

**M68MPB916R3UM/D**

March 1998

**M68MPB916R3**  
**MCU PERSONALITY BOARD**  
**USER'S MANUAL**

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## CHAPTER 1

### GENERAL INFORMATION

#### 1.1 INTRODUCTION

This manual provides general information, hardware preparation, installation instructions, a quick start guide, support information, and schematics for the M68MPB916R3 MCU Personality Board (MPB). The MPB is one component of Motorola's modular approach to microcontroller unit-based product development. This modular approach lets you easily configure our development systems to fit your requirements. The MPB916R3 lets you emulate/evaluate these MCUs:

- MC68HC16R1
- MC68HC916R1
- MC68HC16R3
- MC68HC916R3

The MPB may be used in either the M68MMDS1632 Motorola Modular Development System (MMDS) or the M68MEVB1632 Modular Evaluation Board (MEVB). Alternately, you may install the MPB directly in your target system if the target system includes a modular active probe interconnect (MAPI) interface. The MCU device on the MPB defines which MCU is emulated/evaluated by the MMDS or MEVB. Both systems are invaluable tools for designing, debugging, and evaluating MCU operation of the M68HC16 and M68300 MCU Families. By providing the essential MCU timing and I/O circuitry, these systems simplify user evaluation of prototype hardware/software products.

The MPB includes:

- M68MPB916R3 MCU Personality Board (MPB)
- Plastic overlay for use with the MEVB – pin outs for the logic analyzer connectors on the MPFB
- Documentation (this manual)

## 1.2 SPECIFICATIONS

Table 1-1 lists MPB specifications.

**Table 1-1. MPB Specifications**

Characteristic	Specifications
On-Board Clock	Case style: 14- or 8-pin hybrid crystal clock oscillator (frequency as required by MCU).
External Clock	32 KHz – 16.78 MHz (or maximum MCU allows).
MCU I/O ports	HCMOS compatible
Temperature Operating Storage	0° to +40° C -40° to +85° C
Relative humidity	0 to 90% (non-condensing)
Power requirements	+5Vdc ± 5% @ 500 mA (max.)
Dimensions MCU Personality Board	3.25 x 3.25 in. (82.6 x 82.6 mm)

## 1.3 EQUIPMENT REQUIRED

The external requirements for MPB operation are either an MEVB or MMDS system. For MMDS operation requirements, see the M68MMDS1632 Motorola Modular Development System User's Manual, M68MMDS1632/D. For MEVB operation requirements, see this manual and the M68MPFB1632 Modular Platform Board User's Manual, M68MPFB1632/D.



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## CHAPTER 2

### HARDWARE PREPARATION AND INSTALLATION

#### 2.1 INTRODUCTION

This chapter provides unpacking instructions, hardware preparation information, and installation instructions for the MPB.

When you unpack the MPB from its shipping carton, verify that all items are in good condition. Save packing material for storing and shipping the MPB.

#### NOTE

Should the MPB arrive damaged, save all packing material, and contact the carrier's agent.

#### 2.2 HARDWARE PREPARATION

This portion of the manual explains how to prepare the MPB before use, as well as how to configure the MPB for system operation. This section also explains MPB installation in the MMDS and MEVB.

The MPB has been factory tested and is shipped with installed jumpers. A jumper installed on a jumper header provides a connection between two points in the MPB circuit. The MPB has two types of jumper headers: three-pin and two-pin with a cut-trace short. A cut-trace short has a copper trace between the feed-through holes (bottom or solder side of the MPB). Table 2-1 describes each type of jumper header.

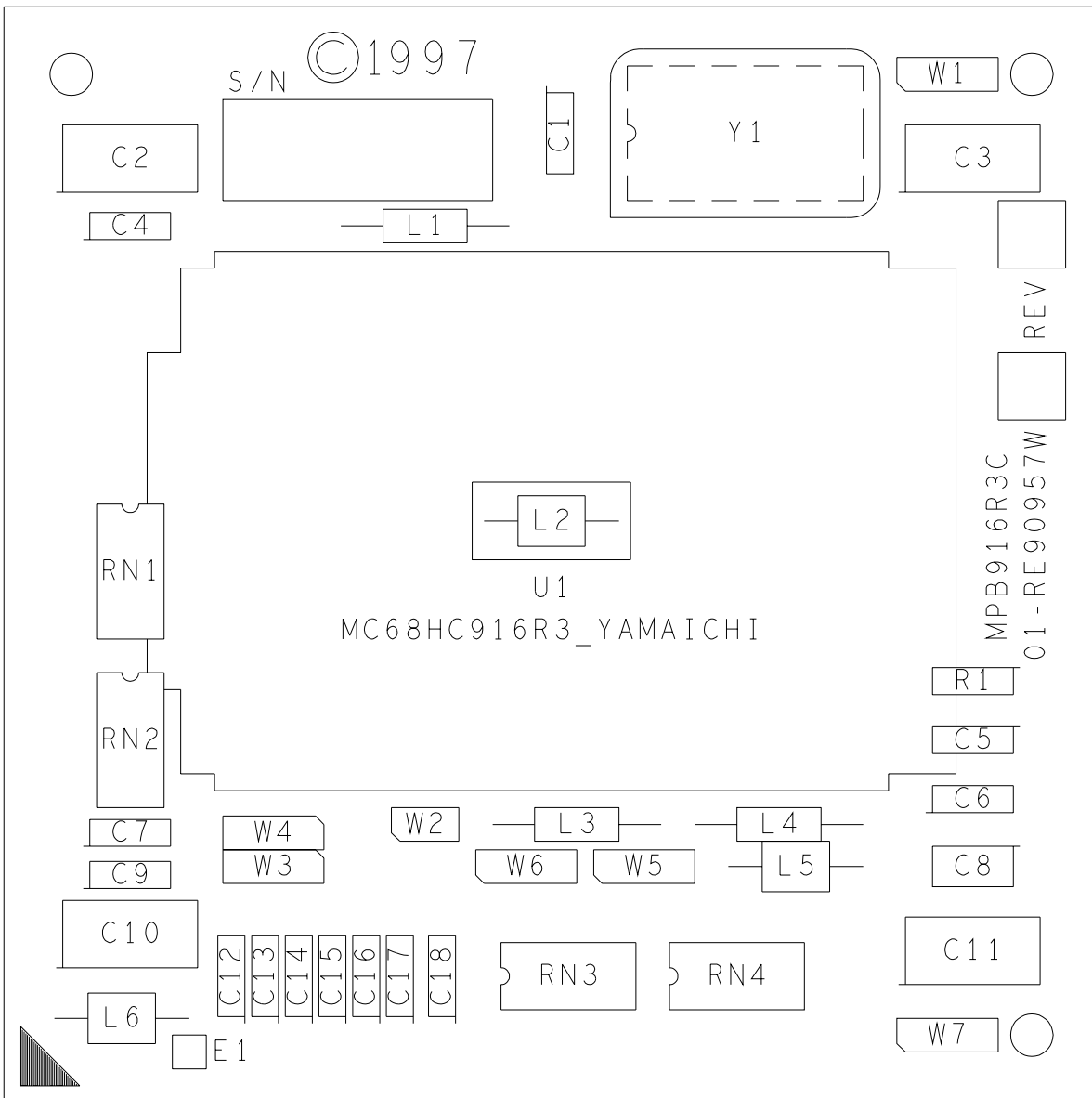
The MPB has five jumper headers (for which Table 2-2 is a quick reference guide). You may reconfigure these jumper headers to customize MPB functionality. The following paragraphs explain each jumper header function. There is also an insertion point (E1) for connecting an external ground.

There are two versions of the M68MPB916R3: B and C. On the B version the MCU is installed in a production socket on the board (Figure 2-1 shows the B version board layout). On the C version the MCU is installed in a clam-shell socket on the board (Figure 2-2 shows the C version board layout).

**CAUTION**



Depending on your application, it may be necessary to cut the W2 wiring trace short (cut-trace short). Be careful not to cut adjacent PCB traces, nor cut too deep into the multi-layer circuit board.

If the cut-trace short on a jumper header is already cut, you can return the MPB to its default setting by installing a user-supplied fabricated jumper.







**Figure 2-1. M68MPB916R3 (C version) Parts Location Diagram (top view)**




**Table 2-1. Jumper Header Types**

Jumper Header Type	Symbol	Description
two-pin with cut-trace short		Two-pin jumper header with cut-trace short, designated WX, where X = the jumper header number. If you cut the short, use a fabricated jumper to return the jumper header to its factory default state.
three-pin		Three-pin jumper header, designated WX, where X = the jumper header number. Use a fabricated jumper to create a connection between two of the three pins of the jumper header.

**Table 2-2. MPB Jumper Header Descriptions**

Jumper Header	Type	Description
W1	1 2 3 	Jumper between pins 1 and 2 (factory default); selects the MPB on-board crystal clock source.  Jumper between pins 2 and 3; selects an external clock source as the MCU EXTAL input signal.
W2	1 2 	Jumper installed or cut-trace short intact (factory default); selects the on-board VDDA power source.  No jumper or cut-trace short; lets you connect an external power source to W2 pin 2 and the external-power-source ground to E1.  <p style="text-align: center;"><b>NOTE</b></p> Jumper header W2 is not populated by the factory.
W3	1 2 3 	Jumper installed on pins 1 and 2 (factory default); selects the MPB on-board VRH power source.  Jumper installed on pins 2 and 3; selects an external VRH power source.
W4	1 2 3 	Jumper installed on pins 1 and 2 (factory default); selects the MPB on-board VRL power source.  Jumper installed on pins 2 and 3; selects an external VRL power source.

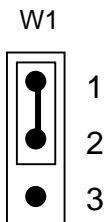
**Table 2-1. Jumper Header Types (continued)**

Jumper Header	Type	Description
W5	<p>1 2 3</p> 	<p>Jumper installed on pins 1 and 2 (factory default); selects the MCU-internal phase-lock-loop frequency synthesizer as the system clock.</p> <p>Jumper installed on pins 2 and 3; selects the EXTAL input as the system clock. The MCU-internal phase-lock-loop frequency synthesizer is disabled.</p>
W6	<p>1 2 3</p> 	<p>Configure the jumpers on jumper headers W6 and W7 to define which MCU is evaluated/emulated; MC68HC16R1, MC68HC916R1, MC68HC16R3, and MC68HC916R3. See paragraph 2.2.7 for more information.</p>
W7	<p>1 2 3</p> 	

**2.2.1 Clock Select Header (W1)**

Jumper header W1 connects the MCU external clock (EXTAL) pin to either an on-board or external (target-system) clock source. The drawing below shows the factory configuration: a fabricated jumper on pins 1 and 2. This configuration selects the MPB on-board clock source; crystal oscillator in the Y1 socket. (This crystal provides for operation at the maximum rate the MCU allows via the internal phase-locked loop or direct clock input.)

If you install the MPB in the active probe or directly on a target system, and use the target system clock as the MPB clock, move the fabricated jumper to W1 pins 2 and 3. This connects the MCU EXTAL pin to the MAPI bus input pin. The frequency of the external clock signal can be from 32 KHz to 16.78 MHz (or to the maximum the MCU allows).



**NOTE**

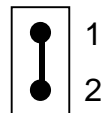
You cannot drive the MPB clock circuit from an external source (target system) with a discrete crystal. If you use a target system clock source to drive the MPB clock circuit, always use a logic-driven clock such as a hybrid oscillator.

### 2.2.2 VDDA Select Header (W2)

Jumper header W2 selects the MPB VDDA power source: either MPB power (VDDI) or an external source. The drawing below shows the factory configuration: a cut-trace short between pins 1 and 2. This configuration connects filtered VDDI to VDDA.

To use an external power source, remove the cut-trace short from W2 pins 1 and 2, then connect the external power source to W2 pin 2. Removal of the cut-trace short isolates the MCU VDDA pin from the other MPB circuitry. Isolation lets you connect a precision VDDA source for accurate 10-bit analog/digital (A/D) generation. When connecting an external VDDA power supply to the MPB, connect the power supply ground to insertion point E1. For more information on A/D generation refer to the Analog-To-Digital Converter Reference Manual, ADCRM/AD.

