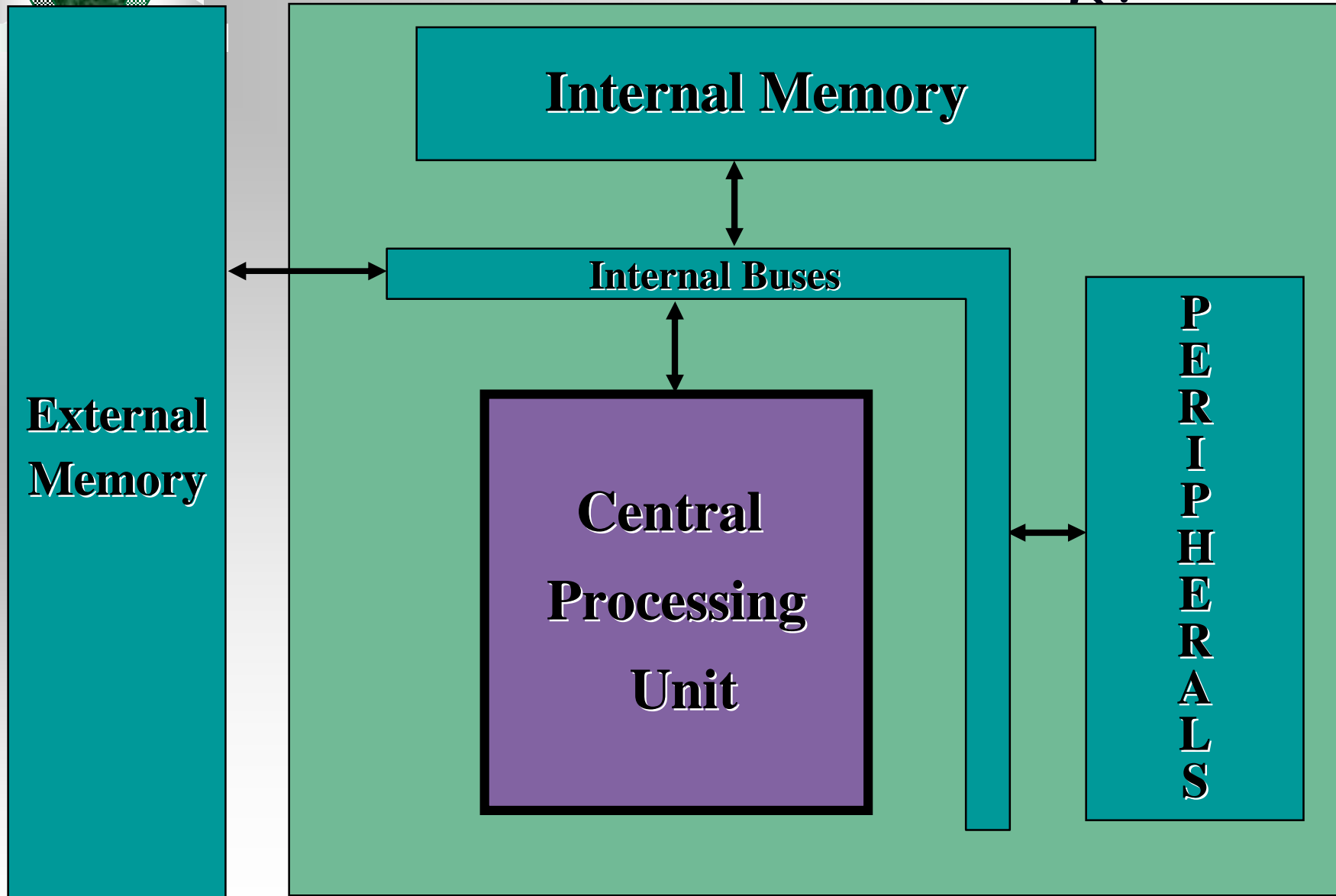


C6000 体系结构和汇编语言

General DSP System Block

