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Loongson Technology Corporation Limited

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Building No.2, Loongson Industrial Park,

Zhongguancun Environmental Protection Park, Haidian District, Beijing

(Tel) 010-62546668

(Fax) 010-62600826





32

1.04

2020/09/17

0.90

0.91

1.00

1) 3.2.3

convertToIntegerExact      roundToIntegralExact

1.01

2)            CSR

1) 2.2.3 2.2.5.1 3.2.5

1)

1.02



	<p>PC</p> <p>2) 21.5</p> <p>3) 2.2.1.10 MULH.WU U</p> <p>4) 3.1.4.4 2Emin Emin</p> <p>5) 3.2.4.6 MOVCF2FR 3.2.4.7 MOVCF2GR 0 0</p> <p>6) 3.2.6.1 32</p> <p>7) 4.2.3.3 4.2.3.4 TLB CSR.TLBIDX.NE 1 TLB TLB</p> <p>8) 5.2.1</p> <p>9) 5.4.3.4 INVTLB r0, r0 INVTLB Q, r0, r0</p> <p>10) 5.4.4 found_ppn</p> <p>11) 6.2.2</p> <p>12) 7.4.1 7-2 DATF DATM</p> <p>13) 7.6.1 RDTIME RDCNTID</p> <p>14) GRLEN 32</p>
1.04	<p>1) 2.2.1.6 32</p> <p>2) 3</p> <p>3) 3.2.3.2 FFINT.{S/D}.L FTINT.L.{S/D}, 3.2.3.3 FTINT{RM/RP/RZ/RNE}.L.{S/D}</p>





```
' !%$ 6FE .....! (
' !%% 6T\X .....! )
' !%& G?5 .....! )
' !%' .....! +
( .....! ,
(!$ .....! ,
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(!%$ .....! ,
(!& .....! (#
(!' .....! (#
(!' !$ G?5 .....! (#
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*$ .....! (,
*!% .....! #
*!%$ .....! #
*!%% .....! #
*!& .....! #
*!' .....! #
*' !$ 6E@7 .....! #
*' !% CE@7 .....! %
*' !& 8H8A .....! %
*' !' 869. ....! %
*' !( 8FG4G .....! &
*' !) 8E4 .....! '
*' !* 547I .....! '
*' !+ 88AGEL .....! (
*' !, 6CH<7 .....! (
*' !#$ F4I 8#q& .....! (
*' !$$ ??5\g ??56G? .....! (
*!( .....! )
```