W2



#### NOTES

If the cut-trace short has been cut, you must install a fabricated jumper on W2 to return it to the factory configuration.

Jumper header W2 is not populated by the factory.

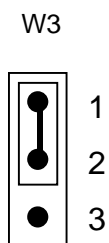
### 2.2.3 Voltage Reference High Select Header (W3)

Jumper header W3 selects the voltage reference high (VRH) source: either MPB power (VDDA) or an external VRH source. The drawing below shows the factory configuration: a fabricated jumper on pins 1 and 2. This configuration selects VDDA as the VRH source.

To use an external VRH source, first place the fabricated jumper on W3 pins 2 and 3. Then connect the MCU VRH pin to the external VRH source. Each configuration defines the best method for connecting the MCU VRH pin to the external VRH source:

- **MPB/MPFB** – connect via the MPFB logic analyzer connector (refer to Chapter 4 for the appropriate logic analyzer pin).
- **MPB/MMDS1632** – connect via the VRH pin of the target MCU socket.
- **MPB/Target System** – connect via the VRH pin of the target system MAPI bus.

Alternately, you may remove the jumper and wire-wrap directly to W3 pin 2. Connecting directly to pin 2 is an option regardless of the configuration.





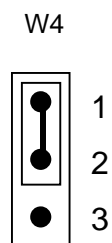
### 2.2.4 Voltage Reference Low Select Header (W4)

Jumper header W4 selects the voltage reference low (VRL) source: either MPB power (VSSA) or an external VRL source. The drawing below shows the factory configuration: a fabricated jumper on pins 1 and 2. This configuration selects VSSA as the VRL source.

To use an external VRL source, first place the fabricated jumper on W4 pins 2 and 3. Then connect the MCU VRL pin to the external VRL source. Each configuration defines the best method for connecting the MCU VRL pin to the external VRL source:

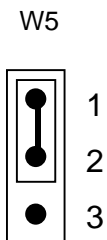
- **MPB/MPFB** – connect via the MPFB logic analyzer connector (refer to Chapter 4 for the appropriate logic analyzer pin).
- **MPB/MMDS1632** – connect via the VRL pin of the target MCU socket.
- **MPB/Target System** – connect via the VRL pin of the target system MAPI bus.

Alternately, you may remove the jumper and wire-wrap directly to W4 pin 2. Connecting directly to pin 2 is an option regardless of the configuration.



### 2.2.5 MCU Clock Source Select Header (W5)

Jumper header W5 selects the MCU clock; either the MCU-internal phase-lock-loop frequency synthesizer or the EXTAL input. The drawing below shows the factory configuration: fabricated jumper on pins 1 and 2. This configuration selects the MCU-internal phase-lock-loop frequency synthesizer as the clock. To use the EXTAL input as the clock, place the fabricated jumper on 2 and 3.



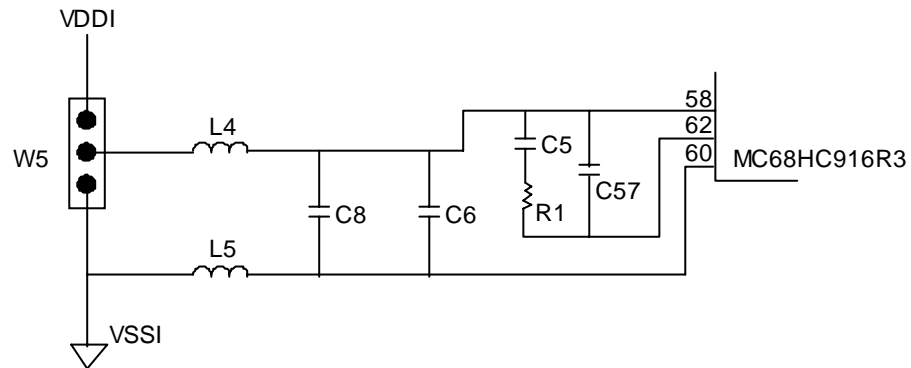
#### NOTE

J14 pin-4 and W16 on the MPFB are marked MODCLK, but this signal, when using an M68HC916R3, is FASTREF. The M68HC916R3 MEVB overlay is correct and marked FASTREF. Use W16 on the MPFB to select the MCU PLL clock input speed.

### 2.2.6 Using a 32 KHz Clock

The factory installed crystal oscillator in location Y1 is rated at 4.194 megahertz. You may change Y1 to change the clock speed of the MPB. The only other oscillator you may install is 32 kilohertz. If you change Y1 to the slower value (32 KHz) you must replace the following capacitors and resistor (see diagram below):

- C5 – 1  $\mu$ f
- C57 – 1  $\mu$ f
- R1 – 18 k $\Omega$



### 2.2.7 MCU ID Code Select Header (W6 & W7)

Jumper headers W6 and W7 select the MCU ID code; either the MC68HC16R1, MC68HC916R1, MC68HC16R3, or MC68HC916R3 MCUs. The drawing below shows the factory configuration: fabricated jumper on W6 pins 1 and 2 and W7 pins 1 and 2. Use this configuration when an MC68HC916R3 MCU is installed on the MPB. To use the MPB with a different MCU installed, configure the fabricated jumpers per the table below.



MCU	W6	W7
MC68HC16R1	2 – 3	2 – 3
MC68HC916R1	1 – 2	2 – 3
MC68HC16R3	2 – 3	1 – 2
MC68HC916R3	1 – 2	1 – 2

### 2.2.8 VSSA Insertion Point (E1)

Insertion point E1 is a plate through hole that lets you connect an external ground to the MPB VSSA pin (refer to paragraph 2.2.2). Insert an external ground wire in E1 and solder it into the plate through hole.

#### NOTE

Insertion point E1 is not populated by the factory.

## 2.3 MEVB CONFIGURATION

The MEVB contains:

- MPB – MCU-device-specific board that defines the MCU to be evaluated.
- M68MPFB Modular Platform Board (MPFB) – which provides the interface connections to the host computer, logic analyzer connections, and the platform for installing the MPB. For more information about the MPFB and MEVB system connections refer to the M68MPFB1632 Modular Platform Board User's Manual, M68MPFB1632/D. Chapter 3 contains information to help you get started using your MEVB.

### CAUTION

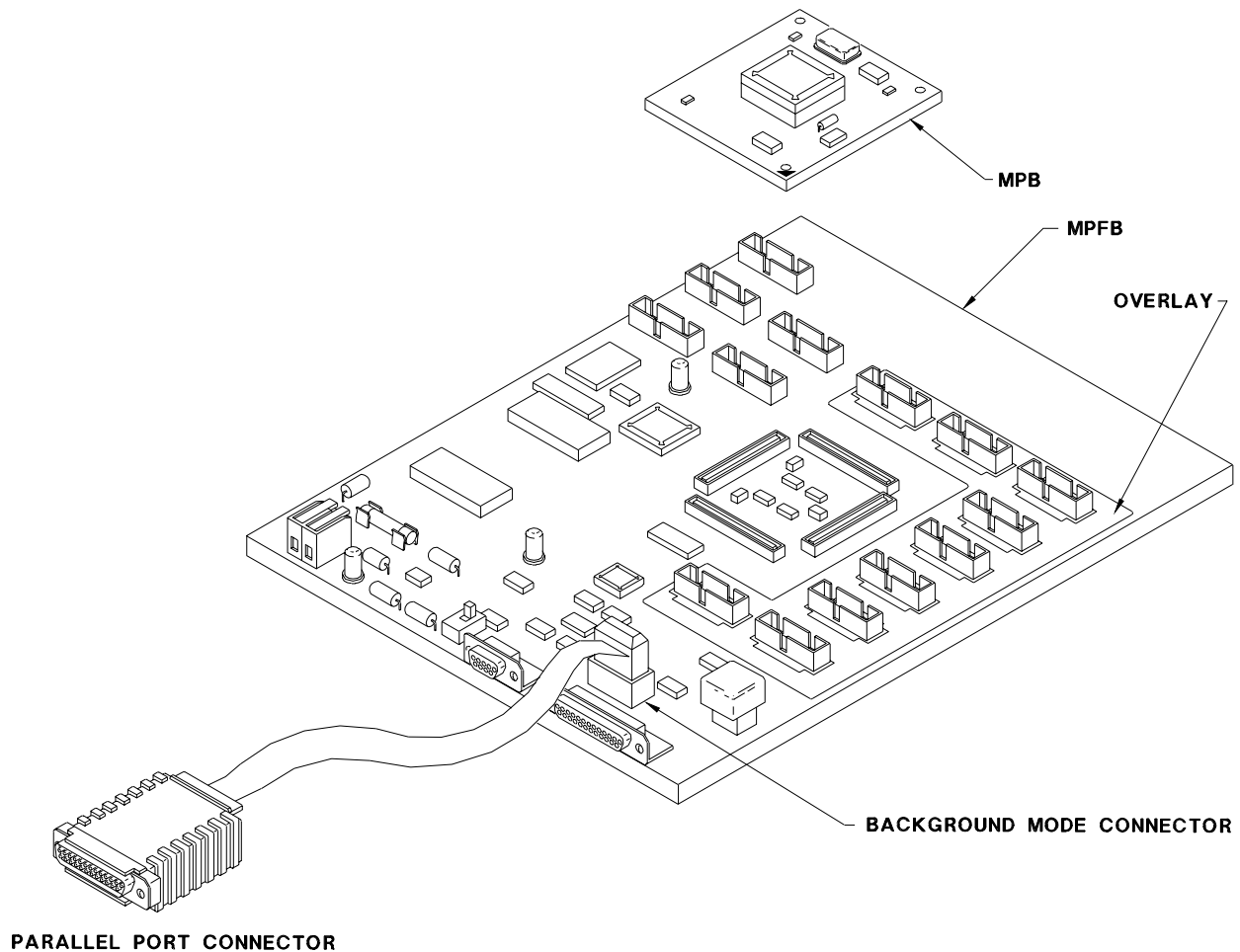
Turn OFF MPFB power when installing the MPB on the MPFB or removing the MPB from the MPFB. Sudden power surges could damage MEVB integrated circuits.

To install the MPB on the MPFB (refer to Figure 2-2):

1. Inspect all connectors for bent or damaged pins.
2. Align the MPB reference mark with the MPFB reference mark.
3. Rotate the MPB until the four MAPI bus connectors on its bottom mate with the MAPI bus connectors on the top of the MPFB. (There is only one way to connect the MPB and the MPFB.)
4. Firmly press the MPB onto the MPFB.

### CAUTION

Support the bottom side of MPFB when installing the MPB on the MPFB. Excessive flexing of the MPFB could damage the printed circuit.



**Figure 2-2. MPB – MPFB Interconnection**

After you have installed the MPB, install the plastic overlay on the MPFB: place the overlay over logic analyzer connectors J12 through J20 and press down. Holes in the overlay slide down over plastic clips on the MPFB. These clips hold the overlay in place.

## 2.4 ACTIVE PROBE CONFIGURATION

The M68MMDS1632 Motorola Modular Development System (MMDS) consists of the station module and an active probe. The active probe consists of a three board set, two cables, and a box:

- MPB – MCU-device-specific board that defines the MCU to be evaluated.
- Target Control Board (TCB) – the interface between the MPB, target system, and the station module. The TCB is supplied with the MMDS. For more information about the TCB refer to the M68MMDS1632 Motorola Modular Development System User's Manual, MMDS1632UM/D.
- Package Personality Board (PPB) – the board that connects the active probe to the target system. The PPB must be purchased separately. For more information about the PPB refer to the appropriate user's manual.
- Active probe cables (2) – the interface between the active probe and the station module. 01-RE90340W01 REV 0 and 01-RE90341W01 REV 0 are printed on the active probe cables. The active probe cables come with the MMDS. For more information about the active probe cables refer to the M68MMDS1632 Motorola Modular Development System User's Manual, MMDS1632UM/D.
- Active probe box – the protective enclosure for the TCB.