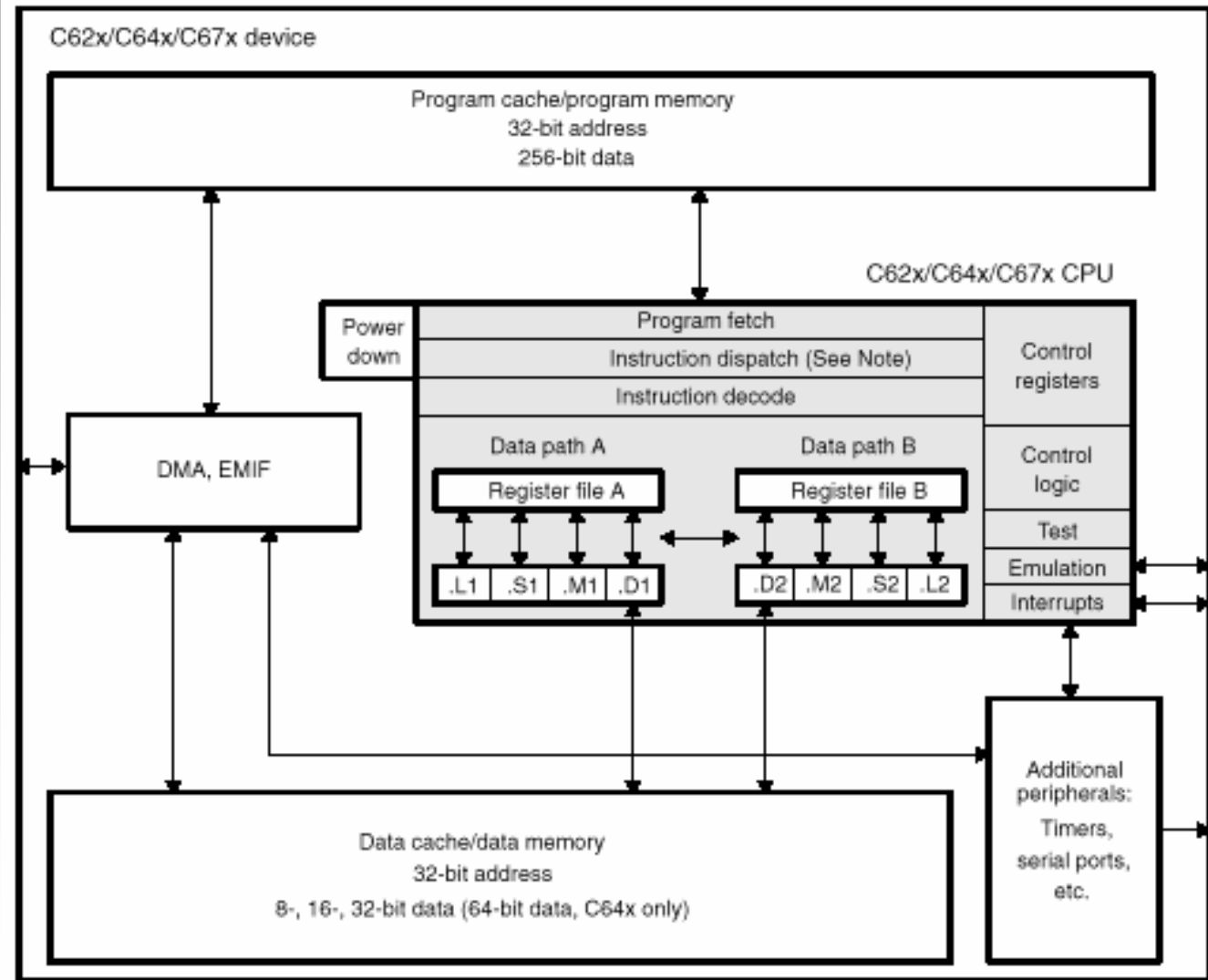
远见品质



远见品质

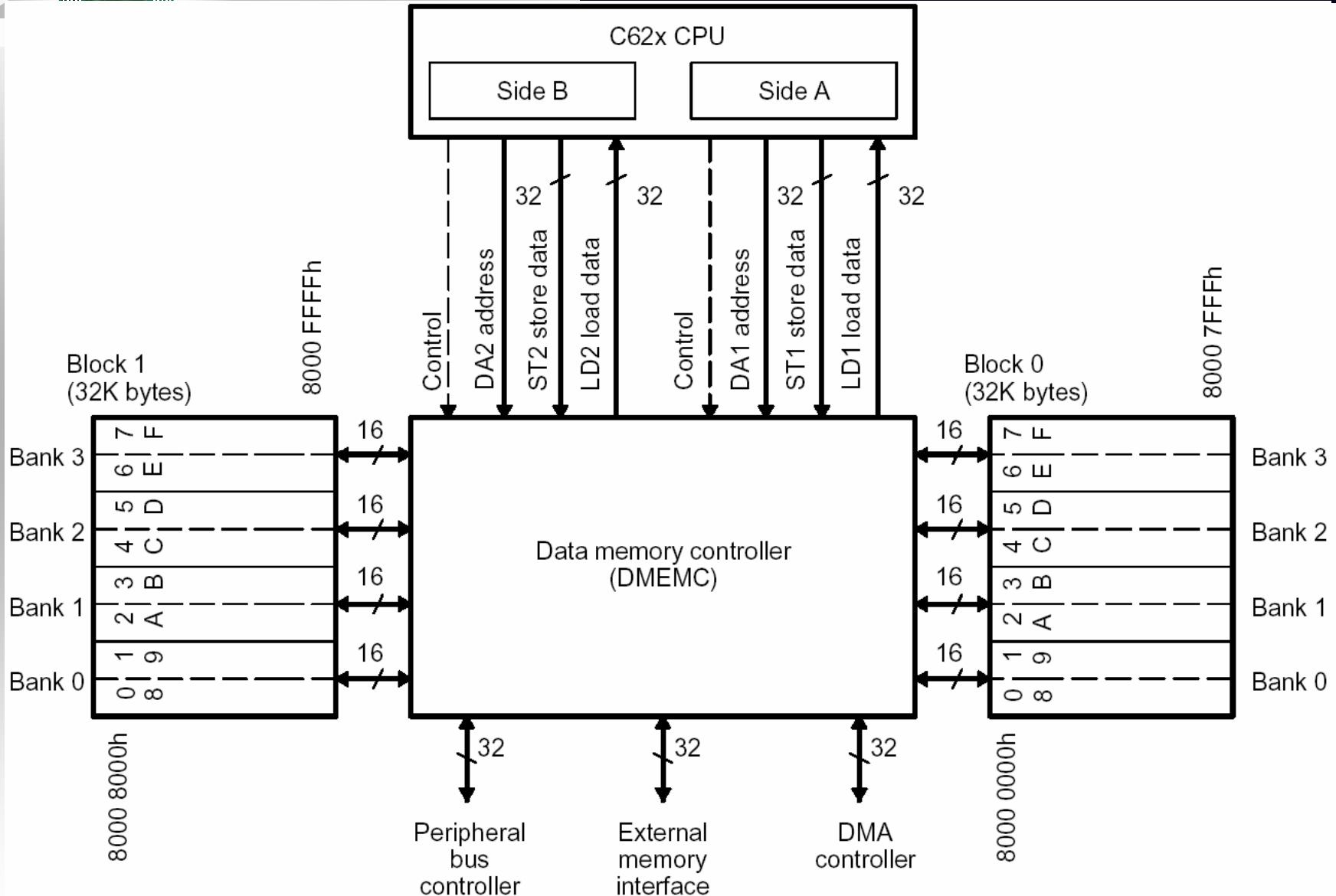
C6000 CPU Architecture