\$\$ ..... \$  
%\$ C6 ..... (  
&\$ ..... %  
(- \$ G?5 ..... (#

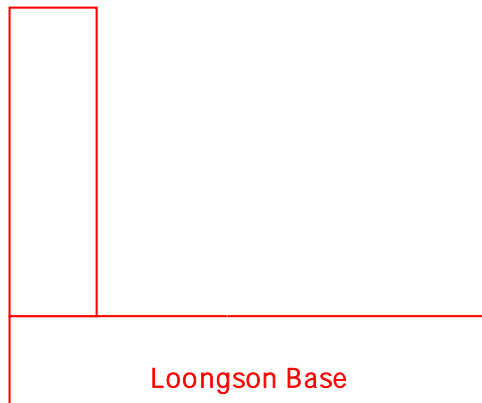
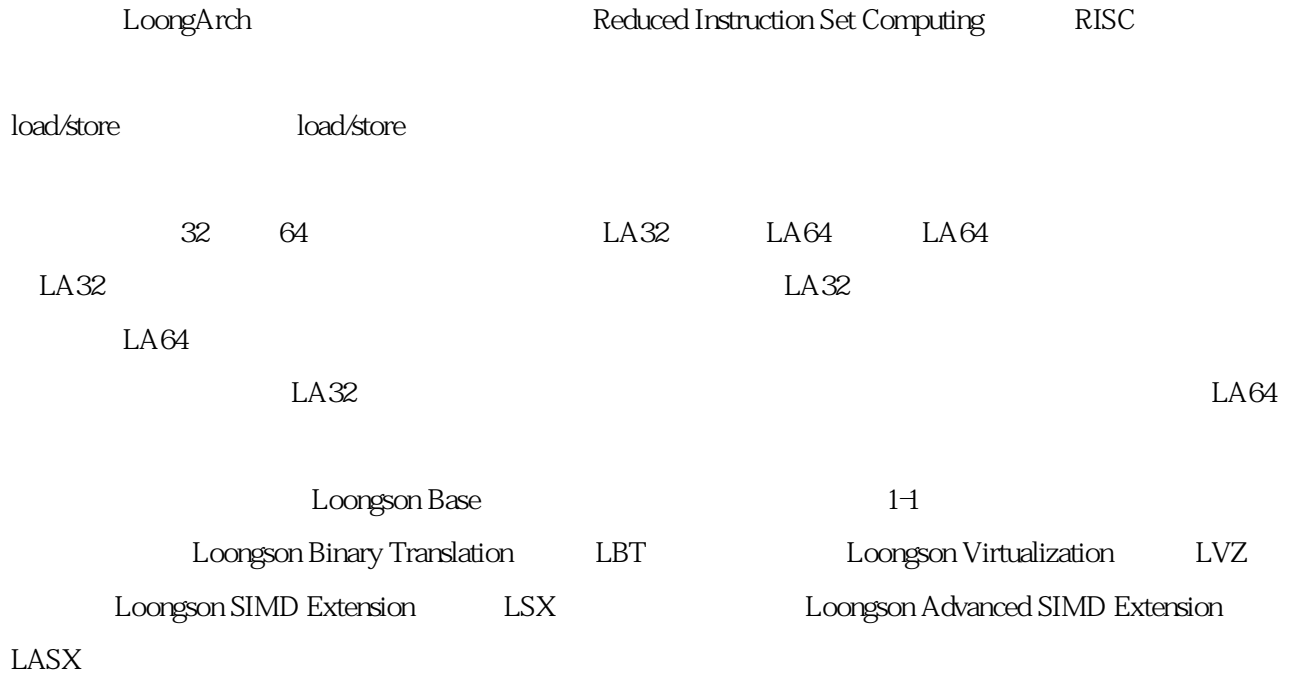






# 1

## 1.1





2

32





1.3

32

F

.XX

.B .H .W .BU .HU .WU







2

32





2.1.2.1







Cache Cache Cache Cache  
 Cache IBAR ] store  
 Cache Cache code 8 9 CACOP  
 Hit Invalidate I-Cache Hit Invalidate and Writeback D-Cache

2.1.8

4

ADEF

1

ALE

2.1.9

32

Weakly Consistency WC

2



## 2.2

### 2.2.1

#### 2.2.1.1 ADD.W, SUB.W

add.w rd, rj, rk

sub.w rd, rj, rk

ADD.W rj rk [31:0] rd

588" K.

SUB.W rj rk [31:0] rd

GI 6" K.

#### 2.2.1.2 ADDI.W

addi.w rd, rj, si12

ADDI.W rj 12 si12 32

rd

588=" K.

#### 2.2.1.3 LU12I.W

lu12i.w rd, si20



LU12L.W 20 si20 12 0 rd  
 @I %&=" K.

ORI 12

2.2.1.4 SLT[U]

slt rd, rj, rk  
 sltu rd, rj, rk

SLT rj rk  
 rd 1 0  
 G@H

SLTU rj rk  
 rd 1 0  
 G@H .

SLT SLTU

2.2.1.5 SLT[U]I

slti rd, rj, si12  
 sltui rd, rj, si12

SLTI rj 12 si12  
 rd 1 0  
 G@H .

SLTUI rj 12 si12  
 rd 1 0  
 G@H =.



SLTI SLTUI

SLTUI

2.2.1.6 PCADDU12I

pcaddu12i rd, si20

PCADDU12I	20	si20	12	0	PC
rd					

D7588I %&=.

2.2.1.7 AND, OR, NOR, XOR

and rd, rj, rk  
 or rd, rj, rk  
 nor rd, rj, rk  
 xor rd, rj, rk

AND	rj	rk
rd		

5B8.

OR	rj	rk	rd
----	----	----	----

CF.

NOR	rj	rk
rd		

BCF.

XOR	rj	rk
-----	----	----









rk [4:0]

2.2.2.2 SLLI.W, SRLI.W, SRAI.W

slli.w rd, rj, ui5  
 srli.w rd, rj, ui5  
 srai.w rd, rj, ui5

SLLI.W rj rd  
 G@@=" K.