### CAUTION

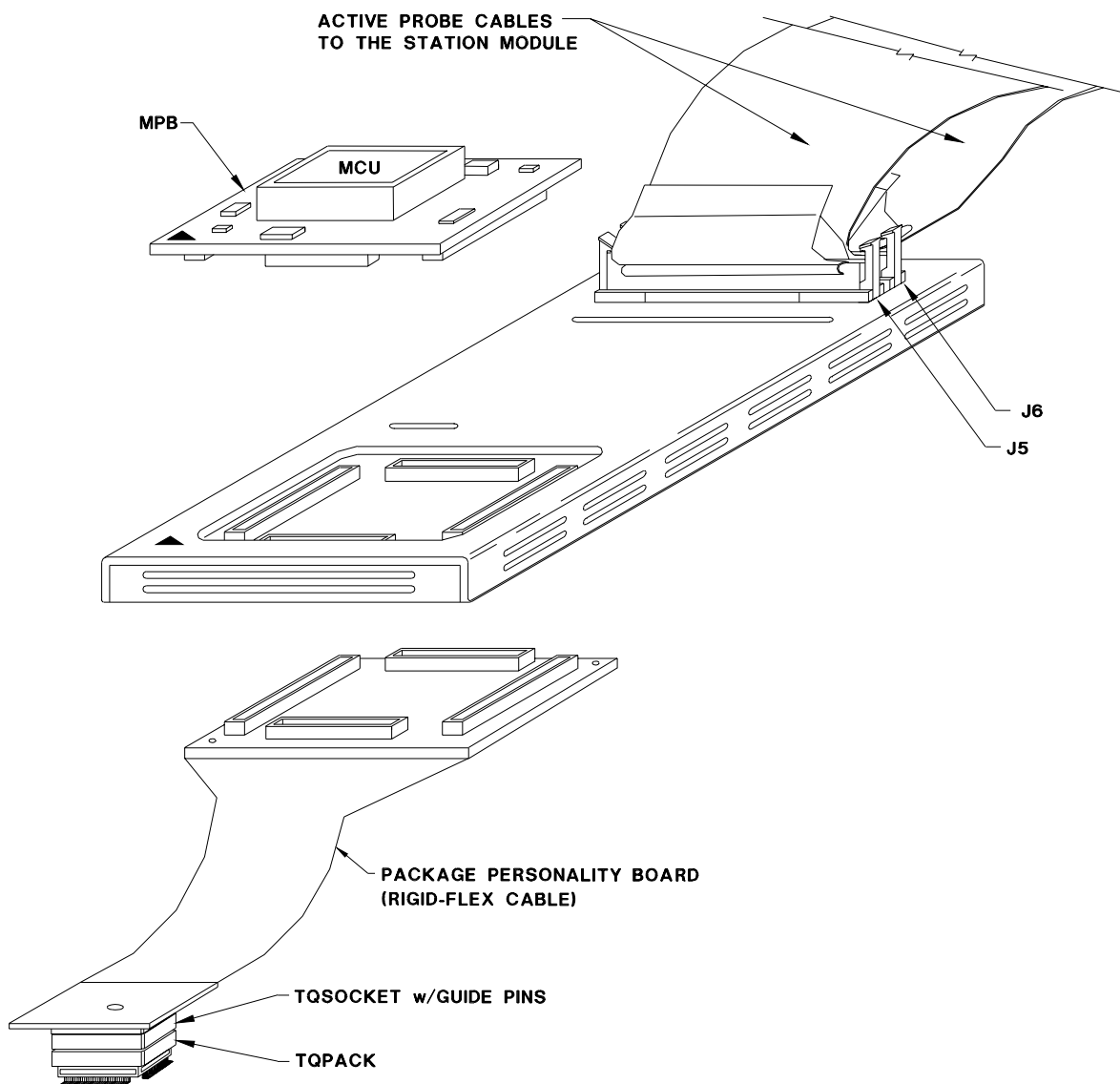
Turn off MMDS and target system power when installing or removing MMDS components. Sudden power surges could damage MMDS and target system integrated circuits.

To configure an active probe:

1. Inspect all connectors for bent or damaged pins.
2. Rotate the MPB until the four MAPI bus connectors on its bottom mate with the MAPI bus connectors on the top of the TCB. (There is only one way to connect the MPB and the TCB.) Firmly press the MPB and the TCB together.
3. Rotate the PPB until the four MAPI bus connectors on its top mate with the MAPI bus connectors on the bottom of the TCB. (There is only one way to connect the PPB and the TCB.) Firmly press the PPB and the TCB together.

4. Connect one end of the 01-RE90341W01 REV 0 active probe cable to connector P6 on the MMDS control board; connect the other end to connector J6 on the TCB. Connect one end of the 01-RE90340W01 REV 0 active probe cable to connector P5 on the MMDS control board; connect the other end to connector J5 on the TCB. Secure the connector clamps on TCB connectors J5 and J6.

The active probe is now ready to connect to the target system (refer to the PPB configuration guide for information on connecting the active probe to the target system.)



**Figure 2-3. Active Probe Interconnection (with Active Probe Box)**



## CHAPTER 3

### MEVB QUICK START GUIDE

#### 3.1 INTRODUCTION

This quick start guide is intended for the user who may not be familiar with Motorola's development tools. This chapter explains the MEVB hardware and software set up for M68MEVB16R3 operation. Hardware set up consists of configuring the MPB and MPFB jumper headers; software set up consists of installing and running the appropriate macro script file within the debugger.

For the purpose of this quick start guide the MPB jumper headers should be configured in their default positions. Chapter 2 of this manual contains the default jumper header settings for the MPB.

#### 3.2 CONFIGURING THE MPFB

The MPFB includes jumper-selectable options such as chip select usage, memory type selection and memory size selection for the pseudo ROM sockets, and reset data control.

##### NOTE

The MPFB must be configured for the specific MPB. Paragraph 3.2.2 provides a configuration for basic MPFB operation. For a detailed description of the MPFB jumper header selections refer to the M68MPFB1632 Modular Platform Board User's Manual, M68MPFB1632/D.





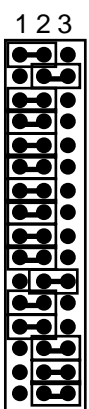
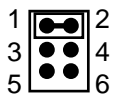
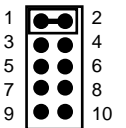
##### 3.2.1 MPFB Memory Devices

Pseudo ROM refers to memory locations U2 & U4. The two pseudo ROM sockets are generic memory sockets that accept a variety of RAM, EPROM, or EEPROM devices. The pseudo ROM sockets, as shipped from the factory, contain two 32K x 8 RAM devices. These memories are 28-pin package devices.

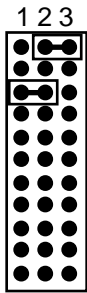





### 3.2.2 MPFB Jumper Headers

Configure your MPFB jumper headers per the instructions in Table 3-1. Table 3-1 contains information exclusively intended for quick start and ignores the other jumper headers.

**Table 3-1. MPFB Quick Start Jumper Header Configuration**

Jumper Header	Type	Description
W2		Install a jumper on pins 1 and 2 to configure pin 1 of the memory devices in the pseudo ROM sockets (U2 & U4) as a standard address line.
W3		Install a jumper on pins 1 and 2 to indicate that the memory devices in the pseudo ROM sockets (U2 & U4) have 28 pins.
W4		Install a jumper on pins 1 and 2 to set the pseudo ROM port size (memory data width) as 16 (word).
W5		Install a jumper on pins 2 and 3 to enable the PRU.
W6		<p>W6 selects the MCU operation mode. Each 3-pin jumper header set corresponds to an MCU data line. While the reset pin is low, the reset data values are driven on the data bus (D0 – D15). (The MEVB reset data circuit is open drain; a high state is provided via a pull-up resistor.) Each reset data line may be set high (H) or low (L). Consult the appropriate MCU user's manual, data book, or technical summary for reset data information.</p> <p>The default setting configures the MC68HC16R3 MCU as 16-bit, expanded mode with these functions:</p> <ul style="list-style-type: none"> <li>• CSBOOT = 16-bit port</li> <li>• Chip select active</li> <li>• Internal ROM disabled</li> <li>• CSE and CSM active</li> </ul>
W10		Install a jumper on pins 1 and 2 to indicate that RAM is installed in the pseudo ROM sockets (U2 & U4).
W12		Install a jumper on pins 3 and 4 to indicate that the two devices installed in the pseudo ROM sockets (U2 & U4) are 32K x 8.

**Table 3-1. MPFB Quick Start Jumper Header Configuration (continued)**

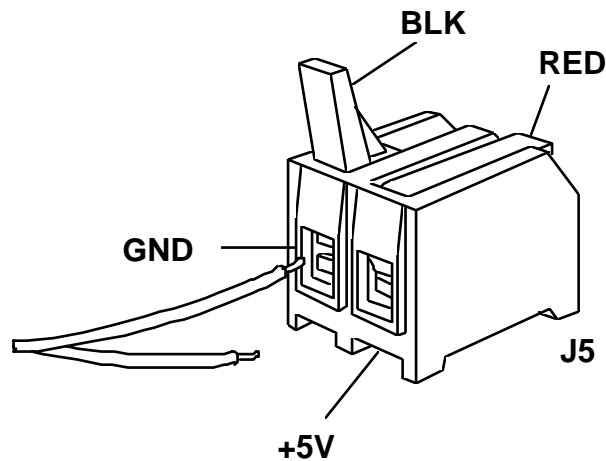
Jumper Header	Type	Description
W14		<p>Jumper header W14 selects the MCU signal for the memory devices in the fast RAM sockets (U9 &amp; U10) and pseudo ROM sockets (U2 &amp; U4). Pins 1 and 2 select the MCU chip select for the memory devices in the fast RAM sockets. Pins 2 and 3 of jumper header W14 select the chip select for the memory devices in the pseudo ROM sockets.</p> <p>Jumper installed on CSBOOT pins 2 and 3 (factory default); use CSBOOT as the memory device chip enable for memory devices in the pseudo ROM sockets.</p>
W16		No jumper installed; the MCU MODCLK signal is pulled high (logic 1) via a resistor during reset.
W17		No jumper installed; the BERR signal is pulled high (logic 1) via a resistor during reset.
W18		Install a jumper on pins 1 and 2 for unrestricted writes to the memory devices in the pseudo ROM sockets (U2 & U4).
W19		Install a jumper on pins 1 and 2 to ground the A19 signal to the MPFB memory arrays.
W22		Install a jumper on pins 2 and 3 to select the evaluation MCU (on the MPB) as an M68HC16 MCU device.

### 3.4 MEVB INSTALLATION INSTRUCTIONS

MEVB installation requires a user-supplied power supply and host computer. The host computer must have a parallel port and must run MS-DOS, as required by ICD16. The following paragraphs explain MPFB connections. Refer to Chapter 2 for instructions to connect the MPB and MPFB.

### 3.4.1 Power Supply – MPFB Connection

Use MPFB connector J5 to connect a user-supplied power supply to the MEVB. Contact 1 is ground; black lever. Contact 2 is VDD (+5 volts); red lever. Use 20 or 22 AWG wire for power connections. For each wire, trim back the insulation 1/4 in. (.635 cm), lift the appropriate lever of J5 to release tension on the contacts, then insert the bare wire into J5 and close the lever. The MEVB requires a +5Vdc @ 1.0 amp power supply for operation. A 1.5 amp fuse is installed on the MPFB +5Vdc power supply input line.



#### CAUTIONS

Do not use wire larger than 20 AWG in connector J5. Such wire could damage the connector.