VLIW, Very Long Instruction word



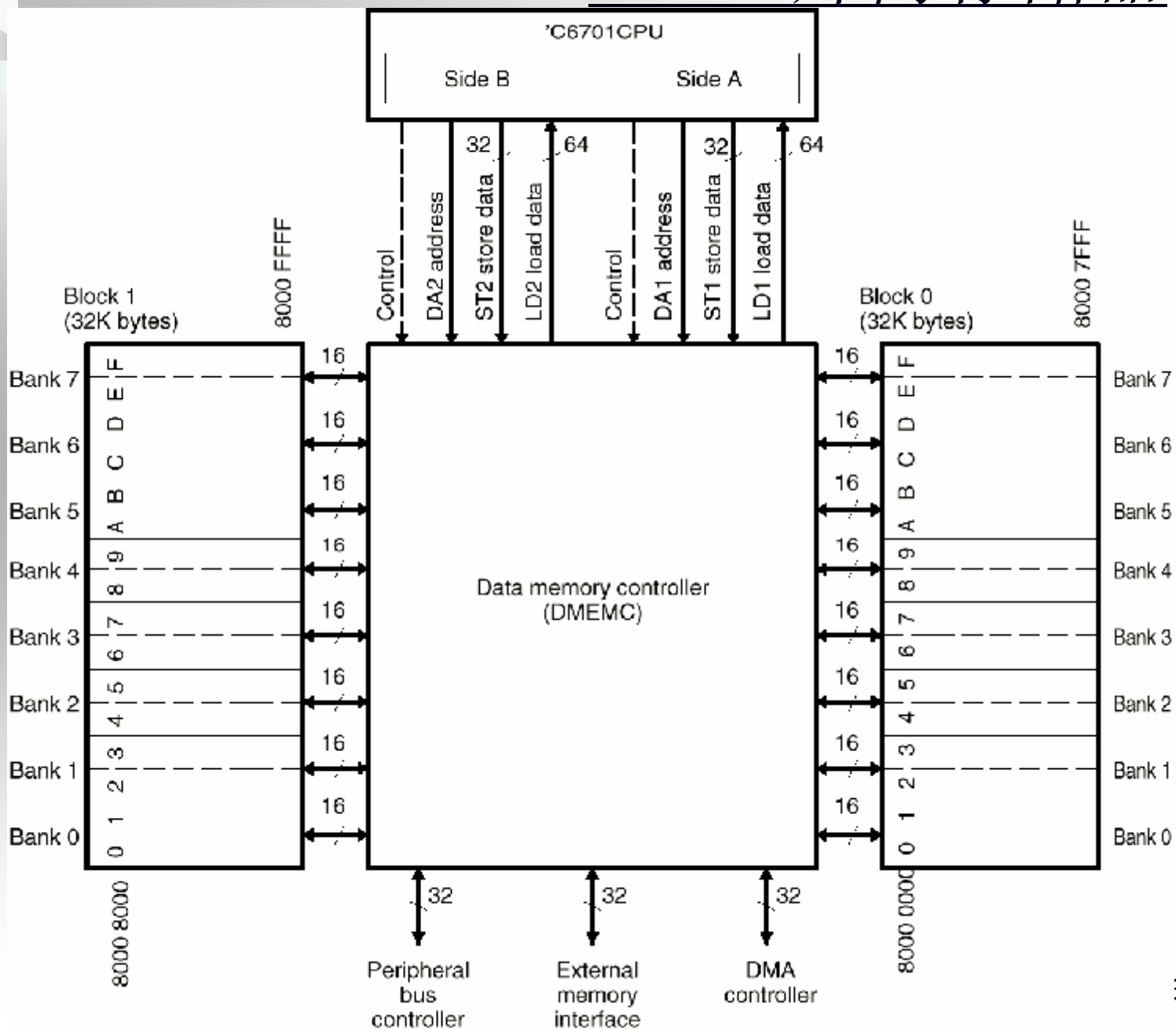


C6201/04/05 片内存储器



