M68EML08KXUM/D

November 1999

M68EML08KX

EMULATOR MODULE

USER'S MANUAL

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CHAPTER 1
INTRODUCTION

This user's manual explains connection, configuration, and operation information specific to the M68EML08KX Emulator Module (KXEM). The KXEM makes possible emulation and debugging of target systems based on MC68HC08KX8 microcontroller units (MCUs). The KXEM is a low-voltage emulator, operating in the range 1.9 to 5.2 Vdc or 1.2 to 3.2 Vdc.

The KXEM can be part of two development systems. This chapter describes those systems and explains the layout of the KXEM.

1.1 DEVELOPMENT SYSTEMS

Your KXEM can be part of two Motorola development systems: the HC0508 Motorola Modular Development System (MMDS) or the M68MMEVS Evaluation System (MMEVS).

1.1.1 Motorola Modular Development System (MMDS)

The MMDS is an emulator system that provides a bus state analyzer and real-time memory windows. The unit's integrated design environment includes an editor, an assembler, user interface, and source-level debug. A complete MMDS consists of:

- **a station module** — the metal MMDS enclosure, containing the control board and the internal power supply.
- **an emulator module (EM)** — such as the KXEM: a separately purchased printed circuit board that enables system functionality for a specific set of MCUs.
- **two logic clip cable assemblies** — twisted-pair cables that connect the station module to your target system, a test fixture, a clock, an oscillator, or any other circuitry useful for evaluation or analysis. One end of each cable assembly has a molded connector, which fits into station-module pod A or pod B. Leads at the other end of each cable terminate in female probe tips. Ball clips come with the cable assemblies.
- **a 9-lead RS-232 serial cable** — the cable that connects the station module to the host computer RS-232 port.

- **a 9- to 25-pin adapter** — a molded assembly that lets you connect the 9-pin cable to a 25-pin serial port.
- **system software** — software, on 3-1/2 inch diskettes.
- **MMDS documentation** — an MMDS user's manual, a system software manual, and the appropriate EM user's manual.

You select the MMDS baud rate: 2400, 4800, 9600, 19200, 38400, or 57600.

As mentioned, your KXEM gives the MMDS the ability to emulate target systems based on MC68HC08KX8 MCUs. By substituting a different EM, you can enable your MMDS to emulate target systems based on a different MCU. (Your Motorola representative can explain all the EMs available.)

1.1.2 M68MMEVS Evaluation System (MMEVS)

An MMEVS is an economical, two-board tool for designing, debugging, and evaluating target systems based on an MC68HC0508 MCU. A complete MMEVS consists of:

- **a platform board (PFB)** — the bottom board, which supports the emulator module. The platform board has connectors for power and for the terminal or host computer.
- **an emulator module (EM)** — such as the KXEM: a separately purchased printed circuit board that enables system functionality for a specific set of MCUs. The EM fits onto the PFB.
- **an RS-232 serial cable** — a separately purchased cable that connects the PFB to the host computer RS-232 port.
- **system software** — software, on 3-1/2 inch diskettes.
- **MMEVS documentation** — an MMEVS operations manual (MMEVSOM/D) and the appropriate EM user's manual.

An MMEVS features automatic selection of the communication baud rate: 2400, 4800, 9600, 19200, 38400, or 57600.

With an KXEM, your MMEVS emulates target systems based on MC68HC08KX8 MCUs. By substituting a different EM, you can enable your MMEVS to emulate target systems based on a different MCU. (Your Motorola representative can explain all the EMs available.)

Chapter 2 explains how to configure and use your KXEM as part of an MMDS or MMEVS system.

1.2 EM LAYOUT

Figure 1-1 shows the layout of the KXEM for the purpose of identifying connectors and jumper headers. These connectors and jumpers are described in more detail in section 2.1 Setting Jumper Headers.

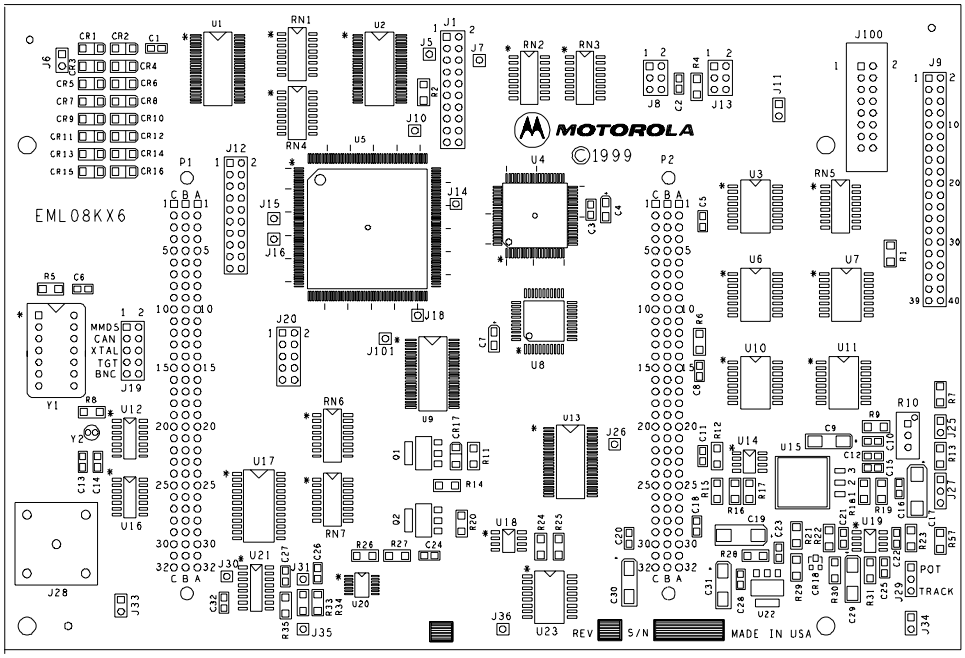

Figure 1-1. M68EML08KX Emulator Module

The KXEM requires the following user-supplied cables for connection to other components of a development system:

- A 40-lead target cable and a Target Head Adapter, to connect the target system to connectors J9.
- One or two 100-KOhm logic analyzer termination adapters (HP part number HP01650-63203), to connect to connectors J1 or J12.

