

Guidelines for Setting Board Jumpers for the IBM 5x86C Microprocessor



Application Note

Authors: Andy Anderson and Doug Massey

Revision Summary: This revision corrects some pin descriptions in the table on page 3.

Caution: In all cases you should consult the table of required settings in the IBM 5x86C BIOS Writer's Guide and the errata notice that applies to your hardware revision level before enabling or disabling any performance related features.

Introduction

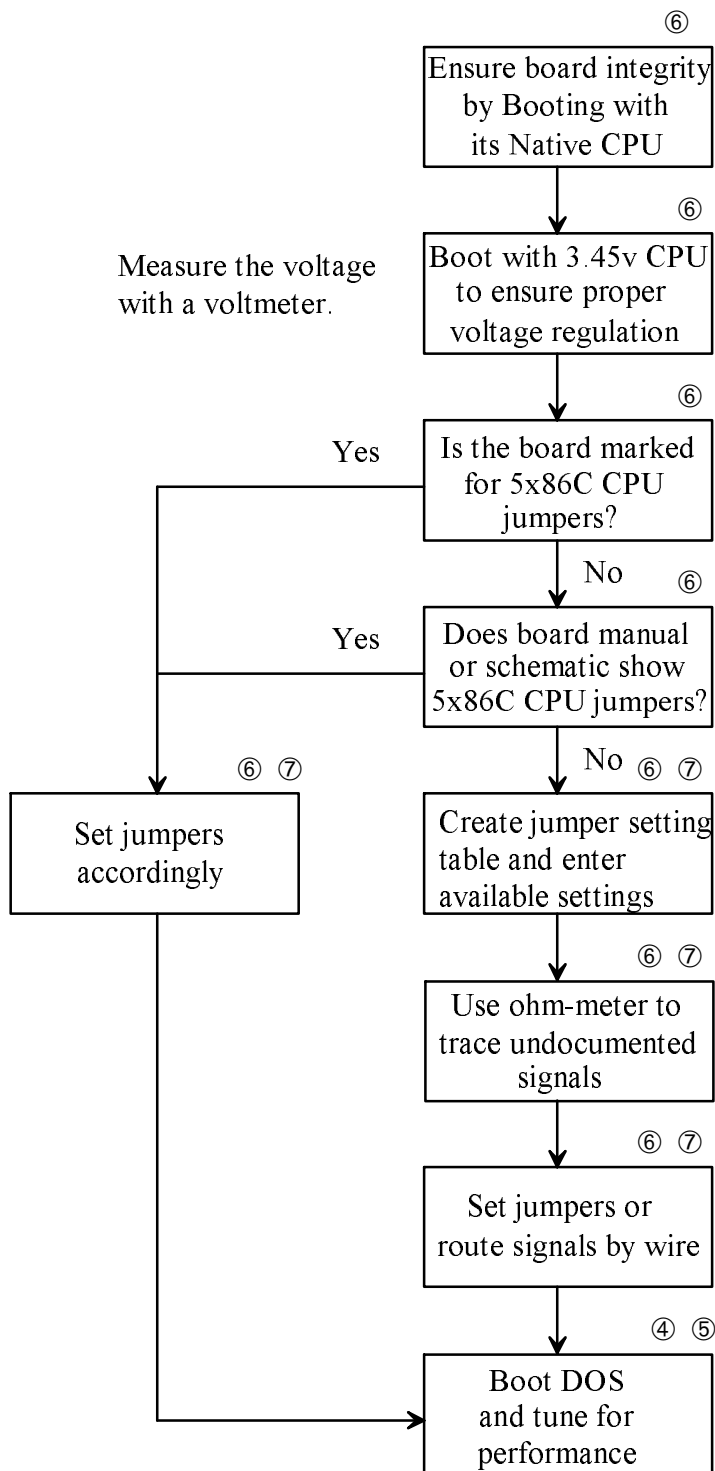
An applications engineer or a system board designer often faces the situation where a customer wants to see how the 5x86C microprocessor performs in his or her system board, even though that board wasn't designed with 5x86C microprocessor in mind. This document will step the engineer through the process needed to get the board booted and running with our microprocessor. It's a good idea to get the materials together that will aid in this process.