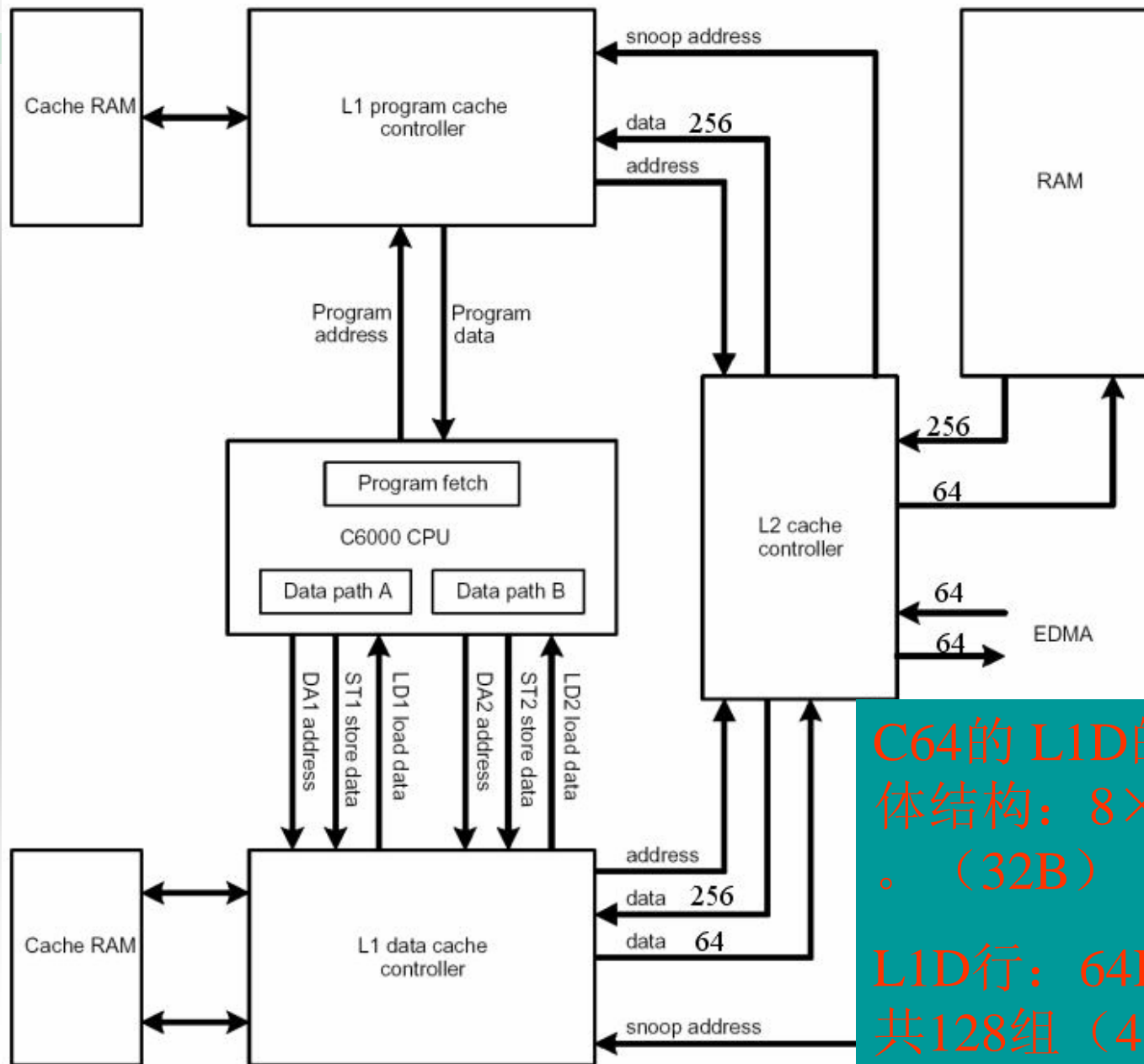
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C6701片内存储器



