Getting Started with the
IBM 5x86C Microprocessor

IBM ®

Application Note

> Revision Summary: This is the initial release of the Application Note.

> **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

This application note is addressed to system and system board designers as well as to Field Application Engineers (FAEs) and any one responsible for bringing up and optimizing a personal computer system based on the IBM 5x86C microprocessor. This note is intended to provide you with an overview of the steps involved and to point you to the documents that contain the detailed information for each.
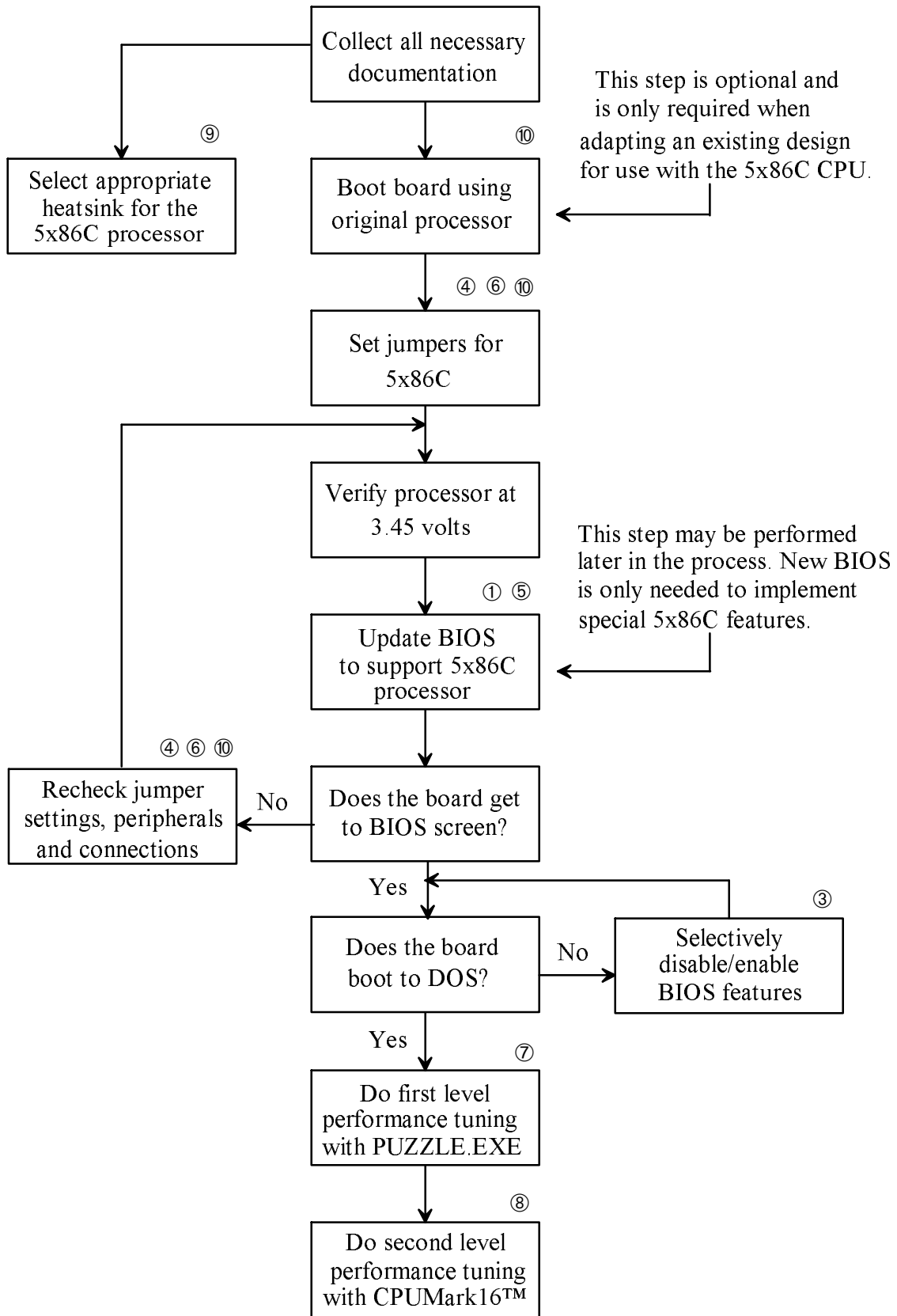
In any system, the overall performance is determined by the configuration of the BIOS, the chipset, the processor and surrounding hardware. In order to achieve high performance, it is important to optimize each of these. Even before optimizing performance, though, it is sometimes necessary to make modifications to the board and the BIOS in order to simply get the system to boot correctly. This application note will step you through the initial system bringup and optimization.

Overview

A number of existing 486 board designs can be adapted for 5x86C microprocessor use. These boards often support multiple 486 microprocessor types such as the Intel® 486DX2 and 486DX4, the IBM 486 DX2 and DX4, the Cyrix® 486 DX2 and DX4 and the AMD® 486DX4. The board documentation will indicate the CPUs already supported.