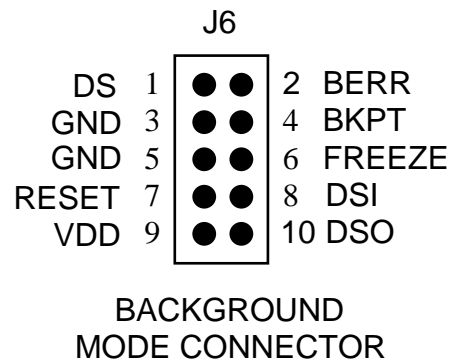
Turn off MEVB power when installing or removing the MPB from the MPFB. Sudden power surges could damage MEVB integrated circuits.

### 3.4.2 Personal Computer – BDM Connection

As the MEVB does not have on-board debug firmware, debugging does not consume MCU resources. Motorola ships the MEVB with the ICD16 in-circuit debugger, which easily connects to the MPFB's standard background-mode header (MPFB connector J6). For additional information about the ICD software, including debugging and assembly information, see the ICD16 user's manual, M68ICD16/D.

Connect the ICD16 debugger to the MEVB by connecting the integral 10-pin cable assembly of the debugger to MPFB connector J6. **Make sure that the red wire of the cable connects to pin 1 of connector J6.** Connect the DB-25 parallel port of the ICD16 to the parallel port of your computer. The drawing below shows signal assignments for connector J6.

For a complete description of PC to MPFB interconnection (via the BDM connector), refer to the ICD16 user manual.



### 3.5 SOFTWARE INSTALLATION

After you have set up the MEVB hardware you must install the software on your computer. Follow the installation procedure in the appropriate software operations manual.

The MCU must be initialized before the MEVB will function. The following is one possible initialization for the MPB16R3. You may adapt this example to your debugger. This initialization enables the maximum system clock frequency and disables the software watchdog while enabling the bus monitor. CSBOOT is set to zero-wait state and the block size set to 64K starting at \$00000. The SRAM is enabled to reside at \$10000 with the stack pointer initialized at \$103FE and the instruction pointer (IP) initialized to \$00200 (PK=0, IP=200).

Load your program at address \$00200.



Below is the MPBR3.ICD initialization macro program listing.

```
symbol SCIMCR FFA00
symbol SYNCR FFA04
symbol SYPCR FFA21
symbol CSBARBT FFA48
symbol CSORBT FFA4A
symbol START 00200
dmmw SCIMCR 40CF      Set module mapping to $FFF000-$FFFFFF
dmmb SYNCR 7F        Set system clock frequency to 16.78 MHz
dmmb SYPCR 04        Turn off software watchdog timer
dmmw CSBARBT 0003    Change CSBOOT block size to 64K
dmmw CSORBT 7830     Change wait state to zero
mdf6 START          Display program in PMM window
pk=0                Initialize CPU registers
a=AA
b=BB
e=0000
ix=0000
iy=0000
iz=0000
hr=0000
ir=0000
k=0000
sp=03fe            Initialize the stack pointer
sk=1
symbol SRAMBAH FFB04
symbol SRAMMCR FFB00
dmmb SRAMBAH 01     Set SRAM base address
dmmb SRAMMCR 00     Enable SRAM array
dmm1 10000 4D6F746F Check SRAM: Write Motorola 68HC16 Advanced MCUs
dmm1 10004 726F6C61
dmm1 10008 20363848
dmm1 1000C 43313620
dmm1 10010 41647661
dmm1 10014 6E636564
dmm1 10018 20204D43
dmm1 1001C 55732020
dmm1 10020 36384843
mdf3 10000         Display SRAM in DMM window
ip=START          Start entering your program here
```





## CHAPTER 4

### MEVB SUPPORT INFORMATION

#### 4.1 INTRODUCTION

This chapter's information is pertains to using the MPB in an MEVB (the MPB installed on a MPFB). Signals on the MPFB logic analyzer connectors are defined by the MPB type.

#### 4.2 LOGIC ANALYZER CONNECTOR SIGNALS

The tables of this chapter describe MPFB logic analyzer connector signals if you install an M68MPB916R3 on the MPFB. The signal descriptions on J12 – J20 are the logic analyzer pin-outs on the plastic overlay supplied with the MPB.

##### NOTE

The signal descriptions in the following tables are for quick reference only. The MC68HC916R3 User's Manual, MC68HC16R3UM/AD, contains a complete description of the MC68HC16R3 MCU signals.

**Table 4-1. Logic Analyzer Connector J7 Pin Assignments**

Pin	Mnemonic	Signal
1, 2	SPARE	No connection
3	OE(ALL)	I/O PRU OUTPUT ENABLE – Input, active high; when low disables <i>all</i> PRU outputs.
4 – 11	PEPAR7 – PEPAR0	PEPAR OUTPUTS – Output signals that show the <i>complement</i> (negated contents) of the PEPAR register.
12 – 19	PE7 – PE0	PORT E I/O SIGNALS – PRU replacement of the port E function.
20	GND	GROUND

**Table 4-2. Logic Analyzer Connector J8 Pin Assignments**

Pin	Mnemonic	Signal
1, 2	SPARE	No connection
3	OE(ABG)	I/O PRU OUTPUT ENABLE – Input, active high; when low disables port A, port B, and port G outputs.
4 – 11	PA7 – PA0	PORT A I/O SIGNALS – PRU replacement of the port A function.
12 – 19	PB7 – PB0	PORT B I/O SIGNALS – PRU replacement of the port B function.
20	GND	GROUND

**Table 4-3. Logic Analyzer Connector J9 Pin Assignments**

Pin	Mnemonic	Signal
1, 2	SPARE	No connection
3	OE(H)	I/O PRU OUTPUT ENABLE – Input, active high; when low disables the port H outputs.
4 – 11	PH7 – PH0	PORT H I/O SIGNALS – PRU replacement of the port H function.
12 – 19	PG7 – PG0	PORT G I/O SIGNALS – PRU replacement of the port G function.
20	GND	GROUND

**Table 4-4. Logic Analyzer Connector J10 Pin Assignments**

Pin	Mnemonic	Signal
1	+5V	+5 VDC POWER – Input voltage (+5Vdc @ 1.0 A) used by the MEVB logic circuits. (To make this pin a no connection, remove the jumper from jumper header W9 on the MPFB.)
2	SPARE	No connection
3	AS	ADDRESS STROBE – Active-low output signal that indicates whether a valid address is on the address bus.
4 – 19	A15 – A0	ADDRESS BUS BITS 15 – 0 – Sixteen bits of the 24-bit address bus.
20	GND	GROUND

**Table 4-5. Logic Analyzer Connector J11 Pin Assignments**

Pin	Mnemonic	Signal
1	+5V	+5 VDC POWER – Input voltage (+5Vdc @ 1.0 A) used by the MEVB logic circuits. (To make this pin a no connection, remove the jumper from jumper header W9 on the MPFB.)
2	SPARE	No connection
3	DS	DATA STROBE – Active-low output signal. During a read cycle, indicates that an external device should place valid data on the data bus. During a write cycle, indicates that valid data is on the data bus.
4 – 19	D15 – D0	DATA BUS 15 – 0 – 16 bits of the MCU bi-directional data bus lines.
20	GND	GROUND

**Table 4-6. Logic Analyzer Connector J12 Pin Assignments**

Pin	Mnemonic	Signal
1, 2	SPARE	No connection
3	CLKOUT	SYSTEM CLOCK OUT – Output signal that is the MCU internal system clock.
4	BERR	BUS ERROR – Active-low signal that indicates that a memory access error has occurred.
5	BKPT / DSCLK	BREAKPOINT – Active-low input signal that signals a hardware breakpoint to the CPU. Development Serial Clock – Clock input signal for background debug mode.
6	FREEZE	FREEZE – Output signal that indicates the CPU has acknowledged a breakpoint.
7	LAT-DSO / (Latched IPIPE0)	LATCHED INSTRUCTION PIPE 0 – Latched output signal of the first state of IPIPE0 for CPU16-based MCUs; indicates instruction pipeline activity.

**Table 4-6. Logic Analyzer Connector J12 Pin Assignments (continued)**

Pin	Mnemonic	Signal
8	LAT-DSI (Latched IPIPE1)	LATCHED INSTRUCTION PIPE 1 – Latched output signal of the first state of IPIPE1 for CPU16-based MCUs; indicates instruction pipeline activity.
9	DSO /  (IPIPE0)	DEVELOPMENT SERIAL OUT – Serial data output signal for background debug mode.  INSTRUCTION PIPE 0 for CPU16-based MCUs.
10	DSI /  (IPIPE1)	DEVELOPMENT SERIAL IN – Serial data input signal for background debug mode.  INSTRUCTION PIPE 1 for CPU16-based MCUs.
11	DSACK1	DATA AND SIZE ACKNOWLEDGE 1 – Active-low input signal that allows asynchronous data transfers and dynamic bus sizing between the MCU and external devices.
12	DSACK0	DATA AND SIZE ACKNOWLEDGE 0 – Active-low input signal that allows asynchronous data transfers and dynamic bus sizing between the MCU and external devices.
13	FC2 /  CS5	FUNCTION CODE 2 – Output signal that identifies the processor state and address space of the current bus cycle.  CHIP SELECT 5 – Output signal that selects peripheral or memory devices at programmed addresses.
14	FC1	FUNCTION CODE 1 – Output signal that identifies the processor state and address space of the current bus cycle.
15	FC0 /  CS3	FUNCTION CODE 0 – Output signal that identifies the processor state and address space of the current bus cycle.  CHIP SELECT 3 – Output signal that selects peripheral or memory devices at programmed addresses.
16	SIZ1	TRANSFER SIZE – Output signal that indicate the number of bytes still to be transferred during this cycle.

**Table 4-6. Logic Analyzer Connector J12 Pin Assignments (continued)**

Pin	Mnemonic	Signal
17	SIZ0	TRANSFER SIZE – Output signal that indicate the number of bytes still to be transferred during this cycle.
18	R/W	READ/WRITE – Output signal that indicates the direction of data transfer on the bus.
19	BGACK /  CSE	BUS GRANT ACKNOWLEDGE – Active-low input signal that indicates an external device has assumed bus mastership.  EMULATOR CHIP SELECT – Output signal that selects external emulation devices at internally-mapped addresses. CSE is used to emulate I/O ports.
20	GND	GROUND

**Table 4-7. Logic Analyzer Connector J13 Pin Assignments**

Pin	Mnemonic	Signal
1	+5V	+5 VDC POWER – Input voltage (+5Vdc @ 1.0 A) used by the MEVB logic circuits. (To make this pin a no connection, remove the jumper from jumper header W21 on the MPFB.)
2	SPARE	No connection
3	DSACK1	DATA AND SIZE ACKNOWLEDGE 1 – Active-low input signal that allows asynchronous data transfers and dynamic bus sizing between the MCU and external devices.
4	AVEC	AUTOVECTOR – Active-low input signal that requests an automatic vector during interrupt acknowledge.
5	HALT	HALT – Active-low input/output signal that suspends external bus activity, to request a retry when used with BERR, or for single-step operation.
6	AS	ADDRESS STROBE – Active-low output signal that indicates a valid address is on the address bus.

**Table 4-7. Logic Analyzer Connector J13 Pin Assignments (continued)**

Pin	Mnemonic	Signal
7	DS	DATA STROBE – Active-low output signal. During a read cycle, indicates that an external device should place valid data on the data bus. During a write cycle, indicates that valid data is on the data bus.
8	BR /  CS0	BUS REQUEST – Active-low input signal that indicates an external device requires bus mastership.  CHIP SELECT 0 – Output signal that selects peripheral or memory devices at programmed addresses.
9	BG /  CSM	BUS GRANT – Active-low output signal that indicates the MCU has relinquished the bus.  INTERNAL MODULE CHIP SELECT – Active-low output signal that selects an external emulation device at internally-mapped address.
10	CSBOOT	BOOT CHIP SELECT – An active-low output chip select for external boot startup ROM
11	CLKOUT	SYSTEM CLOCK OUTPUT – MCU internal clock output signal.
12	A23 /  CS10  E	ADDRESS BUS BIT 23 – One bit of the 24-bit address bus.  CHIP SELECT 10 – Output signal that selects peripheral or memory devices at programmed addresses.  EXTERNAL CLOCK – M6800 bus clock output.
13	A22 /  CS9	ADDRESS BUS BIT 22 – One bit of the 24-bit address bus.  CHIP SELECT 9 – Output signal that selects peripheral or memory devices at programmed addresses.
14	A21 /  CS8	ADDRESS BUS BIT 21 – One bit of the 24-bit address bus.  CHIP SELECT 8 – Output signal that selects peripheral or memory devices at programmed addresses.