远见品质

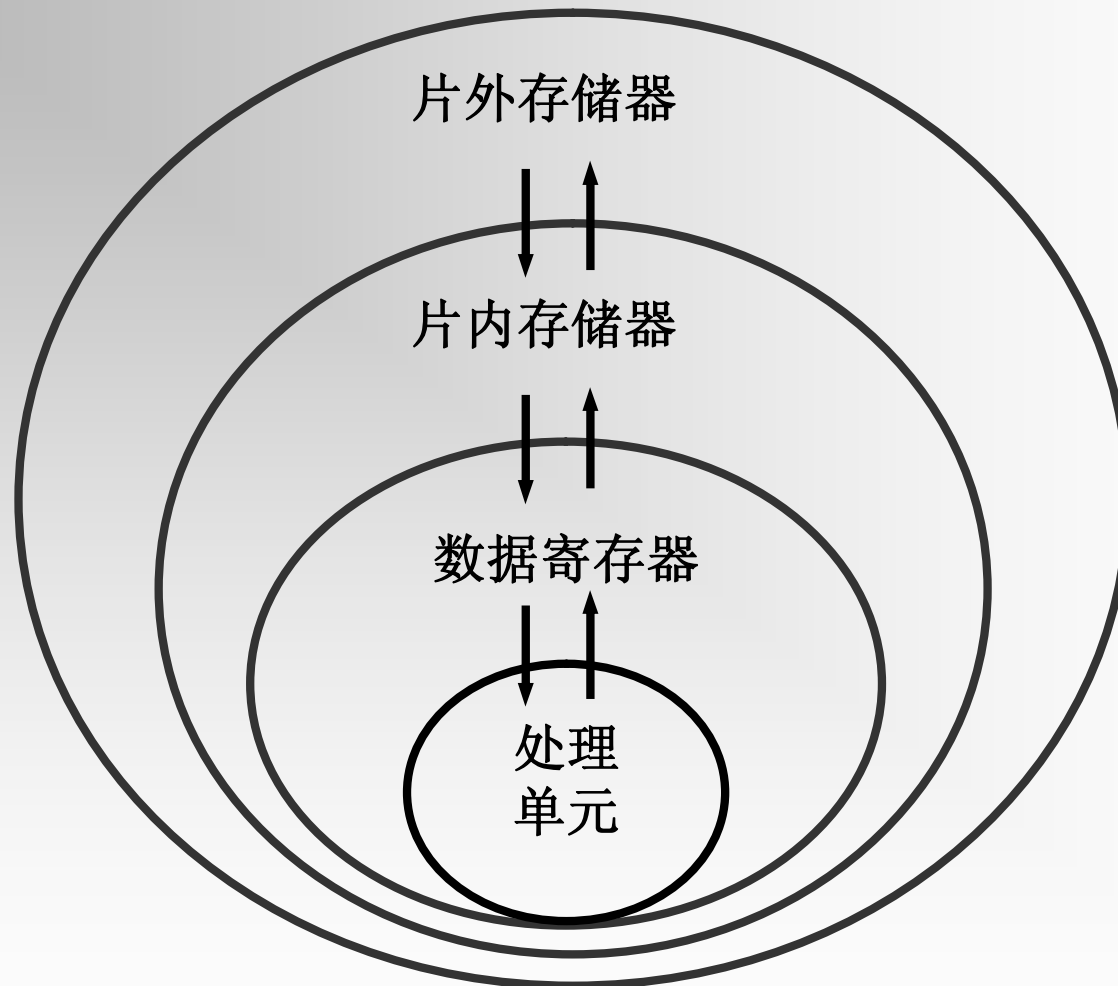
C64x 片内2级存储器



C64的 L1D 的存储体结构： $8 \times 32\text{bit}$ 。
(32B)