For a board being adapted from a 486 design, begin by booting with a supported processor to ensure that the board itself functions correctly. Next, replace the original processor and set the jumpers for a 5x86C processor. These settings should be readily available for a board designed for the 5x86C processor, but may require some ingenuity in the case of an adapted design. The flowchart that follows contains pointers to documents that will be helpful in this and other steps.

For all designs the remainder of the process is the same. Verify that the processor works at 3.45 volts and that you can boot to the BIOS screen. If you can't, recheck the jumper settings, all peripherals and all connections. After making the appropriate BIOS settings, continue booting

```
                    ┌──────────────────┐
                    │ Collect all      │
                    │ necessary        │
                    │ documentation    │
                    └──────────────────┘
                                │
                                ▼
        ⑨                      ⑩                    This step is optional and
 ┌──────────────────┐   ┌──────────────────┐        is only required when
 │ Select           │   │ Boot board using │◄──     adapting an existing design
 │ appropriate      │   │ original         │        for use with the 5x86C CPU.
 │ heatsink for the │   │ processor        │
 │ 5x86C processor  │   └──────────────────┘
 └──────────────────┘            │
                         ④ ⑥ ⑩
                                ▼
                         ┌──────────────────┐
                         │ Set jumpers for  │
                         │ 5x86C            │
                         └──────────────────┘
                                │
                                ▼
                         ┌──────────────────┐
                         │ Verify processor │
                         │ at 3.45 volts    │   This step may be performed
                         └──────────────────┘   later in the process. New BIOS
                                │               is only needed to implement
                         ① ⑤                    special 5x86C features.
                                ▼
                         ┌──────────────────┐
                         │ Update BIOS      │◄──
                         │ to support 5x86C │
                         │ processor        │
                         └──────────────────┘
                                │
  ④ ⑥ ⑩                        ▼
 ┌──────────────────┐   ┌──────────────────┐
 │ Recheck jumper   │   │ Does the board   │
 │ settings,        │◄──│ get to BIOS      │
 │ peripherals      │ No│ screen?          │
 │ and connections  │   └──────────────────┘
 └──────────────────┘            │ Yes
                                ▼
                         ┌──────────────────┐       ③
                         │ Does the board   │ No ┌──────────────────┐
                         │ boot to DOS?     │───►│ Selectively      │
                         └──────────────────┘    │ disable/enable   │
                                │ Yes            │ BIOS features    │
                         ⑦                       └──────────────────┘
                                ▼
                         ┌──────────────────┐
                         │ Do first level   │
                         │ performance      │
                         │ tuning with      │
                         │ PUZZLE.EXE       │
                         └──────────────────┘
                                │
                         ⑧
                                ▼
                         ┌──────────────────┐
                         │ Do second level  │
                         │ performance      │
                         │ tuning with      │
                         │ CPUMark16™       │
                         └──────────────────┘
```

Circled numbers in the flowchart indicate documents listed under "References."

to DOS.

If you cannot get to DOS, selectively disable BIOS settings until you can boot DOS. Once DOS is functioning, you can proceed with performance tuning and enhancement using PUZZLE.EXE and other, more sophisticated benchmark programs.

If, at any point, you are unable to proceed in this process, contact your FAE for further assistance. In some cases it may be necessary to return the board to IBM Microelectronics for detailed analysis and debugging.

Other Considerations

Most boards will need a BIOS update to take full advantage of the 5x86C processor's functions and performance capabilities. A guide to sources for these updates is provided in reference 2 below and the procedure for obtaining the update is given in reference 1.

Many applications will also require a heatsink. Reference 9 outlines the procedure for determining if your application is one of them and lists some possible sources.

References

The documents in the following list are referenced by number in the flowchart on the preceding page. The documents marked with the symbol * contain proprietary information and are available to IBM personnel only. 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/x86doclist.html.

1. *"Procuring BIOS Updates"* Fax #40040
2. Solution Pak for the IBM 5x86C Microprocessor Fax #40037
3. Errata for the revision level 5x86C processor you are using
4. *"Guide for Adapting Intel® DX4 Design for the IBM 5x86C Microprocessor"* Fax #40042
5. *"IBM 5x86C Microprocessor BIOS Writer's Guide"* Fax #40038
6. *"Guidelines for Setting Board Jumpers for the IBM 5x86C Microprocessor"* Fax #40041
7. *"Bring-up and Performance Enhancement of IBM 5x86C Microprocessor-Based Systems Using PUZZLE.EXE"* Fax #40036
8. *"x86 Performance Guidelines, Tuning for Optimal Performance"* *
9. *"Selecting an Appropriate Heatsink for the IBM 5x86C Microprocessor"* Fax #40039
10. The user's guide and schematic for the system board
11. *"IBM 5x86C Microprocessor Databook"*