**Table 4-7. Logic Analyzer Connector J13 Pin Assignments (continued)**

Pin	Mnemonic	Signal
15	A20 /	ADDRESS BUS BIT 20 – One bit of the 24-bit address bus.
	CS7	CHIP SELECT 7 – Output signal that selects peripheral or memory devices at programmed addresses.
16	A19 /	ADDRESS BUS BIT 19 – One bit of the 24-bit address bus.
	CS6	CHIP SELECT 6 – Output signal that selects peripheral or memory devices at programmed addresses.
17 – 19	A18 – A16	ADDRESS BUS BITS 18 – 16 – Three bits of the 24-bit address bus.
20	GND	GROUND

**Table 4-8. Logic Analyzer Connector J14 Pin Assignments**

Pin	Mnemonic	Signal
1, 2	SPARE	No connection
3	DSACK0	DATA AND SIZE ACKNOWLEDGE 0 – Active-low input signal that allows asynchronous data transfers and dynamic bus sizing between the MCU and external devices.
4	FASTREF	FASTREF – General purpose input/output lines.
5	TSC	THREE STATE CONTROL – When TSC is logic high, this input signal forces all output drivers to a high-impedance state.
6	RESET	RESET – Active-low, bi-directional signal to start a system reset.
7	PE3	PORT E BIT 3 – Data input/output signal for port E.
8	SPARE	No connection



**Table 4-8. Logic Analyzer Connector J14 Pin Assignments (continued)**

Pin	Mnemonic	Signal
9 – 15	IRQ1 – IRQ7  PF1 – PF7	TARGET INTERRUPT REQUEST 1 - 7 – Active-low input signals from the target that asynchronously provides an interrupt priority level to the CPU. IRQ1 has the lowest priority, IRQ7 has the highest.  PORT F (bits 1 - 7) – General purpose input/output lines.
16 – 19	SPARE	No connection
20	GND	GROUND

**Table 4-9. Logic Analyzer Connector J15 Pin Assignments**

Pin	Mnemonic	Signal
1 – 3	SPARE	No connection
4 – 8	GND	GROUND
9, 10	CPWM19, CPWM18	CONFIGURABLE PULSE WIDTH MODULATION SUBMODULE 19 and 18 – creates a variable pulse width output signal at a wide range of frequencies.
11, 12	CTS16B, CTS16A	CONFIGURABLE TIMER SINGLE-ACTION CHANNEL 16 A and B – I/O signals that function as single-action capture/compare channels for the CTM.
13, 14	CTS14B, CTS14A	CONFIGURABLE TIMER SINGLE-ACTION CHANNEL 14 A and B – I/O signals that function as single-action capture/compare channels for the CTM.
15, 16	CTS12B, CTS12A	CONFIGURABLE TIMER SINGLE-ACTION CHANNEL 12 A and B – I/O signals that function as single-action capture/compare channels for the CTM.
17	CTS10B	CONFIGURABLE TIMER SINGLE-ACTION CHANNEL 10 B – I/O signals that function as single-action capture/compare channels for the CTM.
18, 19	SPARE	No connection
20	GND	GROUND

**Table 4-10. Logic Analyzer Connector J16 Pin Assignments**

<b>Pin</b>	<b>Mnemonic</b>	<b>Signal</b>
1 – 4	SPARE	No connection
5	CTM2C	INPUT CAPTURE 1 – Input signal that latches the contents of the GPT timer counter (TCNT) into the input capture register TIC1 when a selected edge occurs at the pin.
6	CTD20	CONFIGURABLE TIMER DUAL-ACTION 20 – I/O signal that functions as double-action capture/compare channel for the CTM.
7	CTD22	CONFIGURABLE TIMER DUAL-ACTION 22 – I/O signal that functions as double-action capture/compare channel for the CTM.
8, 9	CTS6A, CTS6B	CONFIGURABLE TIMER SINGLE-ACTION CHANNEL 6 A and B – I/O signals that function as single-action capture/compare channels for the CTM.
10, 11	CTS8A, CTS8B	CONFIGURABLE TIMER SINGLE-ACTION CHANNEL 8 A and B – I/O signals that function as single-action capture/compare channels for the CTM.
12	CTS10A	CONFIGURABLE TIMER SINGLE-ACTION CHANNEL 10 A – I/O signals that function as single-action capture/compare channels for the CTM.
13 – 19	SPARE	No connection
20	GND	GROUND

**Table 4-11. Logic Analyzer Connector J17 Pin Assignments**

<b>Pin</b>	<b>Mnemonic</b>	<b>Signal</b>
1 – 4	SPARE	No connection
5	VSSA	A/D GROUND – A/D ground reference.
6 – 11	AN0 – AN5	ANALOG TO DIGITAL CONVERSION 0 - 5 – Analog input lines to the MCU device.
12	MAPI-VRH	VOLTAGE REFERENCE HIGH – Input reference supply voltage (high) line from the MAPI (must set jumper on the MPB).
13	MAPI-VRL	VOLTAGE REFERENCE LOW – Input reference supply voltage (low) line from the MAPI (must set jumper on the MPB).
14, 15	AN6, AN7	ANALOG TO DIGITAL CONVERSION 6 and 7 – Analog input lines to the MCU device.
16	VSSA	A/D GROUND – A/D ground reference.
17 – 19	SPARE	No connection
20	VSSA	A/D GROUND – A/D ground reference.

**Table 4-12. Logic Analyzer Connector J18 Pin Assignments**

<b>Pin</b>	<b>Mnemonic</b>	<b>Signal</b>
1 – 4	SPARE	No connection
5	MISO	MASTER-IN, SLAVE-OUT – Serial input to SPI in master mode; serial output from SPI in slave mode.
6	MOSI	MASTER-OUT, SLAVE-IN – Serial output from SPI in master mode; serial input to SPI in slave mode.
7	SCK	SPI SERIAL CLOCK – In master mode, the clock signal from the SPI; in slave mode the clock signal to the SPI.
8	SS	SLAVE SELECT – Bi-directional, active-low signal that puts the SPI in slave mode.
9	RXDB	RECEIVE DATA B – Serial data input line to serial communication interface B.
10	TXDB	TRANSMIT DATA B – Serial data output line to serial communication interface B.
11	RXDA	RECEIVE DATA A – Serial data input line to serial communication interface A.
12	TXDA	TRANSMIT DATA A – Serial data output line to serial communication interface A.
13 – 16	GND	GROUND
17 – 19	SPARE	No connection
20	GND	GROUND

**Table 4-13. Logic Analyzer Connector J19 Pin Assignments**

<b>Pin</b>	<b>Mnemonic</b>	<b>Signal</b>
1 – 4	SPARE	No connection
5 – 12	GND	GROUND
13 – 19	SPARE	No connection
20	GND	GROUND

**Table 4-14. Logic Analyzer Connector J20 Pin Assignments**

<b>Pin</b>	<b>Mnemonic</b>	<b>Signal</b>
1 – 4	SPARE	No connection
5 – 18	GND	GROUND
19	SPARE	No connection
20	GND	GROUND



## CHAPTER 5

### MAPI SUPPORT INFORMATION

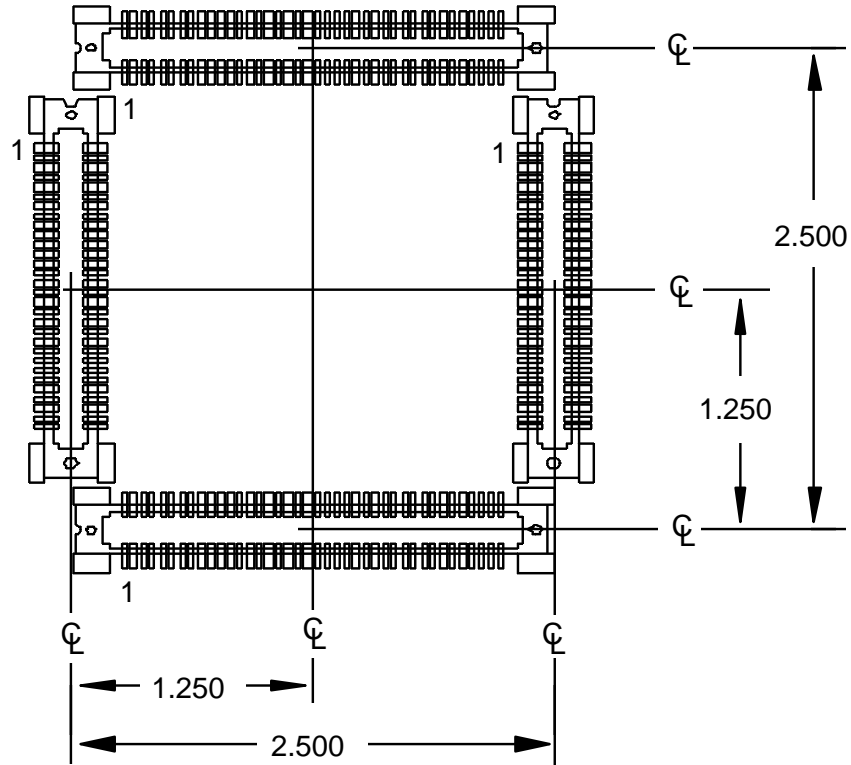
#### 5.1 INTRODUCTION

This chapter information pertains to installing the MPB on a target system. The figures in this chapter show the MAPI interface connector layout and pin assignments for MPB connectors P1, P2, P3, and P4 (Figures 5-1 through 5-5).

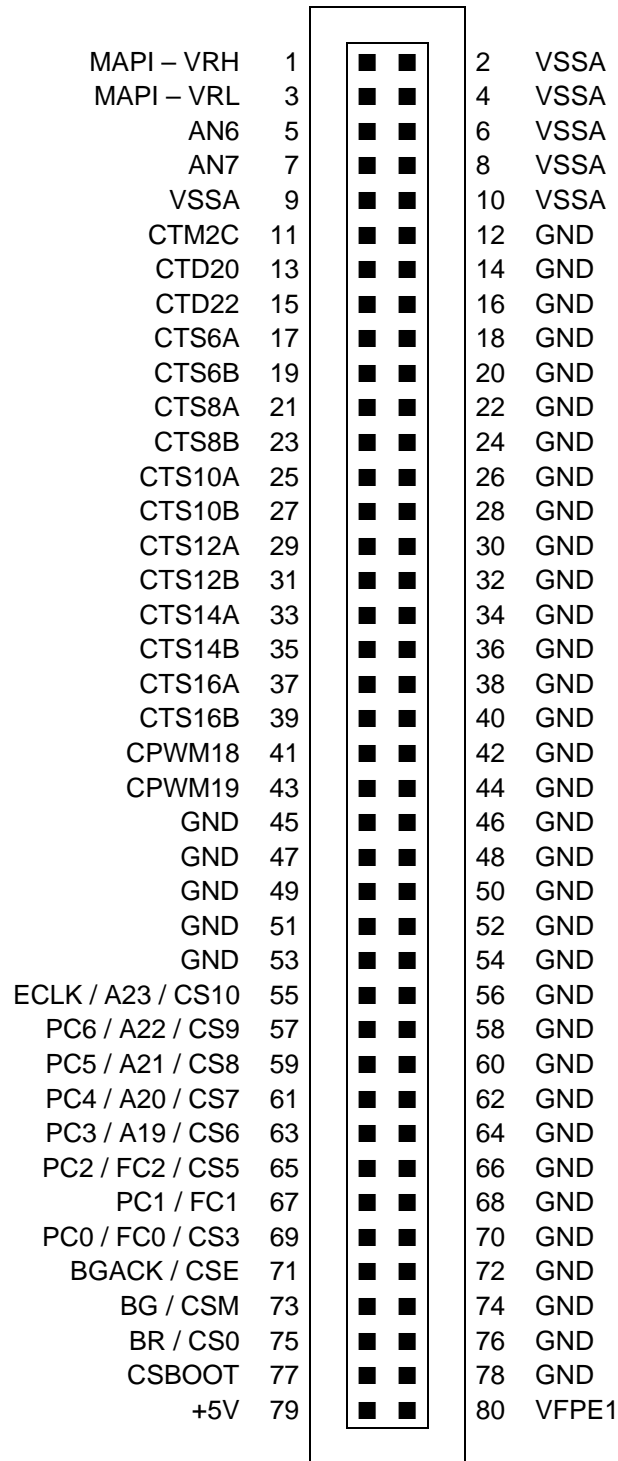
#### 5.2 MAPI BUS CONNECTORS

The connectors required to interface to the MAPI bus are:

- 2 – Robinson Nugent, 2 X30 plugs, P50L-060P-AS-TGF
- 2 – Robinson Nugent, 2 X40 plugs, P50L-080P-AS-TGF

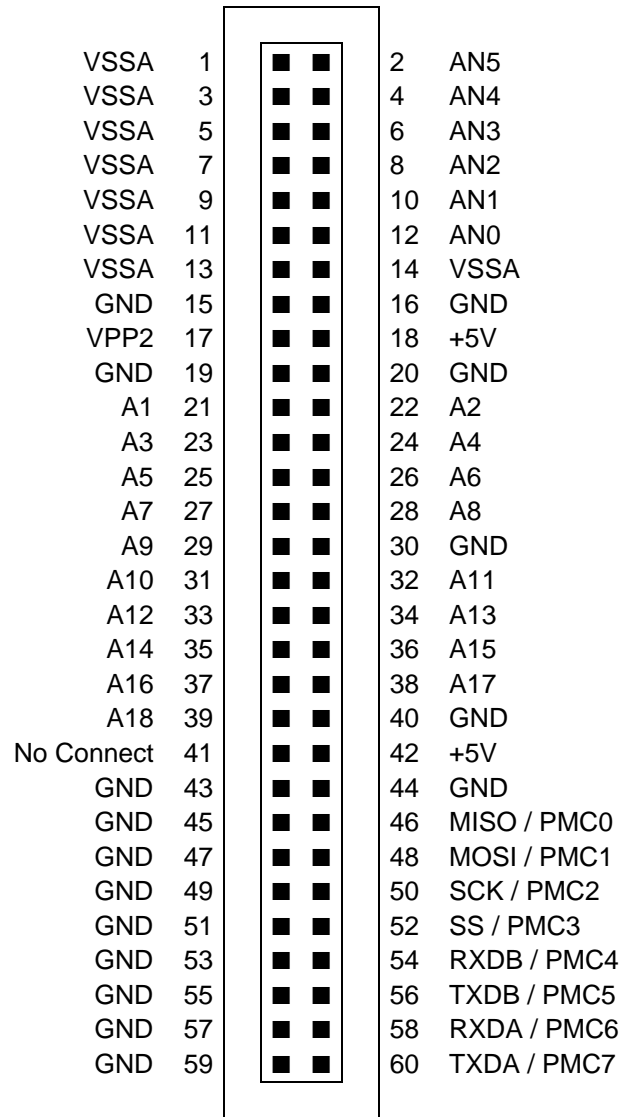


**Figure 5-1. MAPI Interface Connector Layout**



**Figure 5-2. MAPI Interface Connector P1 Pin Assignments**





**Figure 5-3. MAPI Interface Connector P2 Pin Assignments**

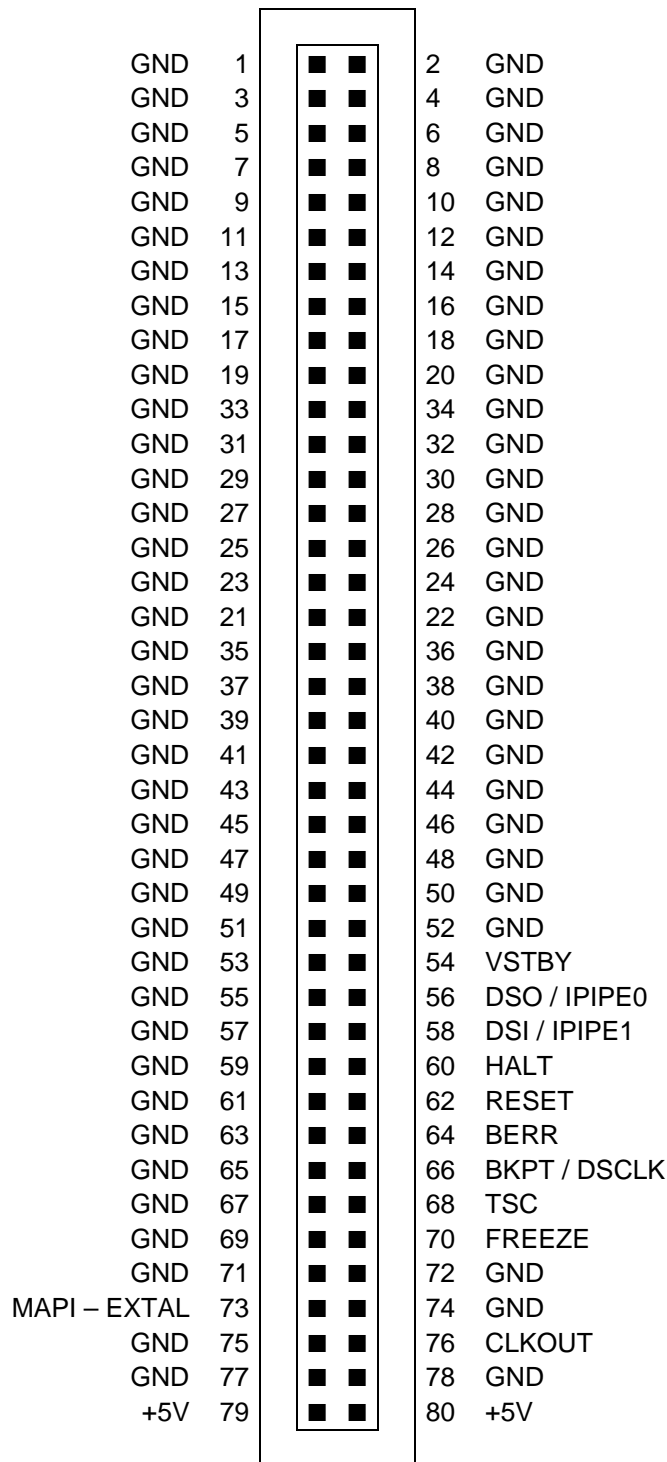
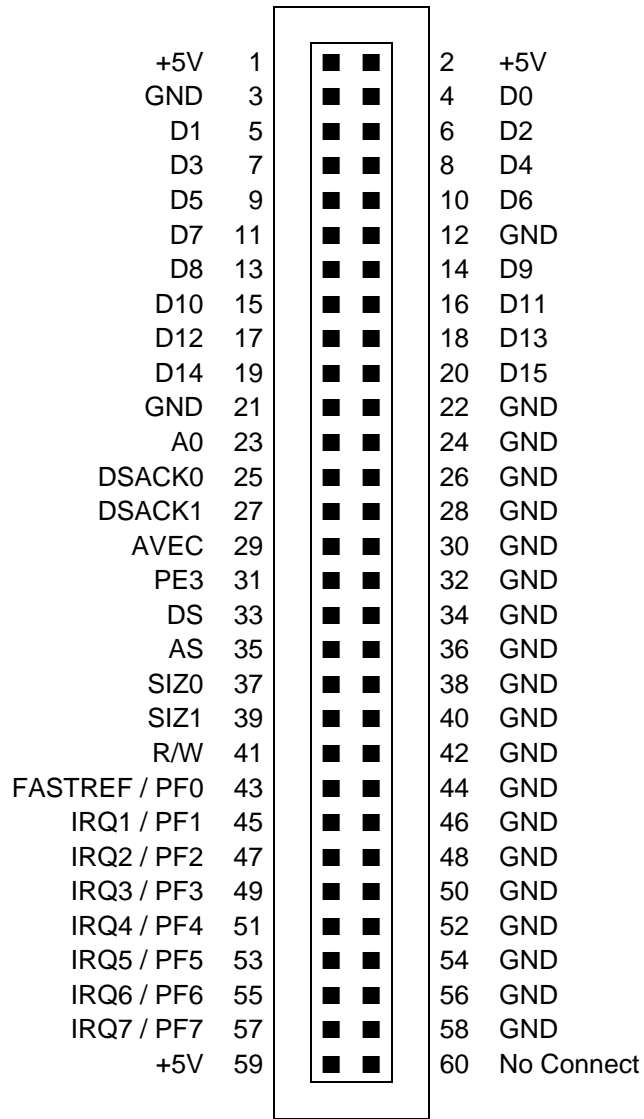


Figure 5-4. MAPI Interface Connector P3 Pin Assignments



**Figure 5-5. MAPI Interface Connector P4 Pin Assignments**



## CHAPTER 6

### SCHEMATIC DIAGRAMS

#### 6.1 INTRODUCTION

This chapter contains the M68MPB916R3 MCU Personality Board (MPB) schematic diagrams. These schematic diagrams are for reference only and may deviate slightly from the circuits on your MPB.

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	O	ORIGINAL RELEASE		

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DRAWN BY: KATSUTOSHI NAGAI  
 DATE: 04/01/97

DESIGN ENGINEER: KATSUTOSHI NAGAI  
 DATE: 04/01/97

PROJECT LEADER:



**MOTOROLA INC.**  
 MICROPROCESSOR AND MEMORY TECHNOLOGIES GROUP  
 6501 WILLIAM CANNON DRIVE WEST AUSTIN, TEXAS 78735 USA

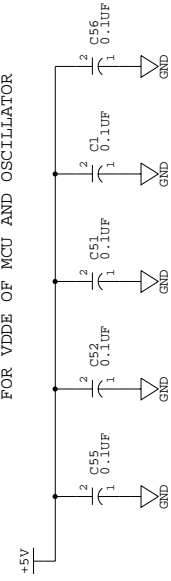
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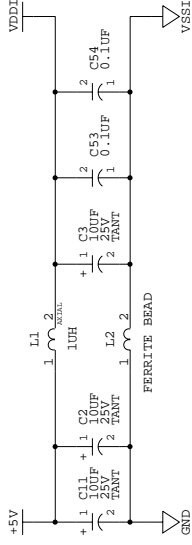


