

Project *A2* IP *XXX*
Hardware Design Document

Provide by: _____

Provide Date: _____

Approval by: _____

Approval Date: _____

Revision History

| Version | Release Date | Owner | Description |
|-------------|-----------------|---------------|------------------------|
| <i>V0.1</i> | <i>2023/7/6</i> | <i>Yi Ren</i> | <i>Initial Version</i> |
| | | | |
| | | | |

Attention: The blue italics are template comments, please remove all of them before releasing the document!

注意：蓝色斜体字部分是模版注释内容，请在正式发布的版本中将他们全部移除！

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1 Introduction

Please provide brief and high-level description here for the IP or SYS. For example, design background and basic IP functions.

2 Feature List

Please list all main features of IP or Sub System here.

FL-001: XXX.

FL-002: XXX.

3 Functional Description

Please provide detailed function description and architecture diagram in this chapter.

3.1 Architecture

如图 3.1 所示。

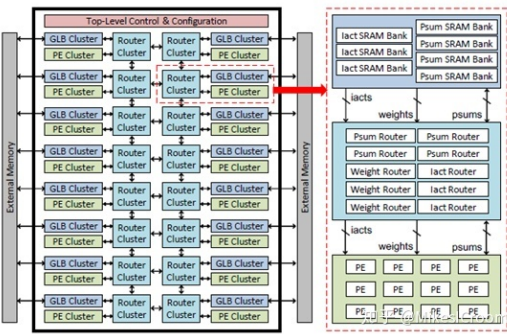


图 3.1: Architecture Diagram

3.2 Design Description

3.3 High Level Timing Diagram

Please provide the high level I/O timing diagram for the whole IP or SYS.

3.4 Clock and Reset

Please provide required clock and reset information in this chapter.

3.4.1 Clock

| Clock Group | Clock Name | Frequency | Duty Cycle | Accuracy |
|-------------|------------|-----------|------------|----------|
| group 1 | clk a | 500MHz | 45%~55% | 100ppm |
| group 2 | clk b | 1GHz | 45%~55% | 100ppm |
| | | | | |

表 3.1: Clock Requirements

3.4.2 Reset

3.5 I/O Interfaces

Please give the fully I/O interfaces in the interface table, the interfaces can be divided into different groups such as:

- *Clock*
- *Reset*
- *Bus interfaces*

3.6 Interrupt

Please list all interrupts detailed information in below table:

3.7 Address Mapping

4 Block Description

The IP or SYS could be divided into several sub modules, please provide detailed design information for each sub block in this chapter.

4.1 Sub Block 1

4.1.1 Block 1 Diagram

4.1.2 Block 1 Design Description

4.1.3 Block 1 FSM

Please draw block 1 FSM diagram if necessary.

4.1.4 Block 1 Timing Diagram

Please draw necessary block 1 timing diagrams here and give the description.

4.2 Sub Block 2

4.2.1 Block 2 Diagram

4.2.2 Block 2 Design Description

4.2.3 Block 2 FSM

Please draw block 2 FSM diagram if necessary.

4.2.4 Block 2 Timing Diagram

Please draw necessary block 2 timing diagrams here and give the description.

5 Use cases

Please draw all necessary data path flow for typical scenarios, and the necessary description was required.

5.1 Scenario 1

5.2 Scenario 2

6 Configuration

6.1 Parameter

6.2 Macro

6.3 Memory

7 PPA Information

7.1 Power

Please give the description regarding the whole low power design methodology in this chapter, and list all of power domain related information in below sheets.

7.2 Performance

Please give the peak performance information in this section.

For example:

- *Max Frequency*
- *Max Bandwidth*
- *Max Outstanding Numbe*

Please list the performance requirement to achieve the basic function.

For example:

- *Latency*
- *Bandwidth*

7.3 Area

Logic 和 mem 区分开，加个表，包括各个 VT cell 比例

Please list the area and vt cell information in below tables, the synthesis configurations should be announced.

8 Implementation Constraints

Please list all design constraints if have:

For example:

- *Multicycle*
- *False path*
- *Logical exclusive*
- *Etc*

9 P&R Guildlines

10 Verification

11 Appendix

12 Body

China is in East Asia.

12.1 Hello Beijing

Beijing is the capital of China.

12.1.1 Hello Dongcheng District

Tian'anmen Square is in the center of Beijing

Chairman Mao is in the center of Tian'anmen Square

12.2 Hello Guangzhou

Sun Yat-sen University is the best university in Guangzhou

12.3 My test

Beijing is the capital of
China.

Washington is the capital of America.

Washington is the capital of America.

