard CMOS Setup

Standard CMOS Setup is the first option on the main menu. The standard CMOS setup utility is used to configure the following features :
‧Date/Time,
‧Hard Disk Type,
‧Floppy Disk Type,
All of these features are commonly seen so we won't elaborate on these items in this menu.

4.3 Advanced CMOS Setup

When you enter the Advanced CMOS Setup, this Setup program is equipped with a series of help screens, accessed through <F1> key, which will display the options available for a particular configuration feature. All of the items on the left side of the screen commonly seen so

they will not be explained in detail here. Here, we will only focus on some special items that are found particularly in ROCKY-328E board. These items are explained in detail below :

- **On-board IDE Controller :**
  The IDE hard disk drive can be **Enable** or **Disable** by this item. When you do not need hard disk, the IDE controller can be disabled.
- **On-board Floppy Controller :**
  The floppy disk drive can be **Enable** or **Disable** by this item. When you do not need floppy disk, the FDD controller can be disabled.
- **Serial Port 1 :**
  The options are **Disable**, **3E8**,**2F8 ,**or **3F8**. You can set the I/O address of the serial port (COMA) or disable it.
- **Serial Port 2 :**
  The options are **Disable**, **2E8**,**3F8**,or **2F8**. You can set the I/O address of the serial port 1 (COMB) or disable it.
- **Parallel Port :**
  The options are **Disable**, **3BC**, **378** or **278**. You can set the I/O address of the parallel port or disable it.
- **Parallel Port Mode :**
  ROCKY-318 provides **EPP,ECP,ECP+EPP,** and **Normal Mode.**
- **Primary Display :**
  You could set **VGA/EGA, CGA40x25, CGA80x25, Mono or Absent**. When set Absent the ROCKY-328E will not check the display adapter when power on the system.
- **System Keyboard :**
  You could set **Present** or **Absent**. When set Absent the ROCKY-328E will not check the display adapter when power on the system.

Appendix A. E^2 Key™ Function

The ROCKY-328E provides an outstanding E^{2}KEY™ function for system integrator. Based on the E^{2}KEY™ you could freely store ID Code, Pass Word, or Critical Data in the 1Kbit EEPROM. Since the EEPROM is a type of nonvolatile memory, you don't have to worry losing very important data.

Basically the E^{2}KEY™ is based on a 1Kbit EEPROM which is configured to 64 words(from 0 to 63). You could access(read or write) each word at any time.

When you want to use the E^{2}KEY™ function, you should find the utility in the package. The software utility will include the following four files,

README.DOC
E2KEY.OBJ
EKEYDEMO.C
EKEYDEMO.EXE.

The E2KEY.OBJ provides two library function for user to integrate their application with E^{2}KEY™ function. These library **(read_e2key and write_e2key)** are written and compiled in C format. Please read the following statement and you will know to use it. It is pretty easy.

unsigned int read_e2key(unsigned int address)
/* This function will return the E^{2}KEY™'s data at address. The address range is from 0 to 63. Return data is one word,16 bits */

void   write_e2key(unsigned   int   address,unsigned data)

/* This function will write the given data to E^{2}KEY™ at address. The address range is from 0 to 63. The data value is from 0 to 0xffff. */

For easy accurate usage, please refer to EKEYDEMO.C code beforehand.

Please note the E^{2}KEY™ function is based on parallel port operations so you should first enable ROCKY-328E's parallel port. Otherwise will be not working.

If you need Windows NT/95 driver for this function. Please download relative drivers from ftp.icpacquire.com.tw.

Appendix B. Watch-Dog Timer

The Watch-Dog Timer is provided to ensure that standalone systems can always recover from catastrophic conditions that caused the CPU to crash. This condition may have occurred by external EMI or a software bug. When the CPU stops working correctly, hardware on the board will either perform a hardware reset (cold boot) or a non-maskable interrupt (NMI) to bring the system back to a known state.

The Watch-Dog Timer is controlled by two I/O ports.

443 (hex)	Read	Enable the refresh the Watch-Dog Timer.
043 (hex)	Read	Disable the Watch-Dog Timer.

To enable the Watch-Dog Timer, a reading action from I/O port 443H must be performed. This will enable and activate the countdown timer which will eventually time out and either reset the CPU or cause an NMI depending on the setting of JP10. To ensure that this reset condition does not occur, the Watch-Dog Timer must be periodically refreshed by reading the same I/O port 433H. This must be done within the time out period that is selected by jumper JP9.

A tolerance of at least 30% must be maintained to avoid unknown routines within the operating system (DOS), such as disk I/O that can be very time consuming. Therefore if the time out period has been set to 10 seconds, the I/O port 443H must be read within 7 seconds.

Note: When exiting a program it is necessary to disable the Watch-Dog Timer, otherwise the system will reset.