1 2 3 4

**+5V AND GND DECOUPLING  
FOR VDDDE OF MCU AND OSCILLATOR**

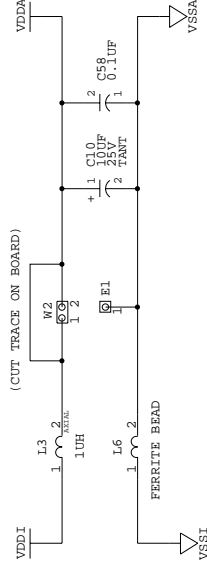


**VDDI/VSSI GENERATION**

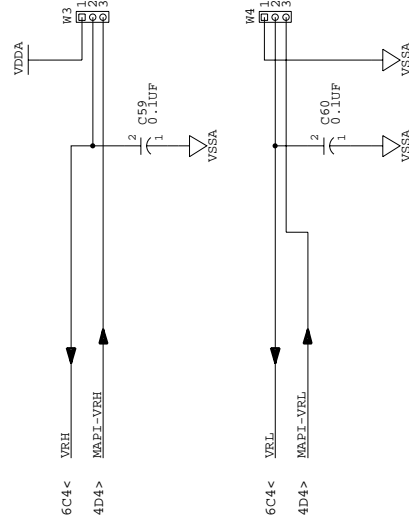


**ADC MODULE**

**VDDA/VSSA GENERATION**

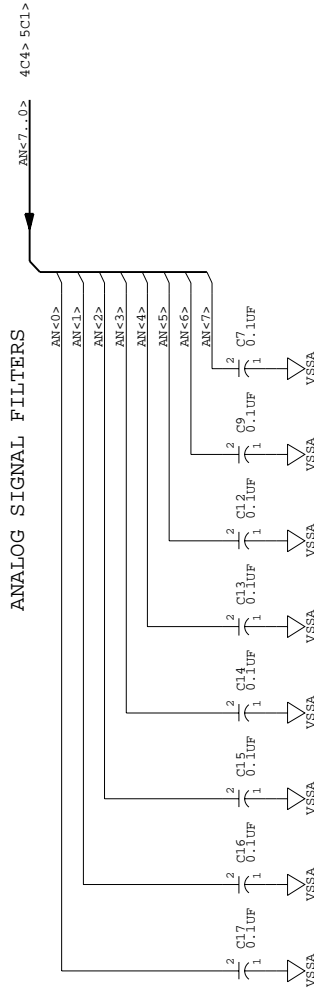


**ADC MODULE  
VRH & VRL SELECTION**



**ADC MODULE**

**ANALOG SIGNAL FILTERS**



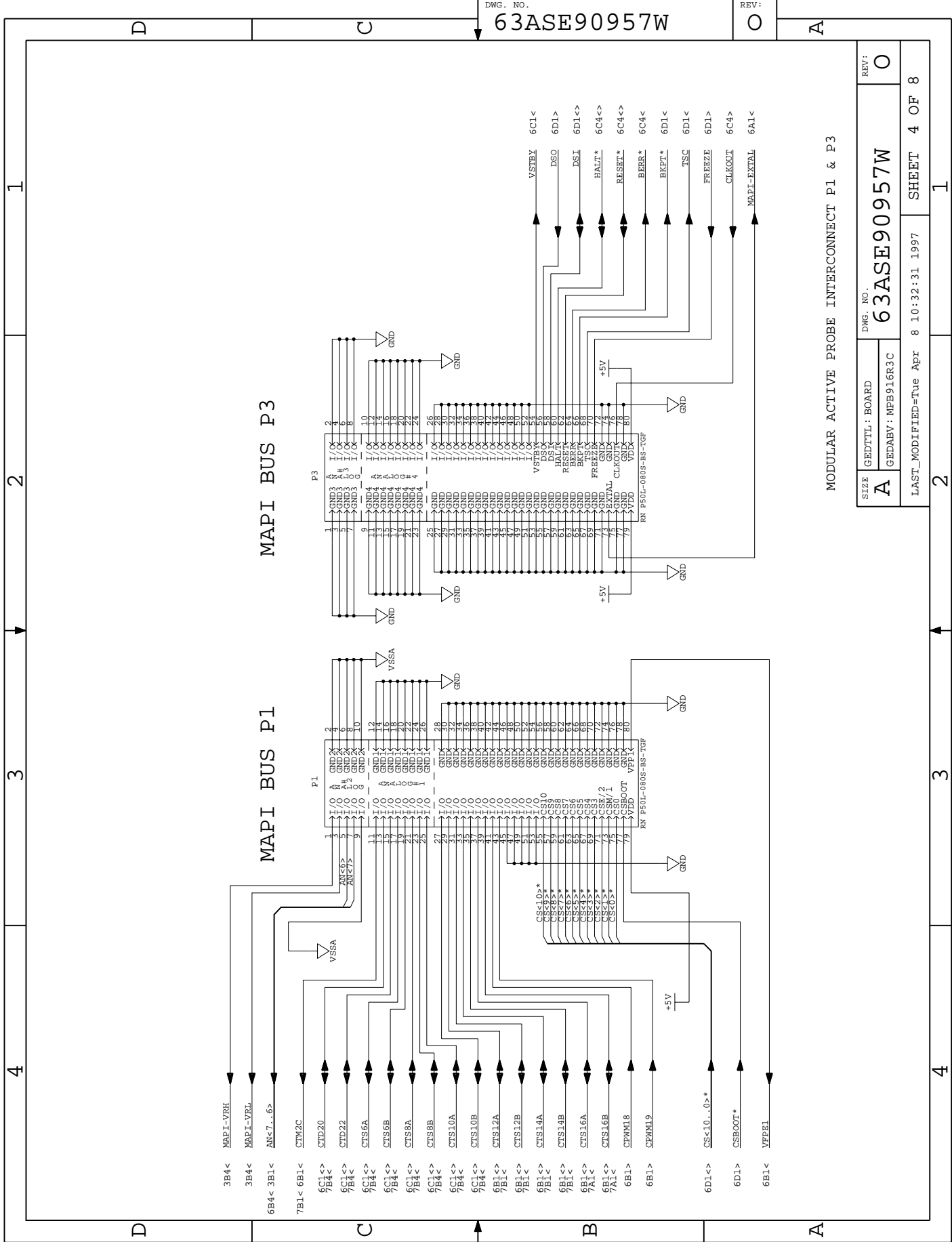
**BYPASS CAPACITORS, CLEAN POWER & SIGNAL FILTERS**

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A	GEDABV: MFB916R3C	63ASE90957W	O
LAST_MODIFIED=Tue Apr 8 10:32:29 1997		SHEET 3 OF 8	

4 3 2 1

D C B A



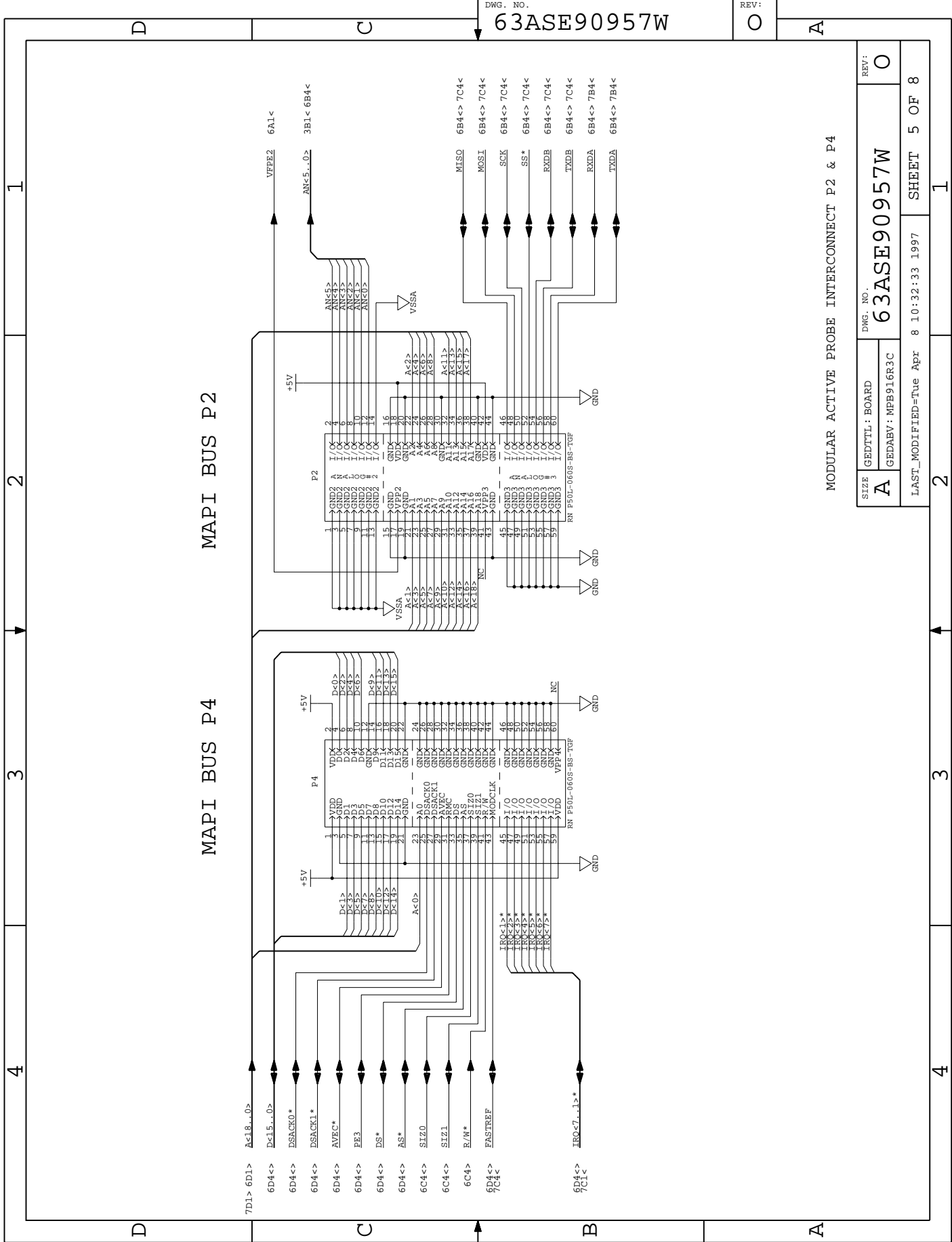


**MAPI BUS P3**

**MAPI BUS P1**

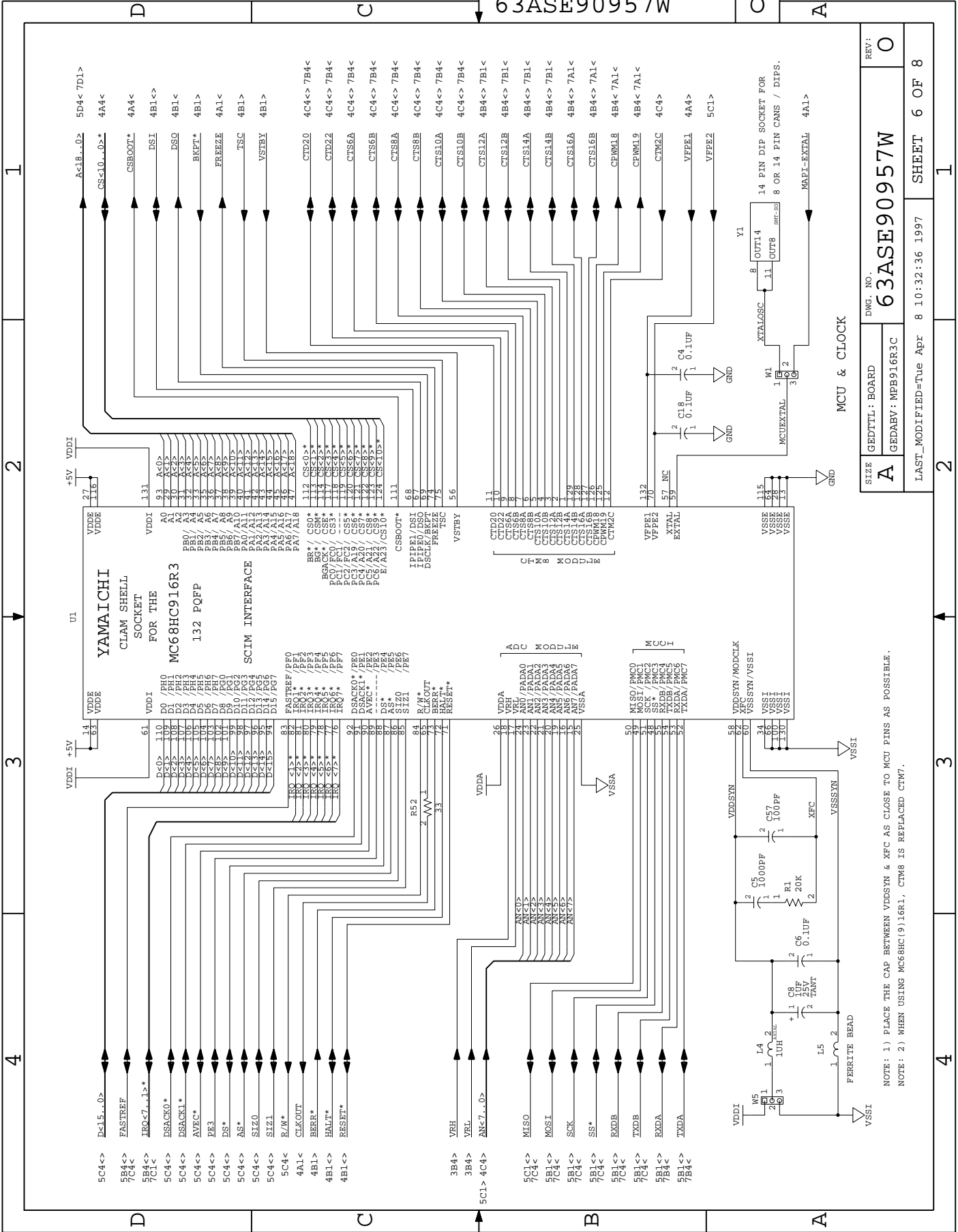
MODULAR ACTIVE PROBE INTERCONNECT P1 & P3

