

TMS470 ARMTDMI Evaluation Module

*Technical
Reference*

TMS470
ARM7TDMI/ARM7TDMIE
Evaluation Module
Technical Reference

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About This Manual

This document describes the board level operations of the TMS470 ARM7TDMI/ARM7TDMIE evaluation module (EVM). The EVM is based on the Texas Instruments version of the Advanced Risc Machines Core Processor.

The TMS470 EVM is a table top card to allow engineers and software developers to evaluate certain characteristics of the TMS470 core processor to determine if the RISC processor meets the designers application requirements. Evaluators can create software to execute onboard or expand the system in a variety of ways.

Notational Conventions

This document uses the following conventions.

The TMS470 and ARM7TDMI/ARM7TDMIE processors are referred to collectively as the TMS470.

Program listings, program examples, and interactive displays are shown in a special italic typeface. Here is a sample program listing.

```
equations  
!rd = XXXXXXXXXXXX;
```

Information About Cautions

This book may contain cautions.

This is an example of a caution statement.

A caution statement describes a situation that could potentially damage your software, or hardware, or other equipment. The information in a caution is provided for your protection. Please read each caution carefully.

Related Documents

Texas Instruments TMS470 Users Guide
Texas Instruments TMS470 Assembly Language Users Guide
Texas Instruments TMS470 C Source Debugger Users Guide
Advanced Risc Machines User Guide

Chapter 1

Introduction to the TMS470 Evaluation Module

This chapter provides you with a description of the TMS470 Evaluation Module along the key features and an outline of the circuit board.

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1.0 Overview of the TMS470EVM

The TMS470 evaluation module (EVM) is a table top card that lets engineers and software designers evaluate certain characteristics of the TMS470 RISC processor to see if the RISC CPU meets the application requirements of their design. You can easily and quickly create software and expand the hardware in a variety of ways to meet almost any prototyping situation.

The TMS470 EVM incorporates the TMS470 ARM7TDMI or ARM7TDMIE core to allow full speed verification of the TMS470 instruction set. The TMS470 is a RISC machine that operates is 32 bit instruction format known as ARM and 16 bit instruction format known as THUMB. The TMS470 will also operate in Big Endian or Little Endian mode. The TMS470 EVM module supports all 4 of these modes of operation and incorporates 512K bytes of Static Ram for on board program development.

To simplify code development and shorten debugging time, a graphical, window oriented debugger is available. Its friendly, windowing, mouse selectable, and menu oriented interface reduces learning time and eliminates the need to memorize complex commands. For more information about the debugger, refer to the Texas Instruments TMS470 C Source Debugger Users Guide.

1.1 Key Features of the TMS470 EVM

The TMS470 EVM has the following features:

- TMS470 Risc Core Operating at 40 MIPs
- 512K Bytes of Zero Wait State Memory
- Single 5Volt supply (on board 3.3 Volt regulator)
- Supports Little Endian or Big Endian Mode
- Supports Thumb and/or ARM Mode
- Parallel I/O Expansion Bus
- On board Standard TI JTAG interface
- Optional Hewlett Packard Hardware Trace Interface Module
- Optional Benchmarking in ARM7TMDIE Core
- ZIF socket for easy CPU insertion

1.2 Functional Overview of the TMS470 EVM

Figure 1-1 shows an outline of the TMS470 ARM EVM. The EVM supports debugging via the onboard JTAG emulation connector with debug environments residing on either a SUN workstation or IBM compatible personal computer running Windows or Windows 95 operating systems.

The TMS470 interfaces to 512K Bytes of zero wait state static memory. An external I/O interface supports parallel I/O ports, or an optional Hewlett Packard 16500B/16555A Logic Analyzer Trace Module. A single 5 Volt supply powers the entire EVM

The onboard JTAG interface provides support for the "C" Source Debugger and the loading and executing of code. There is no onboard boot ROM or direct access into the TMS470 memory. User applications run with emulation tools via the JTAG interface.