Table 1-1 lists KXEM specifications.

Table 1-1. M68EML08KX Specifications

Characteristic	Specifications
MCU extension I/O ports	HCMOS compatible
Operating temperature	0° to 40° C
Storage temperature	-40° to +85° C
Relative humidity	0 to 90% (non-condensing)
Power requirements	5 volts dc, provided from the MMDS control board or MMEVS platform board
Dimensions	8.15 x 4.5 inches (207 x 115 mm)
Weight	7.1 ounces (201 g)

1.3 CUSTOMER SUPPORT

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For a list of the Motorola sales offices and distributors: http://www.mcu.motsps.com/sale_off.html

CHAPTER 2
CONFIGURATION AND OPERATION

configuration and operation of the KXEM when installed in an MMDS or MMEVS. For other parts of system installation or configuration, see the MMDS or MMEVS hardware user's manual.

Note that you can reconfigure an KXEM already installed in an MMDS station module. To do so, switch off station-module power, then follow the guidelines in this chapter. Similarly, you can configure an KXEM already installed on the MMEVS platform board, provided that you disconnect platform-board power.

CAUTION

Be sure to switch off or disconnect power if you reconfigure an installed EM. Reconfiguring EM jumper headers with power left on can damage system circuits.

ELECTROSTATIC DISCHARGE PRECAUTION

Ordinary amounts of static electricity from your clothing or work environment can damage or degrade electronic devices and equipment. For example, the electronic components installed on your printed circuit board are extremely sensitive to electrostatic discharge (ESD). You should wear a grounding wrist strap whenever you handle any printed circuit board. This strap provides a conductive path for safely discharging static electricity to ground.

2.1 SYSTEM LIMITATIONS

The KXEM board uses an MC68HC908GP32 MCU to emulate the KX8. This configuration causes limitations to your system. All five registers in the ICG module and the control register (TBCR) of the TBM are rebuilt externally. The ICG register addresses of the KX8 are the same addresses as the PLL register in the MC68HC908GP32. The ICG register addresses and TBCR address must be moved to the RAM in order to correctly emulate these functions. (See Table 2-1.)

Table 2-1. KX8 Register Address Configuration

Register Name	Original Register Address (KX8)	New Register Address in the RAM (KXEM)
ICGCR	$0036	$0040
ICGMR	$0037	$0041
ICGTR	$0038	$0042
ICDVR	$0039	$0043
ICGDSR	$003A	$0044
TBCR	$001C	$0045

This takes a total of 6 bytes of the user RAM addresses. You must start your code at $46 instead of $40 in the RAM for emulating purpose.

The CONFIG2 register ($1E) is write-able according to the general release specification, but the host software will return an error. The register is actually being written to on the MCU and the PLD reconstruction simultaneously, but the MCU side causes the error message. Error message should be ignored unless subsequent processes continue to fail. In that situation, data written to the CONFIG2 register must be verified and written again after a reset.

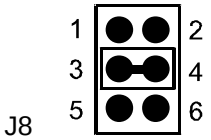
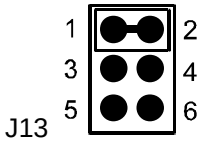
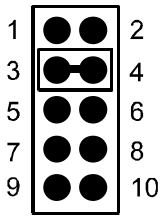
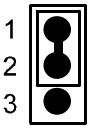
Register Initial Conditions After Reset

Because the ICG registers are rebuilt externally, the register values displayed will not always mirror the specification stated conditions after a reset. Typically, the values displayed in the host software memory are values of the MCU memory addresses, not the emulated KX8 registers. The values of these addresses ‘float’ until written explicitly by user, after which the registers in PLD and the corresponding MCU address values are identical.

2.2 JUMPER HEADER CONFIGURATION

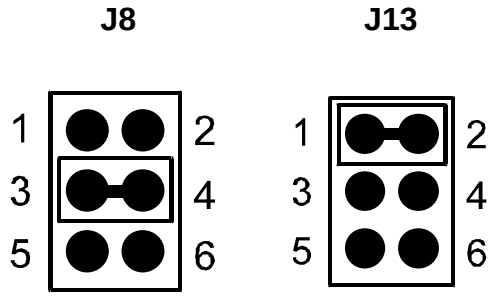
The KXEM has a number of jumper headers that you can configure for your specific requirements. Table 2-1 is a summary of settings for these jumper headers. While paragraphs 2.2.1 through 2.2.5 give more detailed information about each jumper header.

Table 2-1. Jumper Headers

Header	Position	Effect
V_{REFH} Bonding option, J8, J13	 	Jumper between pins 3 and 4 on jumper header J8 and jumper between pins 1 and 2 on jumper header J13 (factory default); emulates a KX8 with pin 15 configured as PTA4/KBD4 Jumper between pins 5 and 6 on jumper header J8 and jumper between pins 3 and 4 on jumper header J13; emulates KX8 with pin 15 configured as V_{REFH}
MCU Clock Source Select, J19		Jumper between pins 1 and 2; selects the MMDS control board or MMEVS platform board as the signal source. Jumper between pins 3 and 4 (factory default); selects the 8.000 MHz oscillator at location Y1 as the signal source. Jumper between pins 5 and 6; selects a user-supplied crystal as the signal source. (Requires user installation of crystal at Y1, resistors at R8 and R52, and capacitors at C13 and C14.) Jumper between pins 7 and 8; selects the XTAL circuit in the user target system as the signal source. Jumper between pins 8 and 10; selects the BNC connector (J28) as the signal source.
VMCU Range select, J25		Jumper between pins 1 and 2 (factory default); selects the range of R10 to be 1.2 V –3.25 V. No jumper; selects the range of R10 to be 1.9 V – 5.25 V.
MCU Voltage Reference Select, J29		Jumper between pins 1 and 2 (factory default); selects the MCU voltage to be controlled by R10. Jumper between pins 1 and 2; selects the MCU voltage to track the user's target system.