SRLI.W rj rd  
 GF@=" K.

SRAI.W rj rd  
 GF5=" K.

5 ui5

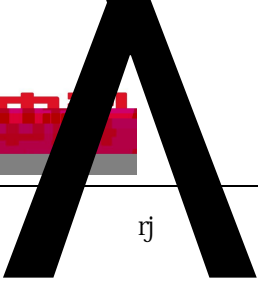
2.2.3

2.2.3.1 BEQ, BNE, BLT[U], BGE[U]

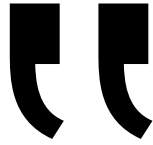
beq rj, rd, offs16  
 bne rj, rd, offs16  
 blt rj, rd, offs16  
 bge rj, rd, offs16  
 bltu rj, rd, offs16  
 bgeu rj, rd, offs16



BEQ  
69E.



rj



rd



BNE  
6B9.

rj

rd

BLT  
6@H

rj

rd

BGE  
6; 9.

rj

rdr

BLTU  
6@H .

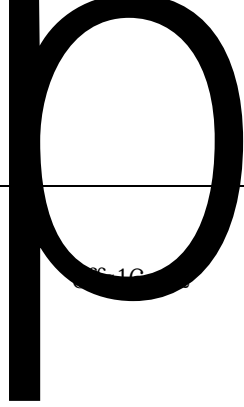


rj

rd







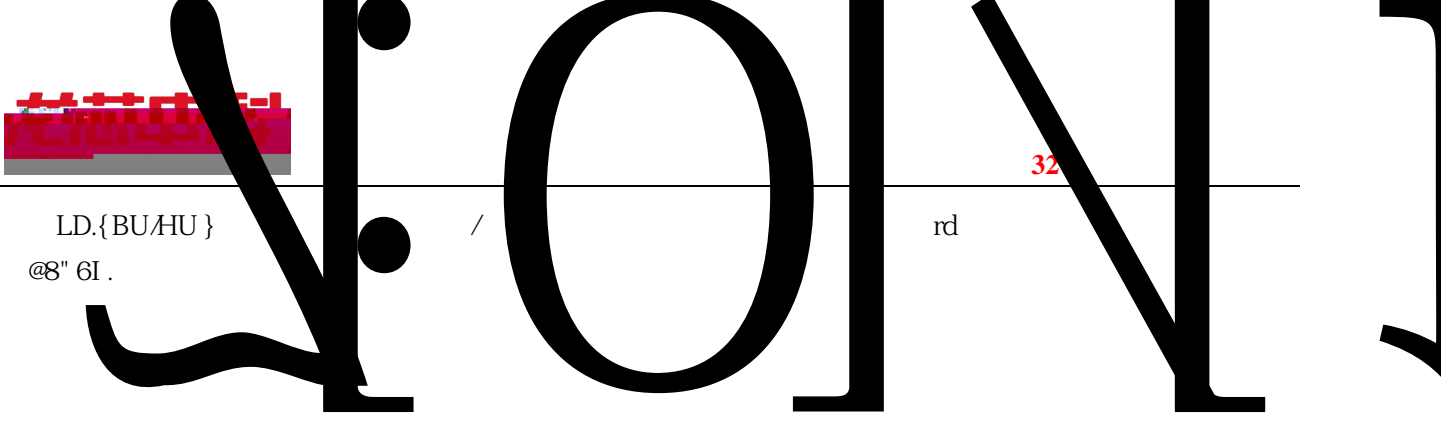
2.2.4

2.2.4.1 LD.{B[U]H[U]W}, ST.{B/H/W}

ld.b      rG rj, sVLGE

re    A





@8" <I .

ST.{B/H/W} rd  
GH' 6.

GH' <.