13 Math

13.1 数学

13.1.1 特殊字符

#,\$,%,&,{,},_,^,~
<,>|,\

13.1.2 数字和单位

- 12 345.678 90
- 0.3×10^{45}
- kg m s^{-1}
- $\mu\text{m } \mu\text{m}$
- $\Omega \Omega$
- 10 and 20
- 10, 20 and 30
- 0.13 mm, 0.67 mm and 0.80 mm
- 10 to 20
- 10°C to 20°C

13.2 数学符号和公式

$$f(x) = x^2 + 1 \tag{1}$$

$$\frac{2h}{\pi} \int_0^\infty \frac{\sin(\omega\delta)}{\omega} \cos(\omega x) \, \mathrm{d}\omega = \begin{cases} h, & |x| < \delta, \\ \frac{h}{2}, & x = \pm\delta, \\ 0, & |x| > \delta. \end{cases} \tag{2}$$

$$y = \begin{cases} -x, & x \leq 0 \\ x, & x > 0 \end{cases} \tag{3}$$

14 Table

14.1 表格

表格的编排建议采用国际通行的三线表¹。三线表可以使用 booktabs 提供的 \toprule、\midrule 和 \bottomrule。它们与 longtable 能很好的配合使用。

表 14.1: 一个颇为标准的三线表²

| Item | | |
|-----------|-------------|------------|
| Animal | Description | Price (\$) |
| Gnat | per gram | 13.65 |
| | each | 0.01 |
| Gnu | stuffed | 92.50 |
| Emu | stuffed | 33.33 |
| Armadillo | frozen | 8.99 |

14.1.1 复杂表格

我们经常会在表格下方标注数据来源，或者对表格里面的条目进行解释。可以用 three-parttable 实现带有脚注的表格，如表 14.2。

表 14.2: A Table with footnotes

| total | 20 ^a | | 40 | | 60 | |
|-------|-----------------|-----------------------|--------|--------|--------|--------|
| | www | k | www | k | www | k |
| | 4.22 | 120.0140 ^b | 333.15 | 0.0411 | 444.99 | 0.1387 |
| | 168.6123 | 10.86 | 255.37 | 0.0353 | 376.14 | 0.1058 |
| | 6.761 | 0.007 | 235.37 | 0.0267 | 348.66 | 0.1010 |

^a the first note.

^b the second note.

如某个表需要转页接排，可以用 longtable 实现。接排时表题省略，表头应重复书写，并在右上方写“续表 xx”，如表 14.3。

表 14.3: Experimental data

| 测试程序 | 正常运行 时间 (s) | 同步 时间 (s) | 检查点 时间 (s) | 卷回恢复 时间 (s) | 进程迁移 时间 (s) | 检查点 文件 (KB) |
|--------|----------------|--------------|---------------|----------------|----------------|----------------|
| CG.A.2 | 23.05 | 0.002 | 0.116 | 0.035 | 0.589 | 32491 |
| CG.A.4 | 15.06 | 0.003 | 0.067 | 0.021 | 0.351 | 18211 |
| CG.A.8 | 13.38 | 0.004 | 0.072 | 0.023 | 0.210 | 9890 |
| CG.B.2 | 867.45 | 0.002 | 0.864 | 0.232 | 3.256 | 228562 |
| CG.B.4 | 501.61 | 0.003 | 0.438 | 0.136 | 2.075 | 123862 |
| CG.B.8 | 384.65 | 0.004 | 0.457 | 0.108 | 1.235 | 63777 |