2.2.1 Pin 15 Function Select Header (J8, J13)

Jumper headers J8 and J13 select one of two options for the usage of pin 15 of the target MCU. This pin can be configured as either a standard port pin (PTA4/KBD4*) or as the reference voltage for the A/D converters (V_{REFH}). To emulate the standard port function (PTA4/KBD4*), install jumpers between pins 3 and 4 on jumper header J8 and between pins 1 and 2 on jumper header J13 (factory default) as shown below. To emulate pin 15 as an A/D reference input, install jumpers between pins 5 and 6 on jumper header J8 and between pins 3 and 4 on jumper header J13.

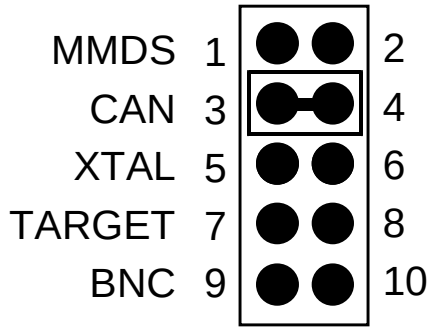


NOTE

Do not set the jumpers on J8 and J13 to any other configuration.

2.2.2 Clock Source Selection Header (J19)

Jumper header J19 selects the source of the clock signal. The diagram below shows the factory configuration: the fabricated jumper between pins 3 and 4 selecting the 8.000 MHz canned oscillator at location Y1.



Alternatively, you may select other sources as the clock:

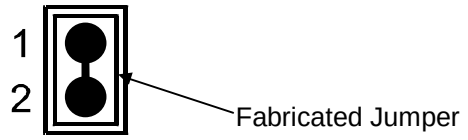
- To select the clock signal from the MMDS control board or MMEVS platform board, install the fabricated jumper between pins 1 and 2. Then use your system software to select a frequency.
- To select a user-supplied crystal, install the fabricated jumper between pins 5 and 6. (Additionally, you must supply the crystal at location Y2, resistors at locations R8 and R52, and capacitors at locations C13 and C14. For specifications and connections, consult Chapter 4 Schematics.)
- To select the target system oscillator circuit, install the fabricated jumper between pins 7 and 8.
- To select the BNC connector (J28), install the fabricated jumper between pins 9 and 10.

NOTE

Only one jumper should be inserted in header J19 at a time. Inserting multiple jumpers in J19 might cause damage to the KXEM.

2.2.3 VMCU Voltage Range Selection Header (J25)

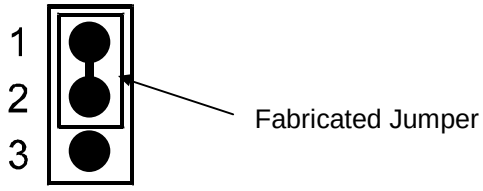
Jumper header J25 selects one of two ranges for the MCU voltage as controlled by R10. The diagram below shows the factory configuration: the fabricated jumper between pins 1 and 2 selecting the range of 1.2 V to 3.25 V.



Alternately, you may select a range of 1.9 V to 5.25 V by removing the fabricated jumper from J25.

2.2.4 VMCU Control Source Selection Header(J29)

Jumper header J29 selects the source for the reference voltage that controls the MCU voltage. The diagram below shows the factory configuration: the fabricated jumper between pins 1 and 2 selecting the variable resistor at location R10 as the reference source. See paragraph 2.3 for adjusting the MCU reference voltage.



Alternately, you may elect to use the user's target system as the reference for the MCU voltage. To select the user target system as the source, reposition the fabricated jumper on J29 between pins 2 and 3.

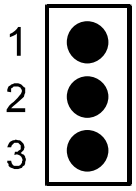
2.2.5 Reserved Headers

The following headers are for use by factory personnel for programming, testing, and development purposes, and should be left open:

J3, J4, J6, J11, J17, J20, J21, J24, J33, and J34.

2.3 ADJUSTING VMCU (J27, R10)

Test point J27 and variable resistor R17 let you adjust the VMCU voltage within the range set by the VMCU Voltage range jumper header (J25). The diagram below shows the jumper header.



To adjust VMCU:

1. Make sure that no target cable is connected to connectors J9.
2. Connect a voltmeter across J27 pins 1 (VMCU) and 2 (GND). (Do not use pin 2 of J27.)
3. Turn the resistor adjustment screw until the voltmeter reads the appropriate level.
4. Disconnect the voltmeter.

CAUTION

Make sure that the target system's operating voltage matches the VMCU level before you connect the target cable to connector J9.

2.3 REMAINING SYSTEM INSTALLATION

When you have configured all jumper headers adjusted voltages, you are ready to complete KXEM installation:

- To install the KXEM in an MMDS station module, remove the entire top half of the station-module enclosure. Fit together EM connectors P1 and P2 (on the bottom of the board) and control-board connectors P1 and P2. Snap the corners of the EM onto the plastic standoffs.
- To install the KXEM on an MMEVS platform board, fit together EM connectors P1 and P2 (on the bottom of the board) and platform-board connectors P3 and P4. Snap the corners of the EM onto the plastic standoffs.
- Copy the personality files from the provided diskette to the directory that contains your debugging software.

At this point, you are ready to make any system cable connections and restore power. For instructions, consult the MMDS or MMEVS operations manual.

CHAPTER 3
CONNECTOR INFORMATION

This chapter consists of pin assignments and signal descriptions for KXEM Target and logic analyzer connectors.

3.1 TARGET CONNECTORS (J9)

Your KXEM has one Target connector: J9, a 2-by-20-pin connector. Figure 3-1 and Table 3-1 give the pin assignments and signal descriptions for this connectors.