### 2.2.4.2 PRELD

preld hint, rj, si12

PRELD Cache Cache rj  
 12 si12 Cache  
 PRELD hint Cache hint 0~31 32  
 hint=0 load Cache hint=8 store Cache hint  
 NOP  
 PRELD Cache cached NOP  
 PRELD MMU

### 2.2.5

#### 2.2.5.1 LL.W, SC.W

ll.w rd, rj, si14  
 sc.w rd, rj, si14  
 LL.W SC.W - - LL.W  
 rd SC.W  
 LL.W LL

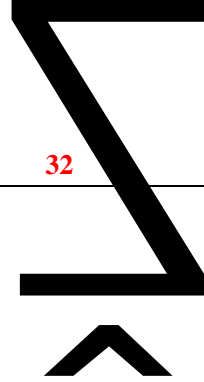




### 2.2.7.3 RDCNTV{L/H}.W, RDCNTID

rdcntl.w rd  
rdcntvh.w rd  
rdcntid rj

Counter			64
Stable Counter	0	1	1



32

32

IEEE 754-2008

0†ü%02 B+&ÛGA-â  
&ÛGA

3-1

3-1

	9477IFŽ 9FH5IFŽ 9@H?IFŽ 97 † IFŽ 9@477IFŽ 9@FH5IFŽ 9A@477IFŽ 9A@FH5IFŽ 9@4KIFŽ 9@AIFŽ 9@4K4IFŽ 9@A4IFŽ 945FIFŽ 9A8: IFŽ 9FDEGIFŽ 9E86C!FŽ 9EFDEGIFŽ 96BCLF< A!FŽ 96?4FFIF
	96@CIVbaWF
	99AGIFIJ Ž 9GAGIJ IFŽ 9GAGE@IJ IFŽ 9GAGECIJ IFŽ 9GAGEMJ IFŽ 9GAGEA8IJ IFŽ
	9@BI IFŽ 9F8?Ž @BI : E%0EIJ Ž @BI 9E% EIFŽ @BI : E%06FEŽ @BI 96FE% EŽ @BI 9E%69Ž @BI 69%0EŽ @BI : E%69Ž @BI 69% E
	568DMŽ 56A8M
	9?7IFŽ 9FGIF <span style="float: right;">R</span>

### 3.1

CL

H

.

B

† 0# 4E B © QŃsd%b

# R 3

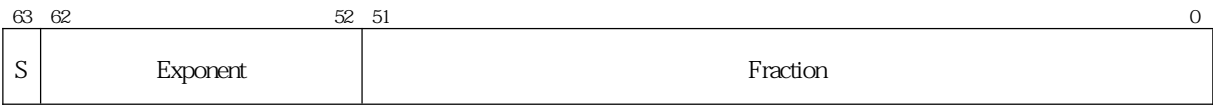


8kcbaxag	9eTVgba	F	Ugn\$P	
		\$		ž% <sup>S9</sup> x f#!9eTVgbafI
Nž #k98P		#		† % <sup>fBkcbaxag \$%fl</sup> x f!\$9eTVgbafI
		\$		ž % <sup>fBkcbaxag \$%fl</sup> x f!\$9eTVgbafI
#k99	0#	#	#	fl fl
		\$	#	fž fl
#k99	'0#		#	fFZaT_aZ Abg T Ah` UXež FATAfI
			\$	fDhYg Abg T Ah` UXež DATAfI

v SNaN QNaN IEEE 754-2008

3.1.1.2

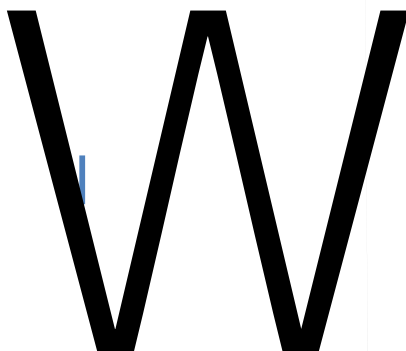
64



S Exponent Fraction 3-3

3-3

8kcbaxag	9eTVgba	F	Ugn\$P	
#	0#	#	#	† #
#	'0#	\$	#	ž #
Nž #k*98P		#		† % <sup>S9</sup> x f#!9eTVgbafI
		\$		ž % <sup>S9</sup> x f#!9eTVgbafI
		#		† % <sup>fBkcbaxag \$%fl</sup> x f!\$9eTVgbafI
		\$		ž % <sup>fBkcbaxag \$%fl</sup> x f!\$9eTVgbafI