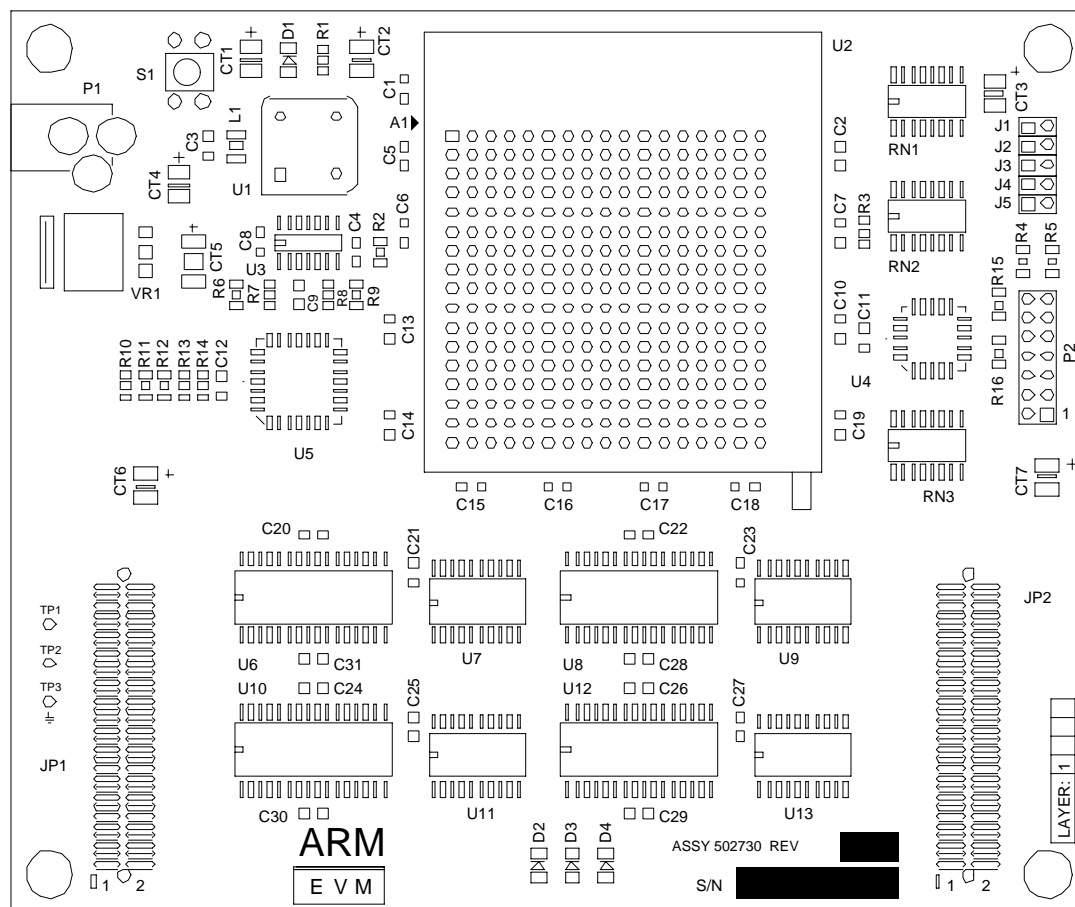


Figure 1-1 TMS470 EVM

Chapter 2

TMS470 EVM

Host Requirements

This chapter describes the host computer requirements for the TMS470 Evaluation Module (EVM).

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2.0 Host Requirements

This chapter outlines the necessary hardware to interface the TMS470 EVM to a host emulation system.

2.1 PC Host Requirements whats needed

This section describes the required and optional hardware you need to install a PC based emulation system.

To install the XDS510PP or XDS510, you will need the following:

- Host, An IBM PC compatible with 386 or Higher CPU running Windows 3.1 or Windows 95 operating system
- Emulator, XDS510PP or XDS510
- Target, TMS470 ARM EVM (This Product)
- XDS510PP, A printer port preferably EPP

To configure your emulation product please refer to the manual that is supplied by the manufacturer.

2.2 Sparc Workstation Host Requirements whats needed

This section describes the required and optional hardware you need to install a Sparc Workstation based emulation system.