续下页

¹ 三线表，以其形式简洁、功能分明、阅读方便而在科技论文中被推荐使用。三线表通常只有 3 条线，即顶线、底线和栏目线，没有竖线。

续表 14.3

| 测试程序 | 正常运行 时间 (s) | 同步 时间 (s) | 检查点 时间 (s) | 卷回恢复 时间 (s) | 进程迁移 时间 (s) | 检查点 文件 (KB) |
|---------------------|----------------|--------------|---------------|----------------|----------------|----------------|
| MG.A.2 | 112.27 | 0.002 | 0.846 | 0.237 | 3.930 | 236473 |
| MG.A.4 | 59.84 | 0.003 | 0.442 | 0.128 | 2.070 | 123875 |
| MG.A.8 | 31.38 | 0.003 | 0.476 | 0.114 | 1.041 | 60627 |
| MG.B.2 | 526.28 | 0.002 | 0.821 | 0.238 | 4.176 | 236635 |
| MG.B.4 | 280.11 | 0.003 | 0.432 | 0.130 | 1.706 | 123793 |
| MG.B.8 | 148.29 | 0.003 | 0.442 | 0.116 | 0.893 | 60600 |
| LU.A.2 | 2116.54 | 0.002 | 0.110 | 0.030 | 0.532 | 28754 |
| LU.A.4 | 1102.50 | 0.002 | 0.069 | 0.017 | 0.255 | 14915 |
| LU.A.8 | 574.47 | 0.003 | 0.067 | 0.016 | 0.192 | 8655 |
| LU.B.2 | 9712.87 | 0.002 | 0.357 | 0.104 | 1.734 | 101975 |
| LU.B.4 | 4757.80 | 0.003 | 0.190 | 0.056 | 0.808 | 53522 |
| LU.B.8 | 2444.05 | 0.004 | 0.222 | 0.057 | 0.548 | 30134 |
| EP.A.2 | 123.81 | 0.002 | 0.010 | 0.003 | 0.074 | 1834 |
| EP.A.4 | 61.92 | 0.003 | 0.011 | 0.004 | 0.073 | 1743 |
| EP.A.8 | 31.06 | 0.004 | 0.017 | 0.005 | 0.073 | 1661 |
| EP.B.2 | 495.49 | 0.001 | 0.009 | 0.003 | 0.196 | 2011 |
| EP.B.4 | 247.69 | 0.002 | 0.012 | 0.004 | 0.122 | 1663 |
| EP.B.8 | 126.74 | 0.003 | 0.017 | 0.005 | 0.083 | 1656 |
| SP.A.2 | 123.81 | 0.002 | 0.010 | 0.003 | 0.074 | 1854 |
| SP.A.4 | 51.92 | 0.003 | 0.011 | 0.004 | 0.073 | 1543 |
| SP.A.8 | 31.06 | 0.004 | 0.017 | 0.005 | 0.073 | 1671 |
| SP.B.2 | 495.49 | 0.001 | 0.009 | 0.003 | 0.196 | 2411 |
| SP.B.4 ^a | 247.69 | 0.002 | 0.014 | 0.006 | 0.152 | 2653 |
| SP.B.8 ^b | 126.74 | 0.003 | 0.017 | 0.005 | 0.082 | 1755 |

^a 一个脚注

^b 另一个脚注

15 Figure

15.1 插图

插图功能是利用 $\text{T}_{\text{E}}\text{X}$ 的特定编译程序提供的机制实现的，不同的编译程序支持不同的图形方式。有的同学可能听说“ $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ 只支持 EPS”，事实上这种说法是不准确的。 $\text{X}_{\text{E}}\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ 可以很方便地插入 EPS、PDF、PNG、JPEG 格式的图片。

一般图形都是处在浮动环境中。之所以称为浮动是指最终排版效果图形的位置不一定与源文件中的位置对应，这也是刚使用 $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ 同学可能遇到的问题。如果要强制固定浮动图形的位置，请使用 `float` 宏包，它提供了 `[H]` 参数。

15.1.1 单个图形

如图 15.1 所示。



1.google figure 2.different color

图 15.1: Main name 2

Stay hungry, stay foolish.

15.1.2 多个图形

简单插入多个图形的例子如图 15.2 所示。这两个水平并列放置的子图共用一个图形计数器，没有各自的子图题。



图 15.2: English caption

如果多个图形相互独立，并不共用一个图形计数器，那么用 `minipage` 或者 `parbox` 就可以，如图 15.3 与图 15.4。



图 15.3: 并排第一个图



图 15.4: 并排第二个图

16 Algorithm

16.1 伪代码

算法环境可以使用 `algorithms` 宏包或者较新的 `algorithm2e` 实现。算法 1 是一个使用 `algorithm2e` 的例子。关于排版算法环境的具体方法，请阅读相关宏包的官方文档。

Algorithm 1: 算法示例

Data: this text
Result: how to write algorithm with $\text{\LaTeX 2}_{\epsilon}$

```

1 initialization;
2 while not at end of this document do
3   read current;
4   if understand then
5     go to next section;
6     current section becomes this one;
7   else
8     go back to the beginning of current section;
9   end
10 end
```

16.2 代码块

我们可以在论文中插入算法，但是不建议插入大段的代码。如果确实需要插入代码，建议使用 `listings` 宏包。

```

#include <stdio.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/wait.h>

int main() {
    pid_t pid;

    switch ((pid = fork())) {
    case -1:
        printf("fork failed\n");
        break;
    case 0:
        /* child calls exec */
        execl("/bin/ls", "ls", "-l", (char *)0);
        printf("execl failed\n");
        break;
```

```
default:
    /* parent uses wait to suspend execution until child finishes */
    wait((int*)0);
    printf("is completed\n");
    break;
}

return 0;
}
```

A Appendix

$$\frac{2h}{\pi} \int_0^\infty \frac{\sin(\omega\delta)}{\omega} \cos(\omega x) \, d\omega = \begin{cases} h, & |x| < \delta, \\ \frac{h}{2}, & x = \pm\delta, \\ 0, & |x| > \delta. \end{cases} \quad (4)$$