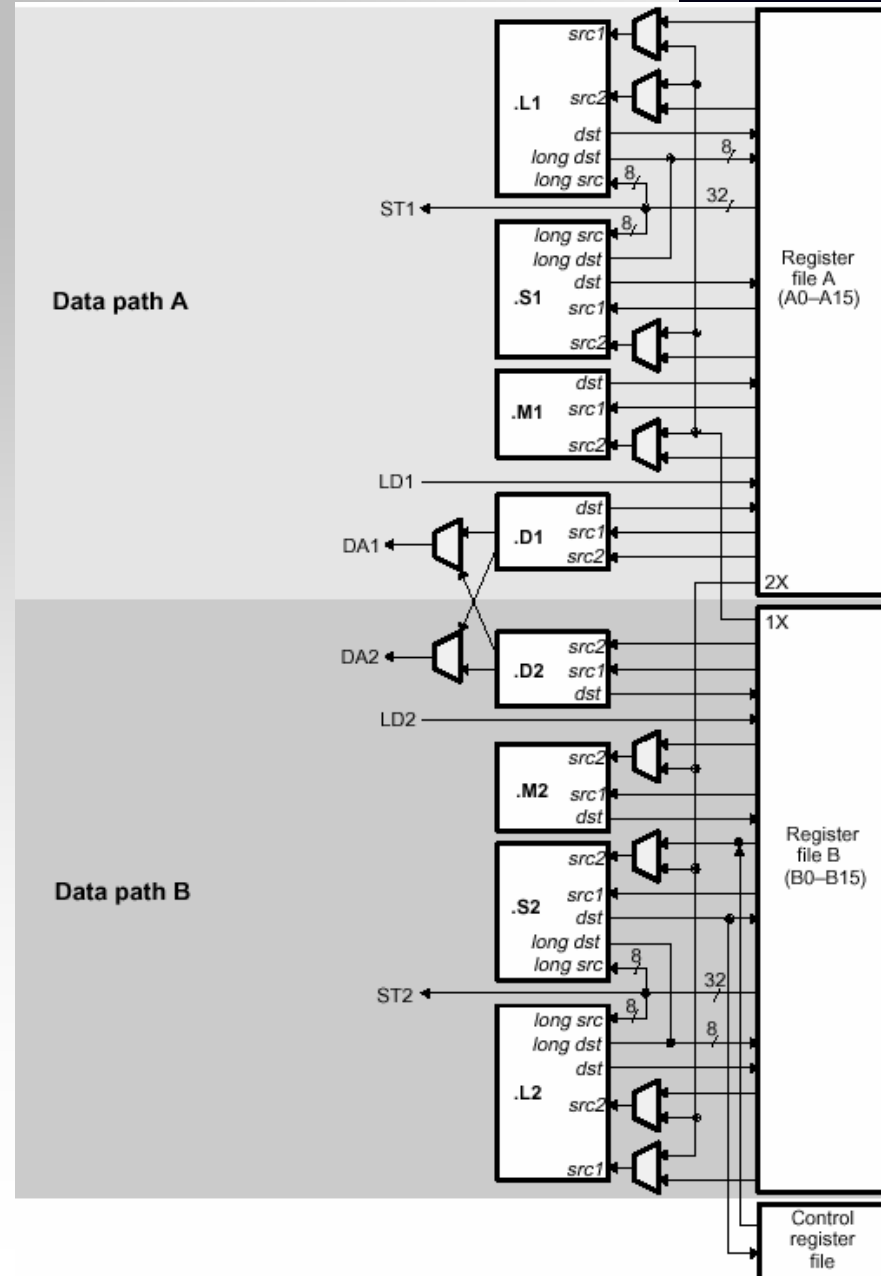
L1D 行：64B。
共128组 (4K字)

程序员角度的DSP结构：存储器的层次



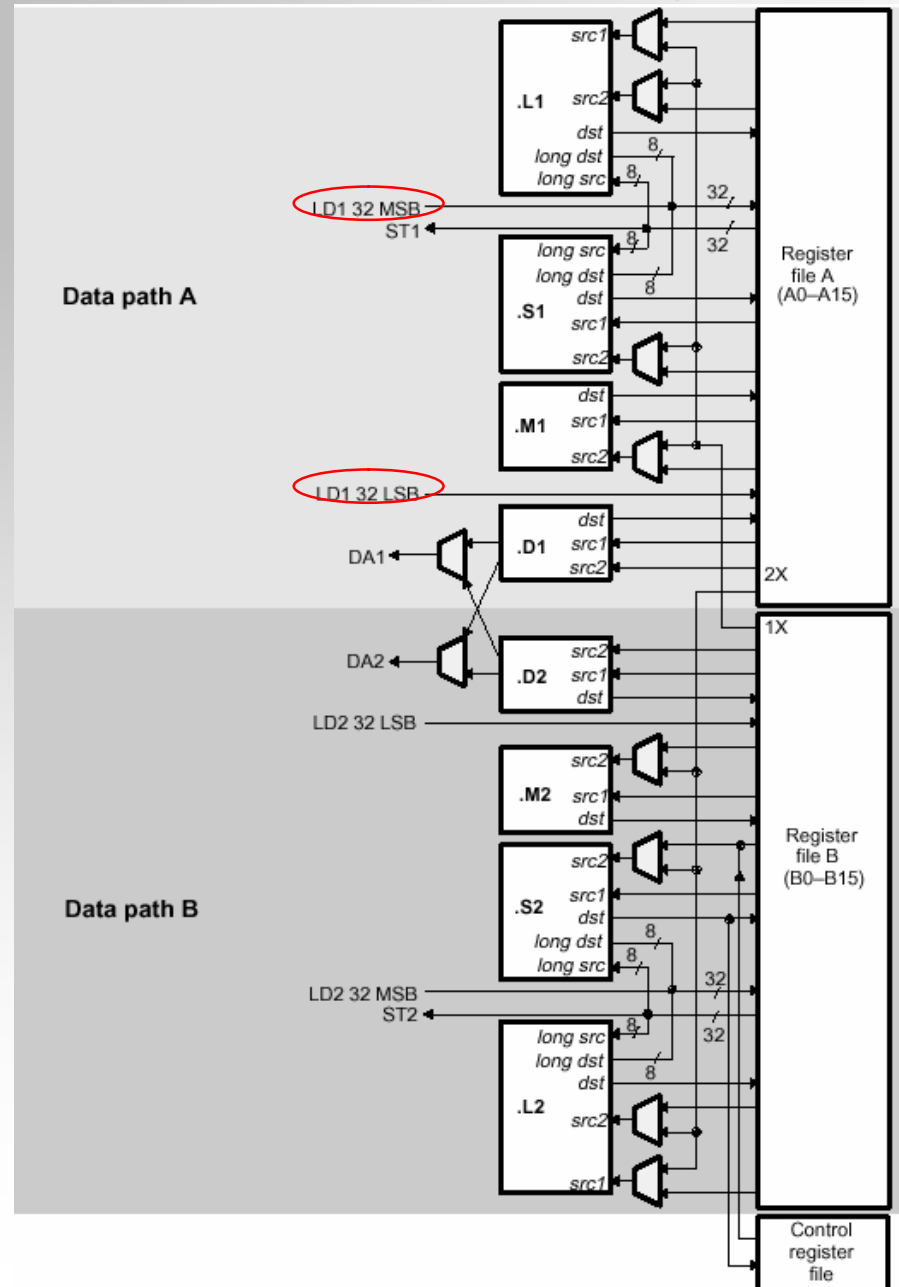
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C62xx CPU Core