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A	GEDAEV: MFB916R3C	<b>63ASE90957W</b>	O
LAST_MODIFIED=Tue Apr 8 10:32:31 1997		SHEET 4 OF 8	



MODULAR ACTIVE PROBE INTERCONNECT P2 & P4

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LAST_MODIFIED=Tue Apr 8 10:32:33 1997		SHEET 5 OF 8	



SIZE	A	GEDFTL: BOARD	DWG. NO.	63ASE90957W	REV:	O
		GEDABV: MPB016R3C				
LAST_MODIFIED=Tue Apr 8 10:32:36 1997			SHEET 6 OF 8			

NOTE: 1) PLACE THE CAP BETWEEN VDDSYN & XFC AS CLOSE TO MCU PINS AS POSSIBLE.  
 NOTE: 2) WHEN USING MC68HC(9)16R1, CTM8 IS REPLACED CTM7.

1

2

3

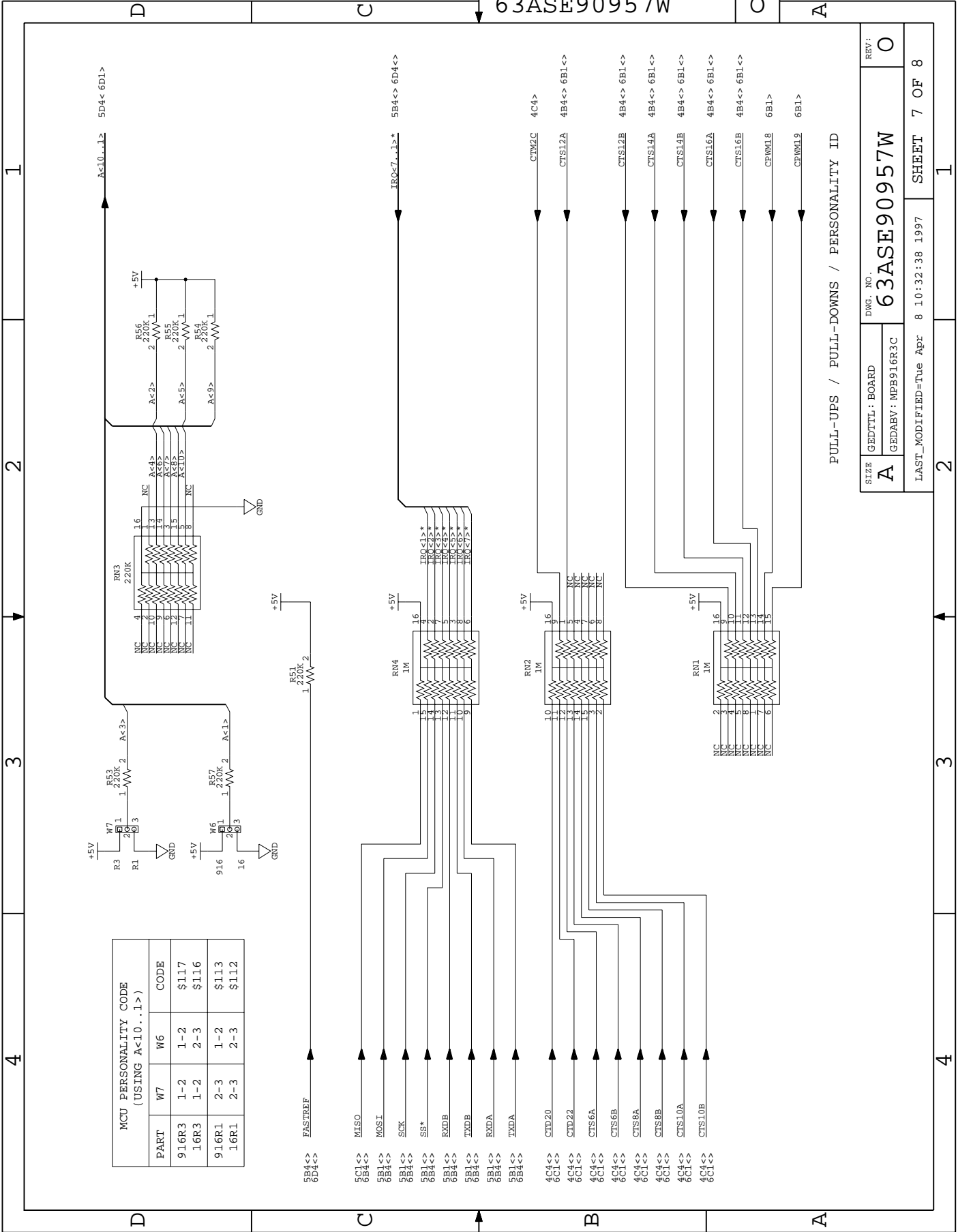
4

1

2

3

4



MCU PERSONALITY CODE (USING A<10...1>)			
PART	W7	W6	CODE
916R3	1-2	1-2	\$117
16R3	1-2	2-3	\$116
916R1	2-3	1-2	\$113
16R1	2-3	2-3	\$112

PULL-UPS / PULL-DOWNS / PERSONALITY ID

SIZE	GEDITTL: BOARD	DWG. NO.	REV:
A	GEDABV: MFB916R3C	<b>63ASE90957W</b>	O
LAST_MODIFIED=Tue Apr 8 10:32:38 1997		SHEET 7 OF 8	

\*\*\* Unit Cross-Reference \*\*\*  
 --- for the entire design ---

C1	BCAP SMT 3D3	
C2	TCAP SMT 25V 10UF 3D2	
C3	TCAP SMT 25V 10UF 3D2	
C4	BCAP SMT 6B2	
C5	BCAP SMT 6A3	
C6	BCAP SMT 6A4	
C7	BCAP SMT 3A1	
C8	TCAP SMT 25V 1UF 6A4	
C9	BCAP SMT 3A2	
C10	TCAP SMT 25V 10UF 3C1	
C11	TCAP SMT 25V 10UF 3D2	
C12	BCAP SMT 3A2	
C13	BCAP SMT 3A2	
C14	BCAP SMT 3A2	
C15	BCAP SMT 3A2	
C16	BCAP SMT 3A3	
C17	BCAP SMT 3A3	
C18	BCAP SMT 6B2	
C51	BCAP SMT 3D4	
C52	BCAP SMT 3D4	
C53	BCAP SMT 3D1	
C54	BCAP SMT 3D1	
C55	BCAP SMT 3D4	
C56	BCAP SMT 3D3	
C57	BCAP SMT 6A3	
C58	BCAP SMT 3C1	
C59	BCAP SMT 3B3	
C60	BCAP SMT 3B3	
E1	HDR101 3C2	
L1	CHOKE 3D2	
L2	FB 3D2	
L3	CHOKE 3C2	
L4	CHOKE 6A4	
L5	FB 6A4	
L6	FB 3C2	
P1	MAP180 4C3	
P2	MAP160 5C2	
P3	MAP180 4C2	
P4	MAP160 5C3	
R1	RESISTOR 1206 6A3	
R51	RESISTOR 1206 7C3	
R52	RESISTOR 1206 6C3	
R53	RESISTOR 1206 7D3	
R54	RESISTOR 1206 7D2	
R55	RESISTOR 1206 7D2	
R56	RESISTOR 1206 7D2	
R57	RESISTOR 1206 7D3	
RN1	RES15COM 7B3	
RN2	RES15COM 7B3	
RN3	RES15COM 7D2	
RN4	RES15COM 7C3	

TXDA  
 TXDB  
 VFPE1  
 VFPE2  
 VRH  
 VRL  
 VSTBY

5B1<> 6B4<> 7B4<  
 5B1<> 6B4<> 7C4<  
 4A4> 6B1<  
 5C1> 6A1<  
 3B4> 6C4<  
 3B4> 6C4<  
 4B1> 6C1<

\*\*\* Signal Cross-Reference \*\*\*  
 --- for the entire design ---

A <18..0>	5D4<> 6D1<> 7D1>
AN <7..0>	3B1<> 4C4> 5C1> 6B4<
AS *	5C4<> 6D4>
AVEC *	5C4<> 6D4>
BERR *	4B1> 6C4<
BEFT *	4B1> 6D1<
CLKOUT	4A1< 6C4>
CPWML8	4B4<> 6B1> 7A1<
CPWML9	4B4<> 6B1> 7A1<
CS <10..0> *	4A4<> 6D1<>
CSBOOT *	4A4<> 6D1>
CTD20	4C4<> 6C1<> 7B4<
CTD22	4C4<> 6C1<> 7B4<
CTM2C	4C4> 6B1< 7B1<
CTS6A	4C4> 6C1<> 7B4<
CTS6B	4C4> 6C1<> 7B4<
CTS8A	4C4> 6C1<> 7B4<
CTS8B	4C4> 6C1<> 7B4<
CTS10A	4C4> 6C1<> 7B4<
CTS10B	4C4> 6C1<> 7B4<
CTS12A	4B4> 6B1< 7B1<
CTS12B	4B4> 6B1< 7B1<
CTS14A	4B4> 6B1< 7B1<
CTS14B	4B4> 6B1< 7B1<
CTS16A	4B4> 6B1< 7A1<
CTS16B	4B4> 6B1< 7A1<
D <15..0>	5C4<> 6D4<>
DS *	5C4<> 6D4<>
DSACK0 *	5C4> 6D4<>
DSACK1 *	5C4> 6D4<>
DSI	4B1<> 6D1<>
DSO	4B1<> 6D1>
FASTREF	5B4> 6D4<> 7C4<
FREEZE	4A1< 6D1>
HALT *	4B1<> 6C4<>
IRQ <7..1> *	5B4> 6D4<> 7C1<
MAP1-EXTAL	4A1> 6A1<
MAP1-VRH	3B4< 4D4>
MAP1-VRL	3B4< 4D4>
MISO	5C1<> 6B4> 7C4<
MOSI	5B1<> 6B4> 7C4<
PE3	5C4> 6D4<>
R/W *	5C4< 6C4>
RESET *	4B1<> 6C4>
RXDA	5B1<> 6B4> 7B4<
RXDB	5B1<> 6B4> 7C4<
SCK	5B1<> 6B4> 7C4<
SI20	5C4> 6C4>
SI21	5C4> 6C4>
SS *	5B1<> 6B4> 7C4<
TSC	4B1> 6D1<

U1 MC68HC916R3 6D3  
 W1 HDR103 6A2  
 W2 HDR102 3C2  
 W3 HDR103 3B3  
 W4 HDR103 3B3  
 W5 HDR103 6A4  
 W6 HDR103 7D3  
 W7 HDR103 7D3  
 Y1 XTALOSC8\_14 6A1

SIGNAL CROSS REFERENCES

SIZE	GEDTTL: BOARD	DWG. NO.	REV:
A	GEDABV: MPB916R3C	63ASE90957W	O
LAST_MODIFIED=Tue Apr 8 10:37:35 1997		SHEET 8 OF 8	