To install the XDS510WS on a Sparc Workstation, you will need the following:

- Host, A SPARCstation or 100% compatible workstation
- Host Interface, A SCSI bus controller with on free SCSI identifier
- Emulator, A XDS510WS Emulator controller
- Emulator, The provided external power supply for the XDS510WS Power Supply
- SCSI Cable, A SCSI cable used for connecting the XDS510WS to the Workstation
- SCSI terminator, A SCSI bus terminator if the XDS510WS is the last device on the chain
- Target, TMS470 ARM EVM (This Product)

To configure your emulation product please refer to the manual that is supplied by the manufacturer.

2.3 HP Workstation Host Requirements whats needed

This section describes the required and optional hardware you need to install a HP 9000 Series 700 PA-RISC Workstation based emulation system running HP-UX 9.0x.

To install the XDS510WS on a Sparc Workstation, you will need the following:

- Host, A HP 9000 Series 700 PA-RISC Workstation
- Host Interface, A SCSI bus controller with on free SCSI identifier
- Emulator, A XDS510WS Emulator controller
- Emulator, The provided external power supply for the XDS510WS Power Supply
- SCSI Cable, A SCSI cable used for connecting the XDS510WS to the Workstation
- SCSI terminator, A SCSI bus terminator if the XDS510WS is the last device on the chain
- Target, TMS470 ARM EVM (This Product)

To configure your emulation product please refer to the manual that is supplied by the manufacturer.

Chapter 3

TMS470

EVM Operation

This chapter describes the key components of the TMS470 Evaluation Module (EVM) and how they operate. It also provides additional information on the EVM's various interfaces.

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3.0 Overview

The TMS470 EVM consists of four major block of logic

TMS470 memory interface
TMS470 JTAG to Host interface
TMS470 external I/O interface
TMS470 Power interface

Each interface will be described in greater in the following sections of this chapter.

3.1 TMS470 Memory Interface

The EVM Includes 512K bytes of zero wait state memory. The memory is selected via a GAL20V8 generic array logic device U5. The TMS470 Memory Map is shown in the two tables below.

Table 1: Big Endian Mode

Addresses	Byte Positions			
	BYTE 3	BYTE 2	BYTE 1	BYTE 0
0000 0000H				
0000 0004H				
.				
.				
.				
0003 FFFFH				

Table 2: Little Endian Mode

Addresses	Byte Positions			
	BYTE 0	BYTE 1	BYTE 2	BYTE 3
0000 0000H				
0000 0004H				
.				
.				
.				
0003 FFFFH				

The memory on the TMS470 can be addressed in Big Endian or Little Endian modes. A jumper at location J1 determines the mode of operation. Table 3 describes the addressing of the each mode of operation and the jumper setting to obtain these modes of operation.

Table 3: ARM Addressing Mode

Location	Position	Functional Description
J1	Installed	Little Endian Addressing Mode
J1	Removed	Big Endian Addressing Mode

3.1.1 TMS470 Memory Interface Timing

The TMS470 provides a number of different ways to interface to external memory. On this EVM the simplest interface was provided as an example to the designer using the TMS470 Core. In this design no clock modification is used, the system clock is generated from an oscillator U1. The TMS470 memory controller is operated in a de-pipelined mode to ease interfacing to static ram devices.