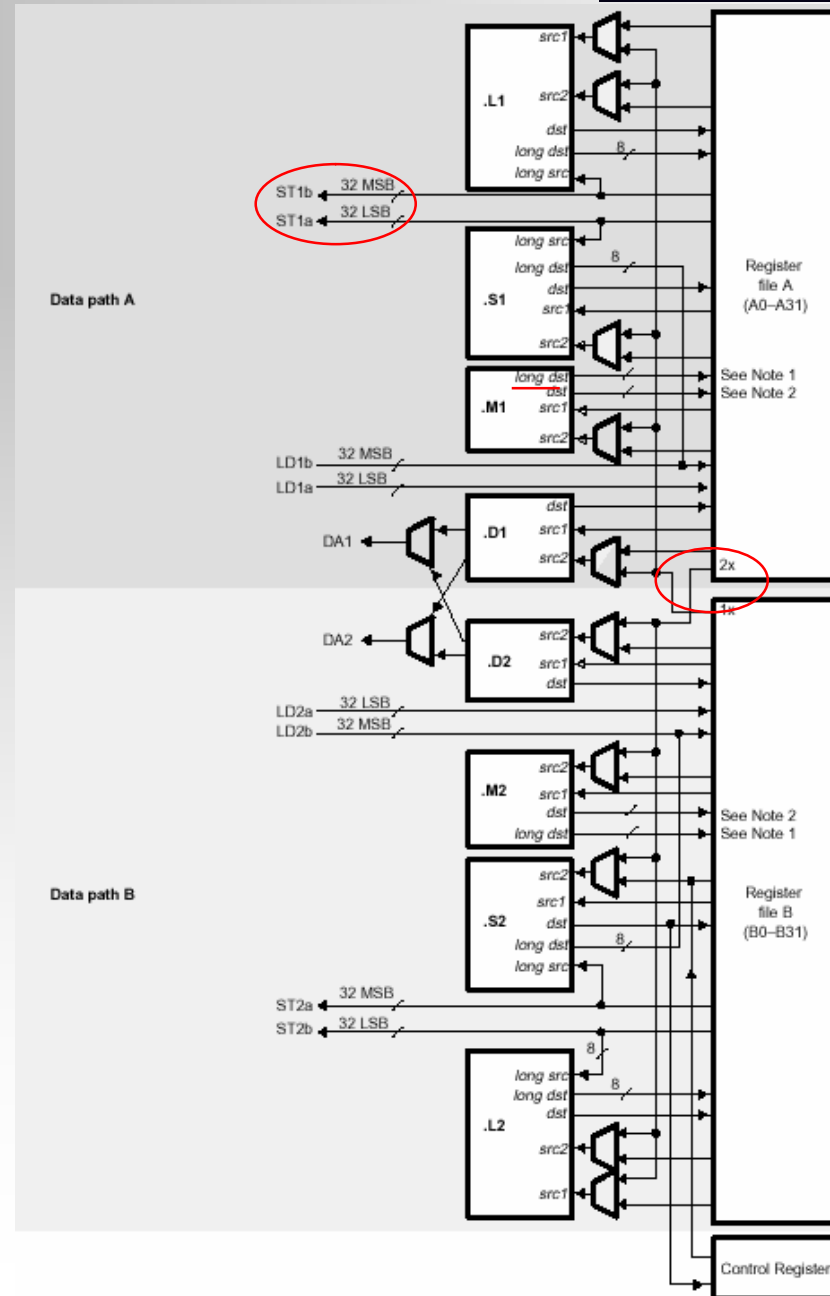
远见品质

C67xx CPU Core



远见品质

C64xx CPU Core



一条C6000的指令和其机器码

- u C6000: **ADD .D2 B5,B4,B4**
ADD (.D2 or.D1) src2,src1,dst1
- u **00000010000101001000100001000010**
- u **000 0 00100 00101 00100 010000 10000 1 0**
- u **(1) (2) (3) (4) (5) (6) (7) (8) (9)**
- u **(1) 条件寄存器: A1,A2,B0~2; C64添加A0**
- u **(2) z, 指定条件寄存器的判断条件**
- u **(3) dst, 目的**
- u **(4) src2, 源2**
- u **(5) src1, 源1**
- u **(6) 操作码: 设定唯一指令的码, sint, 2个源和目标都为有符号整数且功能单元为D时的操作码就是010000 ;**
- u **(7) 固定值**
- u **(8) s, 选择A边寄存器还是B边寄存器**
- u **(9) p, 是否并行**