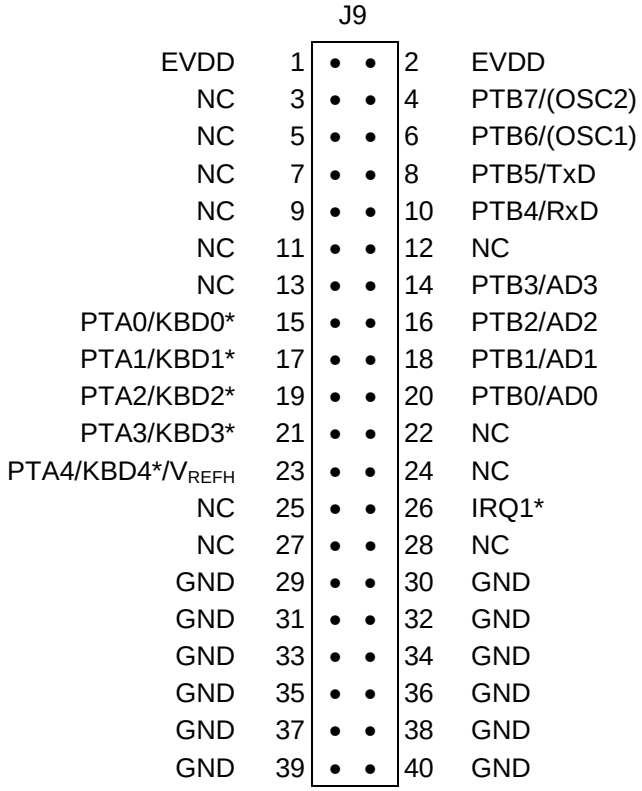


Figure 3-1. TARGET Connector J9 Pin Assignments

Table 3-1. TARGET Connector J9 Signal Descriptions

Pin	Mnemonic	Signal
1, 2	EVDD	EVDD — Operating voltage of the user target board.
15,17,19,21,23	PTA0 — PTA4	PORT A (bits 0—4) — General-purpose I/O lines controlled by software via data direction and data registers. Each of these pins also have an alternate function, please see the KX8 chip spec for further details.
20, 18, 16, 14, 10, 8, 6, 4	PTB0 — PTB7	PORT B (bits 0—7) — General-purpose I/O lines controlled by software via data direction and data registers. Each of these pins also have an alternate function, please see the KX8 chip spec for further details.
26	IRQ1*	INTERRUPT REQUEST — Active-low input line for requesting MCU asynchronous non-maskable interrupt.
29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40	GND	EM GROUND — Ground signal of the EM board.

3.2 LOGIC ANALYZER CONNECTORS (J1, J12)

Your KXEM has two logic-analyzer connectors: J1 and J12, each is a 20-pin connector. Figure 3-3 shows the pin assignments for these connectors. Tables 3-2 and 3-3 give the signal descriptions

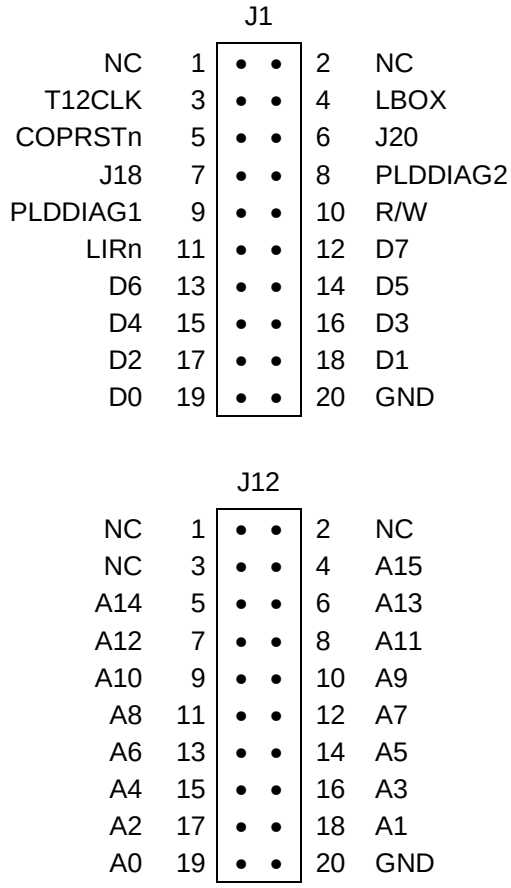


Figure 3-2. Logic Analyzer Connector J19, J21 Pin Assignments

Table 3-2. Logic Analyzer Connector J1 Signal Descriptions

Pin	Mnemonic	Signal
1, 2,	NC	No connection
3	T12CLK	T12 CLOCK — Clock signal from the MCU internal bus clock.
4	LBOX	LAST BUS CYCLE — Signal that indicates the last cycle of the current instruction.
5	COPRSTn	RESET — Active-low signal asserted during resets.
6 — 9	NC	No connection
10	R/W	READ/WRITE — Signal indicating whether the MCU is reading or writing.
11	LIRn	LOAD INSTRUCTION REGISTER — Active-low signal indicating that an opcode fetch is in progress.
12 — 19	D7 — D0	DATA (bits 7—0) — MCU data signal.
20	GND	GROUND

Table 3-3. Logic Analyzer Connector J19 Signal Descriptions

Pin	Mnemonic	Signal
1 — 3	NC	No connection
4 — 19	A15 — A0	ADDRESS BUS (bits 15—0) — MCU latched address.
20	GND	GROUND

3.3 TARGET CABLE ASSEMBLIES

To connect your KXEM to a target system, you need a separately purchased target cable assembly, plus the appropriate target head and target-head/adapter package. Figure 3-3 shows how one end of the flex cable plugs into the KXEM module, and also shows how the target head connects into the target system.