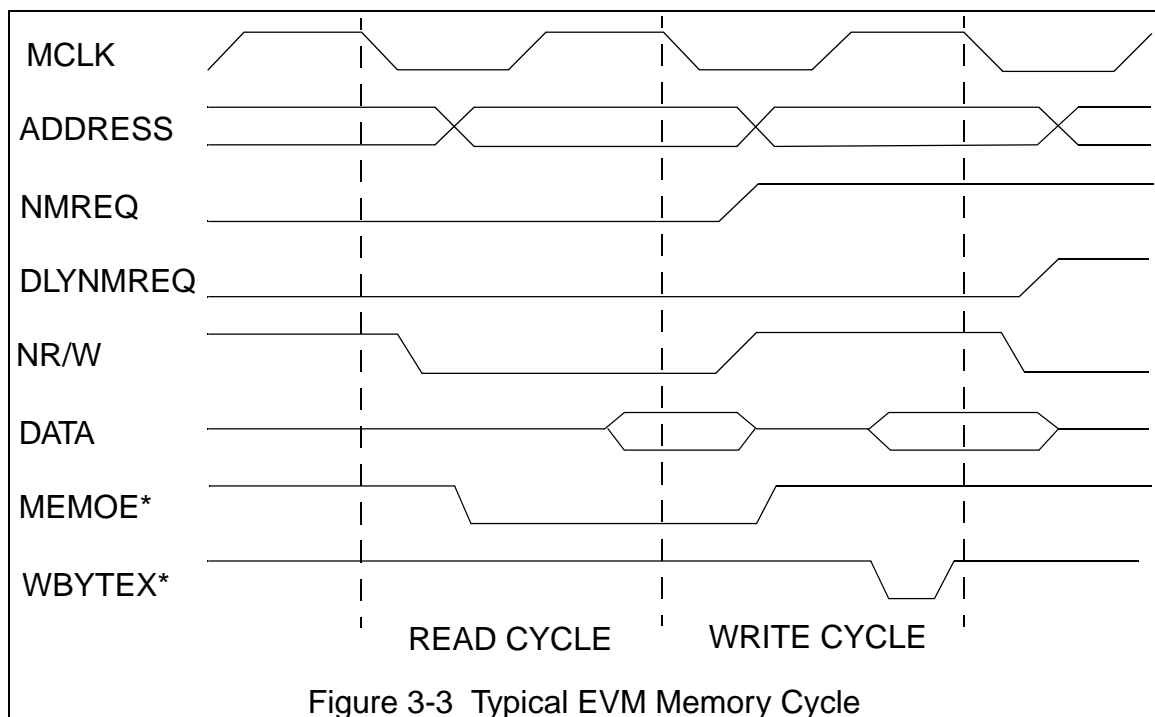


Figure 3-3 Typical EVM Memory Cycle

Figure 3-3 demonstrates the typical memory timing cycle for the TMS470 as configured on this EVM. Note that the NMREQ signal from the TMS470 is output a cycle prior to when it is valid so on the EVM card this signal is delay by GAL U5.

The memory is constantly chip selected and the output enables and write enables control the data transfers. Since the TMS470 operates at 3.3 volts and the memory at 5.0 volts quick switches are used to perform voltage translation.

3.2 TMS470 JTAG Interface

The TMS470 provides an IEEE 1149.1-1990 JTAG interface that provides the debug facilities for the TMS470 EVM. The connector described in Figure 3-3 directly interfaces to Spectrum Digital's XDS510PP or Texas Instruments XDS510 PC and Workstation Emulation Tools.

Figure 3-1 shows a typical user system using a personal computer, a Spectrum Digital XDS510PP, and TMS470 EVM. Note that when Debugging with the XDS510PP no power supply is required for the emulator since it receives power from the TMS470 EVM's Power Detect Pin.