The documents in the following list will be referenced by number throughout this paper. The documents marked with the symbol * contain proprietary information. Those that are identified by a fax number may be obtained by:

- dialing the IBM fax service at (415) 855-4121
- on the World Wide Web at <http://w3chips.btv.ibm.com/products/x86/doclist.html>

1. *"IBM 5x86C Microprocessor Databook"*
2. *"Guide for Adapting Intel® DX4 Design for the IBM 5x86C Microprocessor"* Fax #40042
3. *"IBM 5x86C Microprocessor BIOS Writer's Guide"* Fax #40038
4. *"Bring-up and Performance Enhancement of IBM 5x86C Microprocessor -Based Systems Using PUZZLE.EXE"* Fax #40036
5. *"x86 Performance Guidelines, Tuning for Optimal Performance"* *
6. The user's guide and schematic for the system board
7. The databook for the appropriate chipset

The flowchart on the following page outlines the steps for the process.



① These numbers in the flowchart refer to documents listed in the introduction.

Before trying the 5x86C microprocessor, it's a good idea to boot the board with a variety of microprocessors to check out the integrity of the board itself, as well as to determine which types of processors are already compatible with the system board. If possible include these:

- Intel's iDX4™ at 33/100 MHz
- Intel's P24D™ (486 DX2/SLE™) in write-back mode
- IBM's 486 DX2 and 486 DX4, also in write-back mode.

These processors typically run at 3.3 or 3.45 volts. It is important to run at least one CPU at 3.45V to ensure that the system board can regulate the processor voltage to the range required by the 5x86C microprocessor (3.45V +/- 0.15V). The last three processors use signals that will be required for the 5x86C microprocessor to operate in write-back mode. If the board you're working with can boot these three processors, you are well on your way to a working 5x86C microprocessor setup.

NOTE: The IBM 5x86C microprocessor pinout has some differences compared to the pinouts of other microprocessors and these differences must be accounted for before the IBM 5x86C microprocessor will boot correctly in a system board. The 5x86C microprocessor is available in two packages: a 168-pin PGA (Pin Grid Array) package and a 208-pin QFP (Quad Flat Pack) package. In both cases, there are about a dozen pins that may need to be routed to different system board signals.

The board design usually accommodates this type of rewiring through jumpers so that physical redesign isn't needed. The 5x86C microprocessor pinout is essentially a combination of the pinouts of the Intel DX4, the Intel DX2/SLE or P24D, and the IBM 486 DX2 (the IBM 486 DX4 is available in two PGA pinouts, one that is very similar to the Intel DX4 and another that is very similar to the IBM 486 DX2). Twelve signals have different pin locations between these processors.

PGA Pin	5x86C	P24D	iDX4	IBM DX2	AM486DX4
A10	INV	INV	inc	SUSPA#	<i>INV</i>
A12	HITM#	HITM#	inc	SMI#	<i>HITM#</i>
B12	CACHE#	CACHE#	inc	nc	inc
S4	VOLDET	nc	VOLDET	INVAL	VOLDET
R17	CLKMUL	inc	CLKMUL	HITM#	<i>CLKMUL</i>
B10	SMI#	SMI#	SMI#	PEREQ	<i>SMI#</i>
C12	SMADS#	SMIACT#	SMIACT#	RPLSET0	<i>SMIACT#</i>
C10	WM_RESET	SRESET	SRESET	SMADS#	<i>SRESET</i>
G15	SUSP#	STPCLK#	STPCLK#	SUSP#	<i>STPCLK#</i>
A13	SUSPA#	inc	inc	RPLSET1	inc
B13	nc	WB/WT#	inc	WM_RESET	<i>WB/WT#</i>
J1	nc	Vcc	VCC5	Vcc	inc

"inc" means Internal No Connect, which means that the pin on the package is not physically connected to the microprocessor inside the package. This means that anything can be hooked up to an "inc" pin and still not affect processor functionality. "nc" means No Connect, which tells the system designer not to hook Vcc, GND, or any signal up to this pin. Doing so may compromise processor functionality.

Notice that the first three pins are identical to the P24D, the next two are the same as the iDX4, the next five are some combination of three processors, and the last two are "No connects" for the 5x86C microprocessor.

Here is a similar table for the QFP package.

QFP Pin	5x86C	P24D	iDX4	IBM DX2
71	INV	INV	inc	SUSPA#
63	HITM#	HITM#	inc	RPLSET0
70	CACHE#	CACHE#	inc	RPLVAL#
11	CLKMUL	inc	CLKMUL	nc
65	SMI#	SMI#	SMI#	SMI#
59	SMADS#	SMIACT#	SMIACT#	SMADS#
58	WM_RESET	SRESET	SRESET	WM_RESET
73	SUSP#	STPCLK#	STPCLK#	SUSP#
67	SUSPA#	nc	nc	INVAL
96	nc	nc	nc	HITM#
3	nc	Vcc	VCC5	nc

Notice that the QFP doesn't have a VOLDET pin (since the package is only available for 3V parts). Also, some of the IBM 486 DX2 signals have been moved with respect to the other processors.