fa fj fk fa fj fj fk

SNaN QNaN

SNaN 1

0 1

SNaN QNaN QNaN

QNaN QNaN

QNaN 0x7FC00000 QNaN 0x7FF8000000000000

3.1.2

Word W 32b

3.1.3

Condition Flag Register CFR

Floating-point Register FR

FCSR Floating-point Control and Status Register

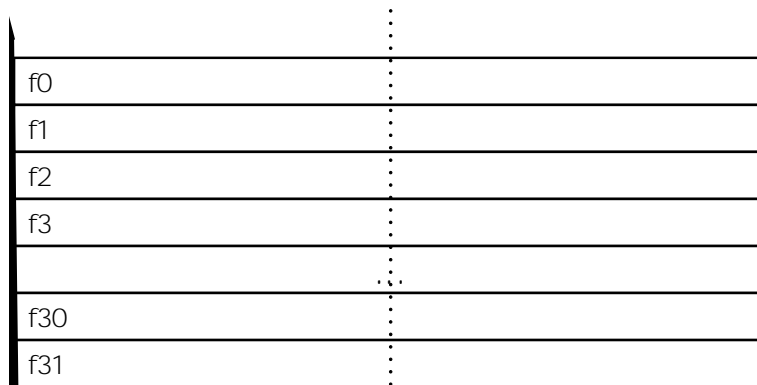
3.1.3.1

FR 32 f0-f31

FR 32 FR 64 LA32 LA64

FR

32





63 32

3.1.3.2

CFR	1	fcc0	CFR	1
		1	0	

3.1.3.3

FCSR	4	fcsr0~fcsr3	32	fcsr1~fcsr3	fcsr0
fcsr1~fcsr3		fcsr0		fcsr1~fcsr3	fcsr0
fcsr0		3-4			
			3-4	FCSR0	

'-#	8aTUxf	EJ	I MBH<
*-(	#	E#	#
,+	E@	EJ	# EAB <888 *(' z%##+ dchaVG\WfGb8i Xa \$ EM <888 *(' z%##+ dchaVGbj TeW\Xeb % EC <888 *(' z%##+ dchaVGbj TeW\Cbfgi X & E@ <888 *(' z%##+ dchaVGbj TeW\AXZTgi X
\$-\$	#	E#	#
%#-\$	9IZf	EJ	9IZf I MBH<
%&#\$	#	E#	#
%+-%	6ThfX	EJ	I MBH<
&\$%	#	E#	#

FCSR1	FCSR0	Enables	FCSR0
FCSR2	FCSR0	Cause	Flags FCSR0
FCSR3	FCSR0	RM	FCSR0

3.1.3.4





IEEE 754-2008

Inexact (I)

Underflow (U)

Overflow (O)

Division by Zero (Z)

Invalid Operation (V)

FCSR0 Cause

FCSR0 Cause

FCSR0

Enables

1

Enable

1

Enable

0

FCSR0

Flag

1

3-5

3-5

<

EAB

v %<sup>3</sup>%

#Z fUabè T\_Z  
v %<sup>3</sup>%

abè T\_

EM

#Z fUabè T\_

H

EC

† %<sup>3</sup>%

#Z fUabè T\_Z  
† %<sup>3</sup>%

abè T\_

E@

ž %<sup>3</sup>%

#Z fUabè T\_Z  
ž %<sup>3</sup>%

abè T\_

EAB

† ž

EM

B

EC





QNaN

3.1.4.2  $\text{&à}d\ddot{o}$  (Z)

0

3.1.4.3 (O)

3.1.4.4 (U)

0

$(-2^{E_{\min}}, 2^{E_{\min}})$

E<sub>min</sub>





: 8=J" G.

: 8=J" 8.

3.2.1.2 F{MADD/MSUB/NMADD/NMSUB}.{S/D}

fmadd.s	fd, fj, fk, fa	fmadd.d	fd, fj, fk, fa
fmsub.s	fd, fj, fk, fa	fmsub.d	fd, fj, fk, fa
fnmadd.s	fd, fj, fk, fa	fnmadd.d	fd, fj, fk, fa
fnmsub.s	fd, fj, fk, fa	fnmsub.d	fd, fj, fk, fa

FMADD.{S/D}	fj	/	fk	/
	fa	/		/
	fd			

: A588" G.