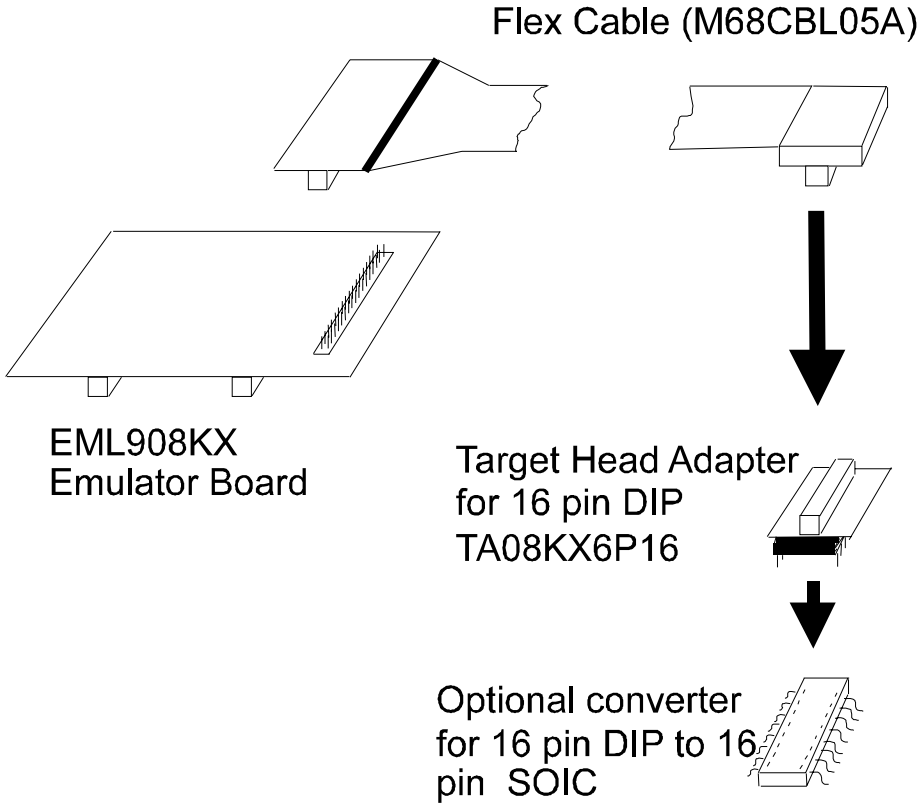


Figure 3-3. Target Cable Assembly

If you install the KXEM in the MMDS station module, run the flex cable through the slit in the station-module enclosure.

CHAPTER 4
SCHEMATICS

This chapter consists of schematics for the KXEM. The six schematic pages begin on the next page of this manual.

TABLE OF CONTENTS	
1	COVE R
2	TOP LEVEL OF HIER ARCHY
3	PORT LOGIC (PLD)
4	MC U
5	VOLTAGE REGULATORS AN D CLOCK GENERATION
6	BYPASS/DECOUPLING CAPACITORS AND SPA RES

KX6

KX6

REVISIONS

REV	DESCRIPTION	DA TE	REVISED BY
O	ORIGINAL RELEA SE	2/24/ 99	JEK
A	PRO DUCTION RELEASE	4/16 /99	JEK

GENERAL NOTE S:

1. INTERPRET DIAGRAM IN ACCORDANCE WITH AM ERICAN NATIONAL STANDARDS INSTITUT E SPECIFICATIONS, CURRENT REVISION, WITH THE EXCEPTIONS OF LOGIC BLOCK S YMBOLOGY.

2. DEVICE TYPE NUMBER IS FOR REFERENCE ONLY. THE NUMBER VA RIES WITH THE M ANUFACTURER.

3. SPECIAL SYMBOL USAGE:
   * DENOTES ACTIVE L OW SIGNAL
   《 》 DENOTES OFFPAG E CONNECTOR

4. UNLESS OTHERWISE SPECI FIED:
   ALL RESISTORS ARE IN OHMS, 5%, 1/ 8 WATT
   ALL CAPACITORS ARE IN uF, +/-20%, 5 0V
   ALL VOLTAGES ARE D C
   ALL POLARIZED CAPACIT ORS ARE TANTALUM

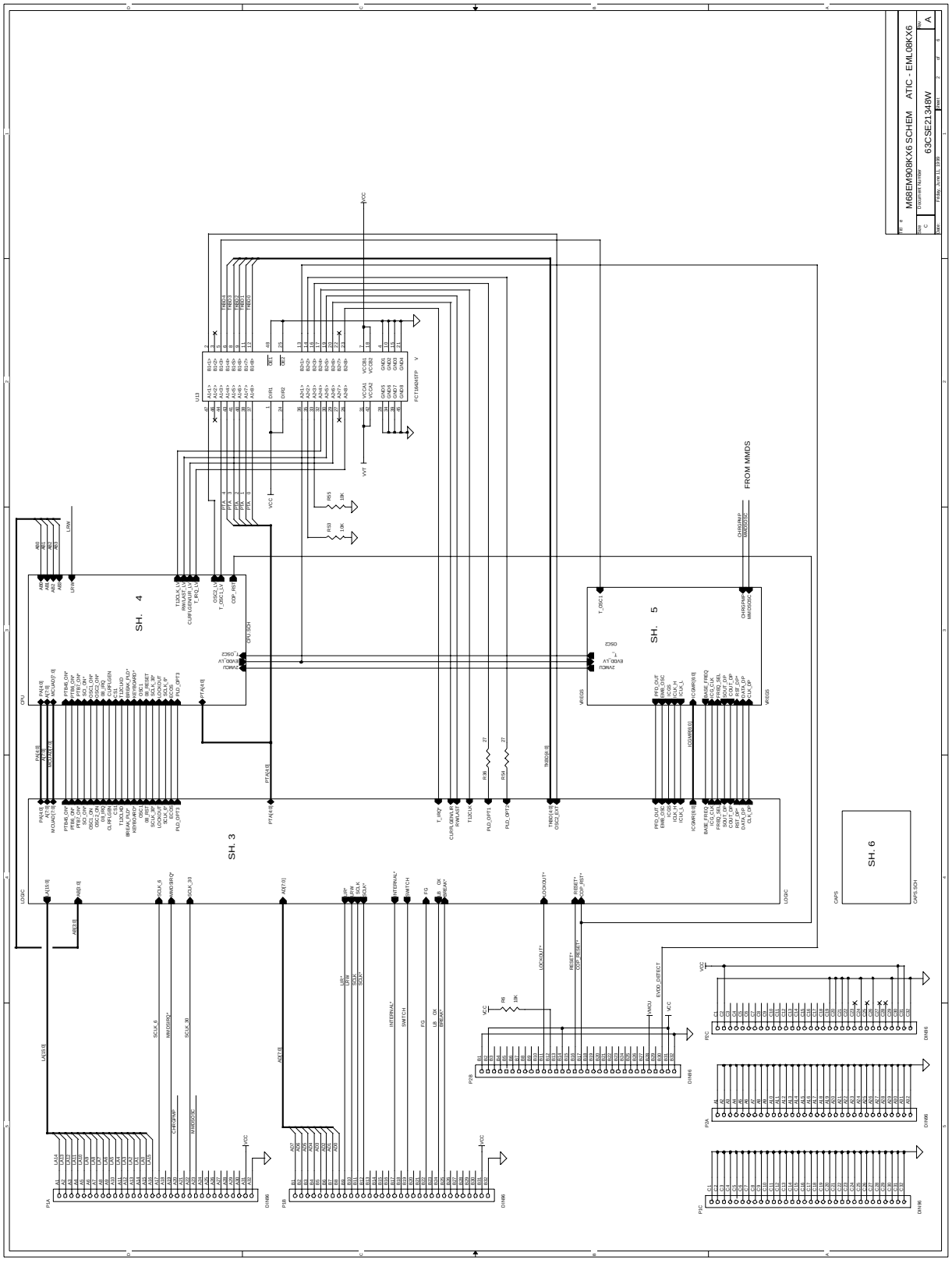
DRAWN:	John E. Keenan	DATE:	4/16/99
CHECKED:		DATE:	
APPROVED:		DATE:	