对比：8086的ADD指令

8086/8088 一条指令长1~6字节

8086 ADD CX,DX CX和DX相加放到CX

000000 0 1 11 001 010; 寻址方式和立即数，这里没有

ADD (1) (2) (3) (4) (5)

(1) 0 reg为目的，

(2) 1 字处理（8086的字为16bit），表示操作的是CX,DX不是CL,DL。

(3) 11，寄存器模式，和 001, 010,一起表示是CX和DX

(4) CX, (2) (3) 和001一起决定是CX

(5) DX, (2) (3) 和010一起决定是DX



远见品质

Implementation of Sum of Products (SOP)

SOP is the key element for most DSP algorithms.

So let's write the code for this algorithm and at the same time learn the C6000 architecture.

$$Y = \sum_{n=1}^N a_n * x_n$$
$$= a_1 * x_1 + a_2 * x_2 + \dots + a_N * x_N$$

Two basic operations are required for this algorithm.

(1) **Multiplication**

(2) **Addition**

Therefore two basic instructions are required

远见品质

CODE

```
MVKL .S2 pt1, A5
MVKH .S2 pt1, A5

MVKL .S2 pt2, A6
MVKH .S2 pt2, A6

MVKL .S2 pt3, A7
MVKH .S2 pt3, A7
MVKL .S2 count, B0
ZERO .L A4
loop LDH .D *A5++, A0
LDH .D *A6++, A1
MPY .M A0, A1, A3
ADD .L A4, A3, A4
SUB .S B0, 1, B0
[B0] B .S loop
STH .D A4, *A7
```



远见品质

TMS320C62/C64/67 Instruction Set

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'C62/C64 Basic Instruction Set (by category)

Arithmetic

ABS
ADD
ADDA
ADDK
ADD2
MPY
MPYH
NEG
SMPY
SMPYH
SADD
SAT
SSUB
SUB
SUBA
SUBC
SUB2
ZERO

Logical

AND
CMPEQ
CMPGT
CMPLT
NOT
OR
SHL
SHR
SSHL
XOR

Data Mgmt

LDB/H/W
MV
MVC
MVK
MVKL
MVKH
MVKLH
STB/H/W

Program Ctrl

B
IDLE
NOP

Bit Mgmt

CLR
EXT
LMBD
NORM
SET

Note: Refer to the 'C6000 CPU Reference Guide for more details.

远见品质

'C62/C64 Basic Instruction Set(by unit)

.S Unit	
ADD	MVKLH
ADDK	NEG
ADD2	NOT
AND	OR
B	SET
CLR	SHL
EXT	SHR
MV	SSHL
MVC	SUB
MVK	SUB2
MVKL	XOR
MVKH	ZERO

.M Unit	
MPY	SMPY
MPYH	SMPYH

Other	
NOP	IDLE

.L Unit	
ABS	NOT
ADD	OR
AND	SADD
CMPEQ	SAT
CMPGT	SSUB
CMPLT	SUB
LMBD	SUBC
MV	XOR
NEG	ZERO
NORM	

.D Unit	
ADD	STB/H/W
ADDA	SUB
LDB/H/W	SUBA
MV	ZERO
NEG	

Note: Refer to the 'C6000 CPU Reference Guide for more details.

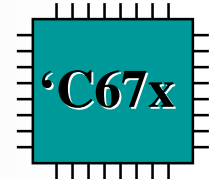
远见品质

'C67xx Additional Instructions (by unit)

.S Unit	
ABSSP	CMPLTDP
ABS DP	RCPS P
CMPGTSP	RCPD P
CMPEQSP	RSQRSP
CMPLTSP	RSQRDP
CMPGTDP	SPDP
CMPEQDP	

.M Unit	
MPYSP	MPYI
MPYDP	MPYID

.L Unit	
ADDDP	INTSP
ADDSP	INTSPU
DPINT	SPINT
DPSP	SPTRUNC
INTDP	SUBSP
INTDPU	SUBDP



.D Unit	
ADDAD	LDDW

Note: Refer to the 'C6000 CPU Reference Guide for more details.

1. C6000汇编语言和体系结构
流水线
2. C6000 C运行时环境
寄存器使用约定、函数调用约
定、系统启动流程
3. C6000的RTOS – DSP/BIOS

本课程中其他内容:

(1) 基于CCS的嵌入式实时软件开发

与调试: 以上述1,2,3为基础

(2) C6000代码优化: 以上述1为基础



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谢谢！