The best way to modify the board for a 5x86C microprocessor is to determine which jumpers control which pins, then determine how to set the jumpers to route the correct chipset signals to these pins. This information is not always readily available. The board's user's manual will have jumper settings for the processors it supports.

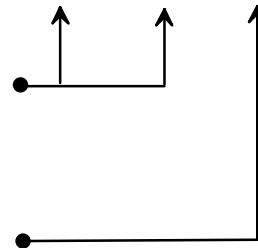
On the next page is a worksheet that can be used to determine the jumper settings for the IBM 5x86C processor. Create a list of jumpers that are available, and fill in a column of settings for each processor -- one column for iDX4, one for P24D, etc. Leave a blank column for the 5x86C microprocessor, and fill it in the jumper settings based on the information available.

Sample Jumper Settings Worksheet

Jumper	Description of Jumper	iDX4	P24D	5x86C
JP1	FERR# selection	3-4	3-4	3-4
JP2	C12: SMI \overline{ACT} # or SMI \overline{ADS} #	2-3	2-3	2-3
JP3	S4: VOLDET or \overline{INVAL}	1-2	open	1-2
JP4	B15: NMI or nc	1-2	1-2	1-2
JP5	A15: \overline{IGNNE} or NMI			
JP6	C10: WM_ \overline{RST} or SMADS	3-4	3-4	3-4
JP7	INV: A10 or S4	open	1-2	1-2
JP8	cache for JP11: PCD or CACHE	open	2-3	2-3
JP9	B13: WM_ \overline{RST} or nc	1-2	1-2	1-2
JP10	A10: INV or nc	1-2	2-3	2-3
JP11	B12: cache or nc	1-2	2-3	2-3
JP12	A12: HITM or SMI	open	2-3	2-3
JP13	Use regulator?	closed	closed	closed
JP14	Use regulator?	closed	closed	closed
JP15	1/2 clk input?	1-2	1-2	1-2
JP16	G15: STPCLK or CPURDY	2-3	2-3	2-3
JP17	R17: CLKMUL or nc	closed	open	closed

Settings for iDX4 and P24D will typically be found in the board user's manual or silk-screened on the system board.

Settings for the 5x86C are filled in by the FAE and are generally going to be some combination of the other two.



This example is fictitious and shouldn't be studied in great detail. It is provided only as an example of what your notes should look like as you try to determine which jumpers to use for the 5x86C microprocessor. Some user's manuals will describe exactly what each jumper is doing and how each peg of the jumper is connected to the CPU and chipset. For some system boards, the information will be printed right on the silkscreen. If this information isn't provided, check the schematic of the system board, which will show how the pegs of the jumpers are connected to the CPU and chipset. If, for some reason, it is impossible to get the schematic, you can use an ohmmeter to find the short-circuits between the jumper pegs and the CPU socket and the chipset pins. This is laborious, but with the aid of the CPU pin descriptions given above and a chipset signal databook, the same information can be derived.

From there it's a matter of contriving jumper settings that will connect the pins on the CPU socket to the correct chipset signals. Some of the jumper settings may carry over from P24D and iDX4, some may have to be connected by a wire, if the jumpers aren't physically located near each other. With these pins correctly jumpered and the voltage verified at 3.45V, the system should boot DOS.

Booting DOS doesn't necessarily mean that you have everything jumpered correctly, and a mistake somewhere may cause software problems later. Nevertheless, it is a good sign. If this is successful, processor optimization can begin, starting with the Application Note:

"Bring-up and Performance Enhancement of IBM 5x86C Microprocessor -Based Systems Using PUZZLE.EXE"

If the system doesn't boot, check all your peripherals for solid connection and recheck your jumper settings. This is not a trivial change to the board and mistakes are easy to make. If the board boots to BIOS but hangs, crashes or reboots before reaching DOS, try entering the BIOS and disabling features of the system such as Power Management, L1 and L2 cache operation, and Suspend Mode. The more simple the boot sequence is, the better the chances for success. Afterwards, the features can be added back in one at a time to determine which feature was causing the problem.

If the system refuses to work with 5x86C microprocessor, users should contact their FAE for assistance. FAEs and other IBM personnel should contact the Applications Engineering group at IBM Burlington. In some cases it may be necessary to ship the system to our lab in Burlington for analysis of the problem.

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