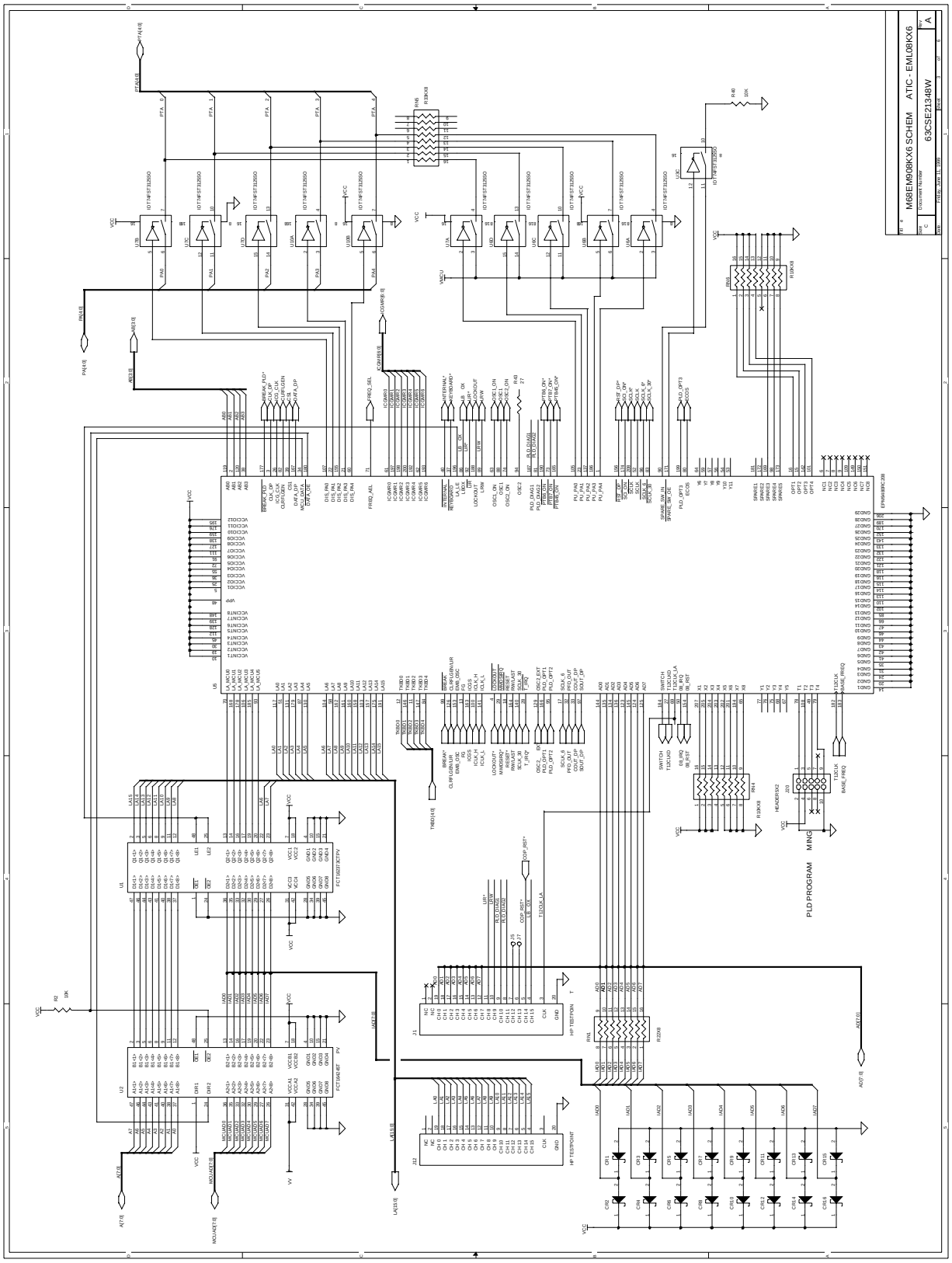
MOTOROLA
SEMICOND UCTOR PRODUCTS SECTOR
6501 WILLIAM CANNON DRIVE WEST AUS TIN, TX 78735 USA