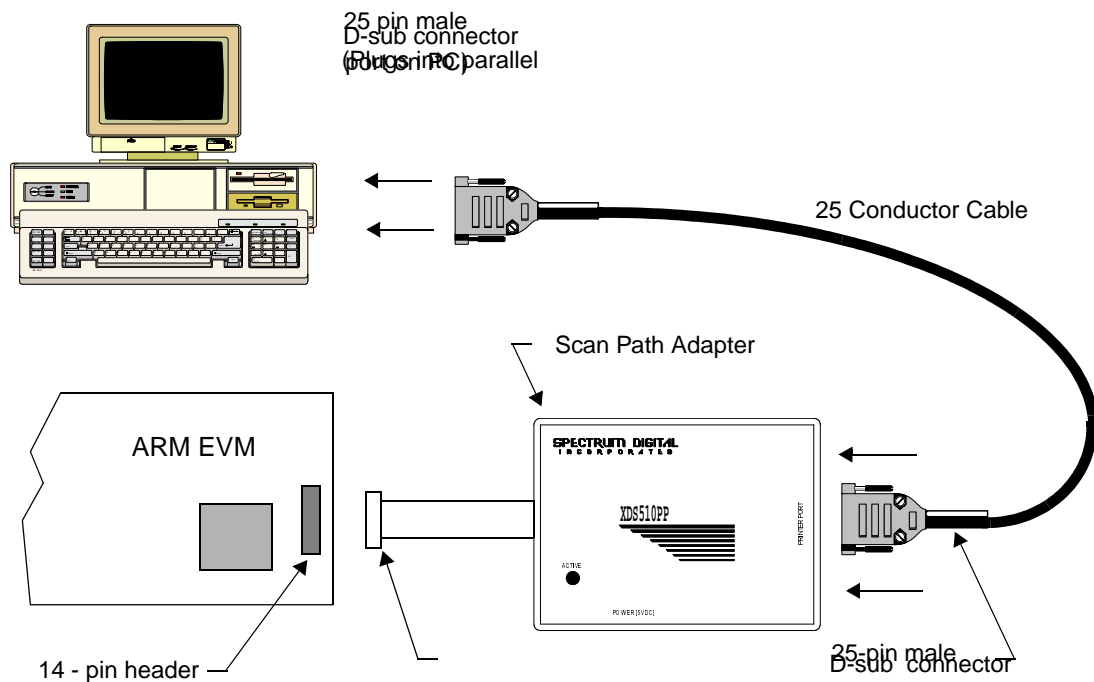


Figure 3-4 Typical Application Setup

3.3 External I/O interface

The TMS470 EVM provides two AMP 60 pin connectors that allow the developer to construct an external I/O interface or to connect the optional HP Logic Analyzer Trace Module. The Signals Provided on the connector are outlined in Table 3-1.

Table 4: Connector Pinouts

Connector JP2				Connector JP1			
Pin #	Signal	Pin #	Signal	Pin #	Signal	Pin #	Signal
1	Ground	2	Ground	1	Ground	2	Ground
3	D9	4	D8	3	A9	4	A8
5	D11	6	D10	5	A11	6	A10
7	D13	8	D12	7	A13	8	A12
9	D15	10	D14	9	A15	10	A14
11	Ground	12	Ground	11	Ground	12	Ground
13	D17	14	D16	13	A6	14	A7
15	D19	16	D18	15	A4	16	A5
17	D21	18	D20	17	A2	18	A3
19	D23	20	D22	19	A0	20	A1
21	Ground	22	Ground	21	Ground	22	Ground
23	D25	24	D24	23	A30	24	A31
25	D27	26	D26	25	A28	26	A29
27	D29	28	D28	27	A26	28	A27
29	D31	30	D30	29	A24	30	A25
31	Ground	32	Ground	31	Ground	32	Ground
33	D1	34	D0	33	A22	34	A23
35	D3	36	D2	35	A20	36	A21
37	D5	38	D4	37	A18	38	A19
39	D7	40	D6	39	A16	40	A17
41	Ground	42	Ground	41	Ground	42	Ground
43	BL1	44	BL0	43	SPARE	44	MAS0
45	BL3	46	BL2	45	NRW	46	MAS1
47	+5 V	48	+5 V	47	+3.3 V	48	+3.3 V
49	EMU0LA	50	EM1LA	49	+3.3 V	50	+3.3 V
51	Ground	52	Ground	51	Ground	52	Ground
53	DBACK	54	TBIT	53	NOPC	54	SEQ
55	BIGEND	56	NWAIT	55	NEXEC	56	DLYNM-REQ
57	MCLK	58	EXT INT	57	ABORT	58	NMREQ
59	Ground	60	Ground	59	Ground	60	Ground

3.4 Power Requirements

Although the TMS470 CPU operates at 3.3 Volts the TMS470 EVM requires only a 5Volt supply. An onboard regulator provides the 3.3 Volts for the CPU and other various glue logic. The power requirements for the TMS470 EVM are shown below:

Table 5: Power Requirements

Module	Supply Voltage	Current
TMS470EVM	+5 Volts +/-10%	250mA
XDS510PP	+5 Volts +/-10%	150mA

The power jack is a male 2.0mm barrel input.