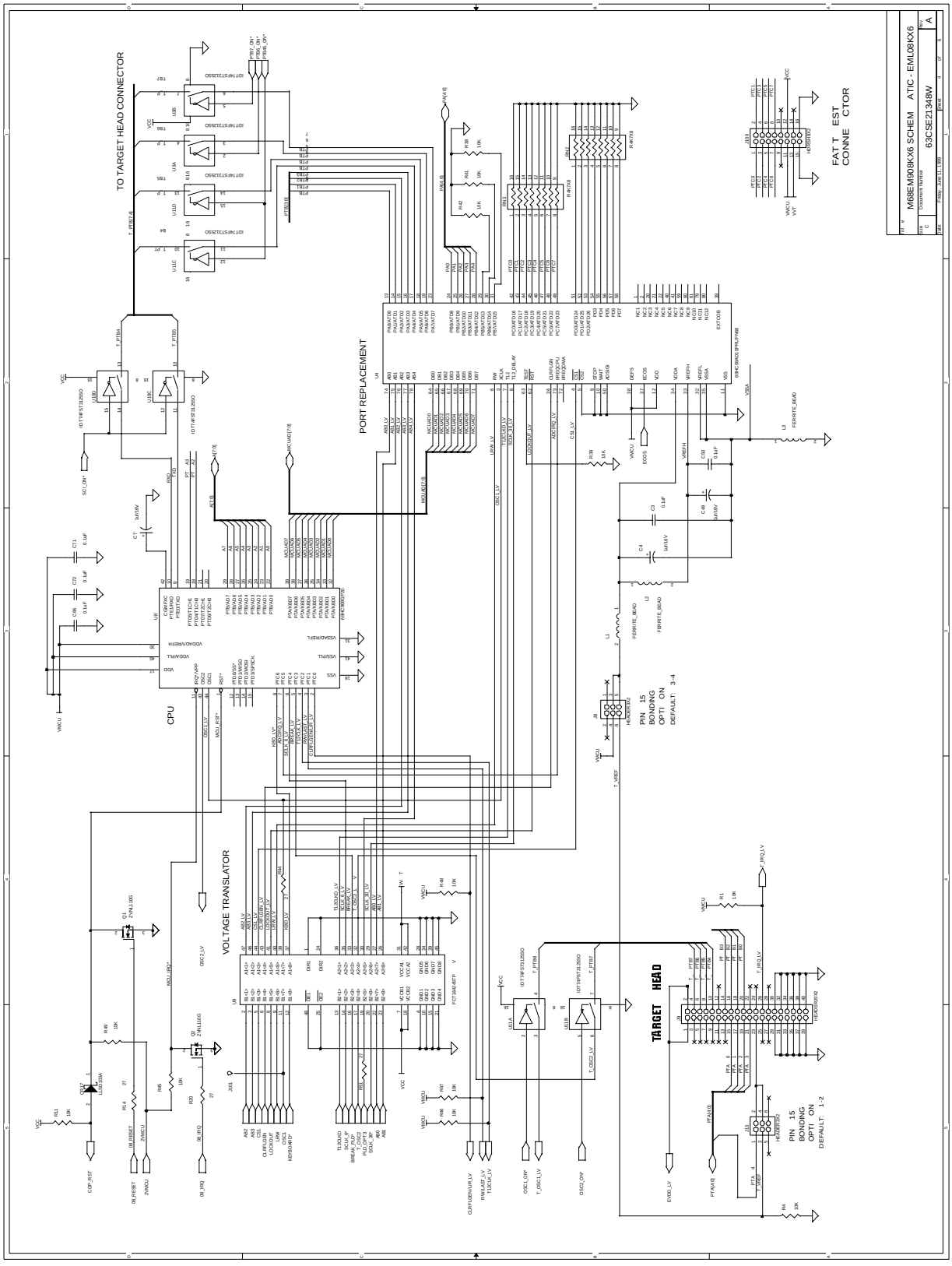
Title: M68EM908KX6 SCHEMATIC

Size	Dwg. No.	Rev:
C	63CSE213 48W	A

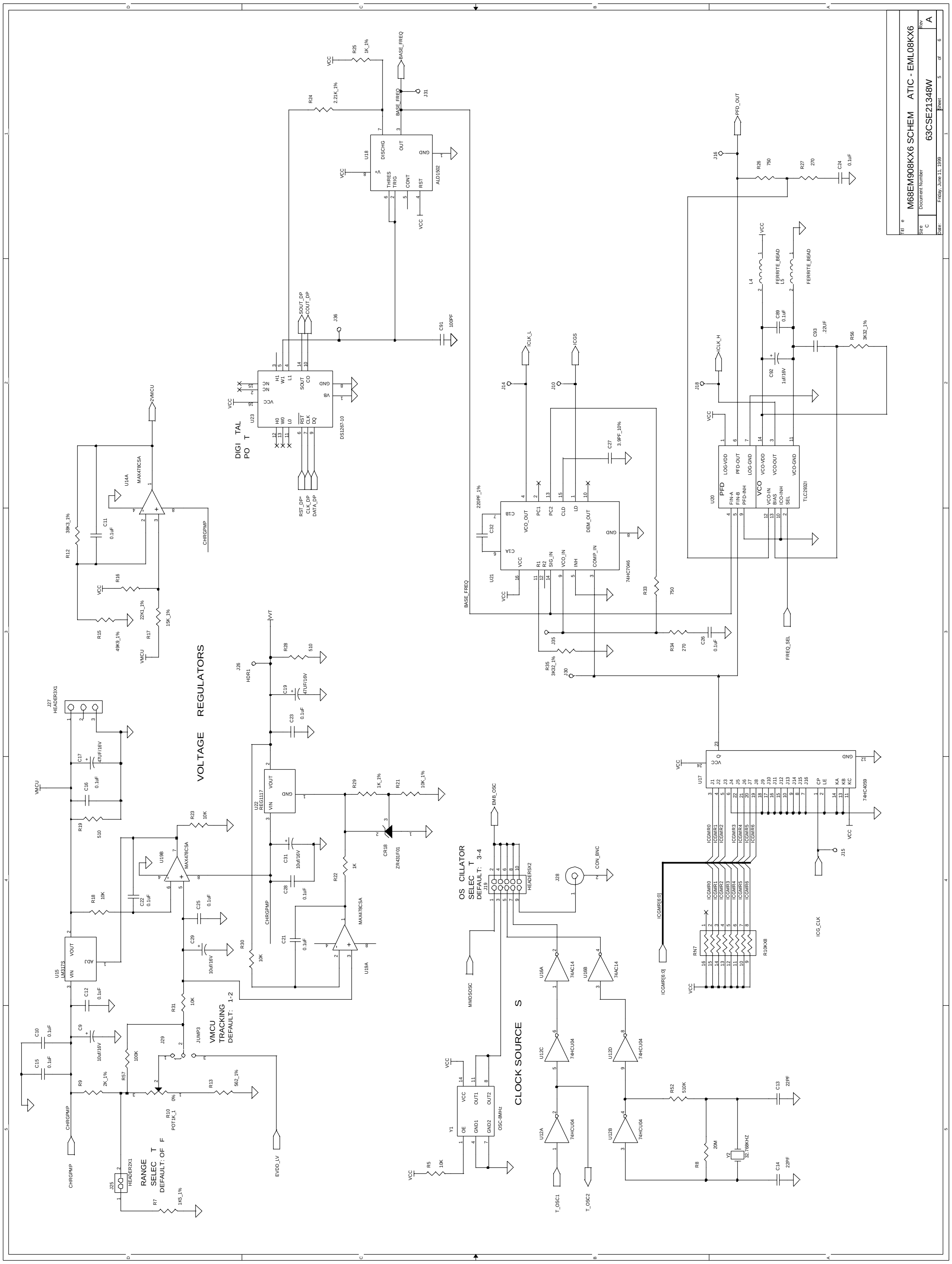
Last Modified: Tuesday, May 04, 1999 Sheet 1 of 6


M68EM908KX6.SCHEM ATIC - EML08KX6
63CSE21348W
Friday, June 15, 2000
SH. 3
SH. 4
SH. 5
SH. 6
FROM MMDS
CPU
LOGIC
OSC1
OSC2
VCC
RESET*
LOCKOUT*
INTERRUPT*
SWITCH
EVDO_DIRECT


M68EM908KX6.SCHEM ATIC - EML08KX6
63CSE21348W
PLD PROGRAM MING


TO TARGET HEAD CONNECTOR
PORT REPLACEMENT
CPU
VOLTAGE TRANSLATOR
TARGET HEAD
FAT T EST
CONNE CTOR
PIN 15
BONDING
OPTI ON
DEFAULT: 3-4
PIN 15
BONDING
OPTI ON
DEFAULT: 1-2
M68EM908KX6 SCHEM ATIC - EML08KX6
63CSE21348W

MOTOROLA


VOLTAGE REGULATORS
CLOCK SOURCE
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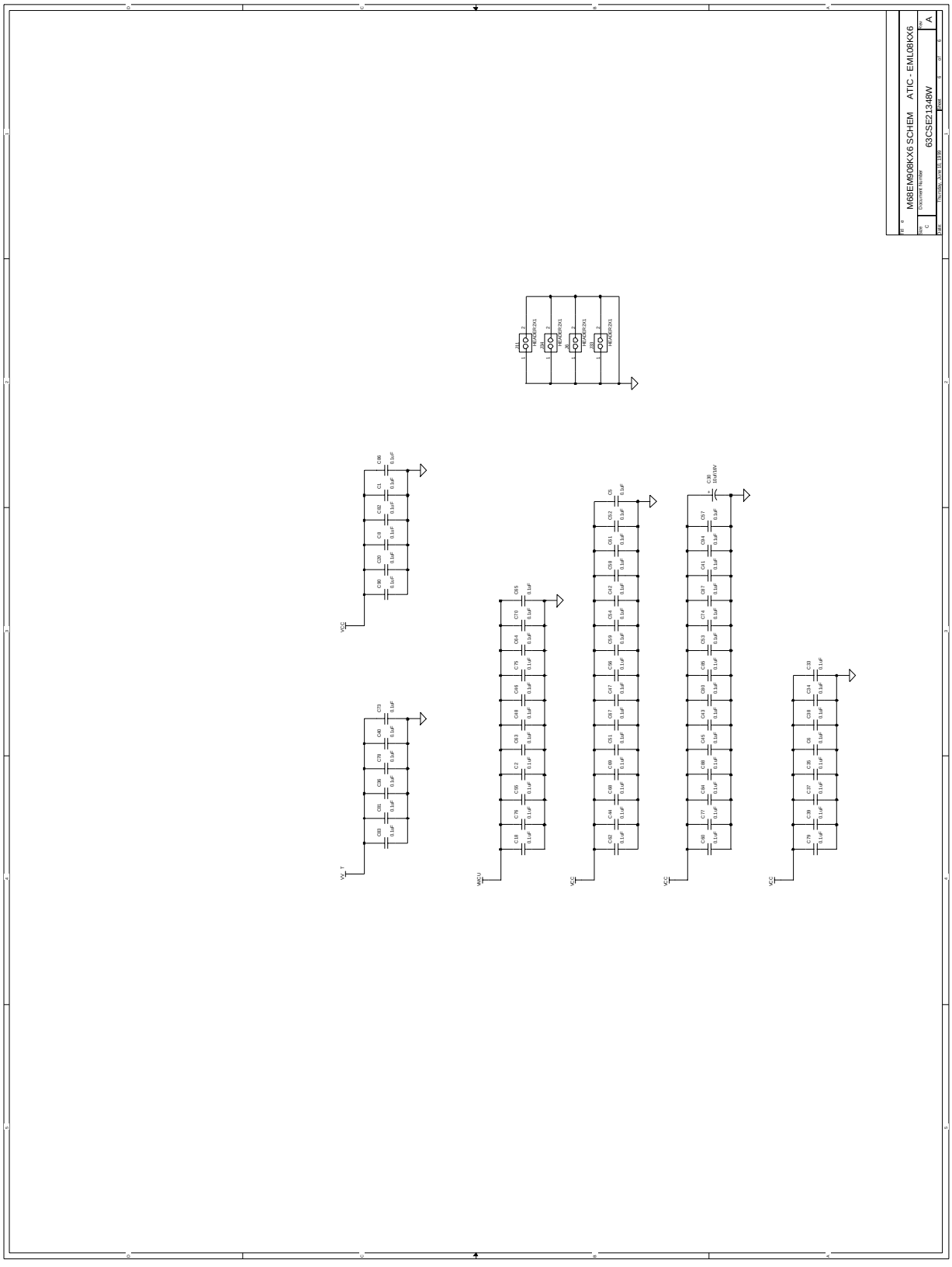
M68EM908KX6 SCHEM ATIC - EML08KX6
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A
Thursday, June 10, 1999
VCC
VCC
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