: A588" 8.

FMSUB.{S/D}	fj	/	fk	/
	fa	/		/
	fd			

: AGI 6" G.

: AGI 6" 8.

FNMADD.{S/D}	fj	/	fk	/
	fa	/		/
	fd			

: BA588" G.

: BA588" 8.



---

FNMSUB.{S/D}

fj

/

fk

/



FMINA.{S/D}

fj  
fd

/

fk

/

IEEE 754-2008

minNumMag(x,y)

: A=B5" G.

: A=B5" 8.

3.2.1.5 F{ABS/NEG}.{S/D}

fabs.s fd, fj  
fneg.s fd, fj

fabs.d fd, fj  
fneg.d fd, fj

FABS.{S/D}

fj  
fd

/

0

: 56" G.

IEEE 754-2008

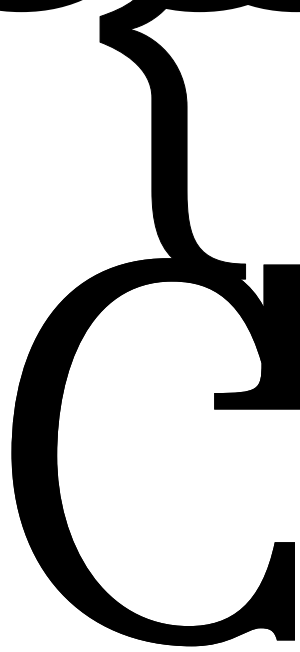
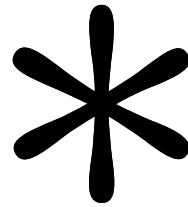
3' 2 J

FRECIP.{S/D}  
/

fj  
fd

/

1.0





FATA	DATA	aXZTgi X i T_hX			cbfngi X i T_hX		
		abe T_	fhUabe T_	#	abe T_	fhUabe T_	#





IEEE-754-2008 class(x)

: 7@5GG" G.

: 7@5GG" 8.

### 3.2.2

#### 3.2.2.1 FCMP.cond.{S/D}

fcmp.cond.s cc, fj, fk

fcmp.cond.d cc, fj, fk

cc

cond 22

VbaW

GehX  
6baWjba

DATA

888 \*(' z%##+

649 #k#

6HA #k+

68D #k'

6H8D #k6

HA

8D

Vb` cTeXDhVgHabelWexW

Vb` cTeXDhVg8dhT\_

3.2.1 FCVT.S.D, FCVT.D.S

convertFormat(x) fd, fj fcvt.d.s fd, fj

FCVT.S.D fj  
fd  
: 7JH" G" 8.

7)

FCVT.D.S fj a"  
fd  
: 7JH" 8" G.  
) 5>I G

IEEE 754-2008 convertFormat(x)

3.2.3.2 FFINT.{S/D}.{W/L}, FTINT.{W/L}.{S/D}

ffints.w	fd, fj	ffintws	fd, fj
ffints.l	fd, fj	ffintl.s	fd, fj
ffintd.w	fd, fj	ffintwd	fd, fj
ffintd.l	fd, fj	ffintl.d	fd, fj

FFINT.{S/D}.{W/L} <o?°\*Å\*Y fj / /  
/ f >:e G ê





/ fd ,  
: H=BHFD" K" G.

: H=BHFD" K" 8.

: H=BHFD" @" G.

: H=BHFD" @" 8.

FTINTRZ.{WL}. {S/D} fj / /  
/ fd  
: H=BHFN" K" G.

: H=BHFN" K" 8.

: H=BHFN" @" G.

: H=BHFN" @" 8.

FTINTRNE.{WL}. {S/D} fj / /  
/ fd  
: H=BHFB9" K" G.

: H=BHFB9" K" 8.

: H=BHFB9" @" G.

: H=BHFB9" @" 8.

IEEE 754-2008

	888 *(' ž%##+
9G-AGE A 8!nj ""?prF" 7p	Vbai XegGb-agZxe8kTVgWfGb8i Xafkfl
9G-AGE Mhj ""?prF" 7p	Vbai XegGb-agZxe8kTVgGbj TeWwXebfkfl
9G-AGE C!nj ""?prF" 7p	Vbai XegGb-agZxe8kTVgGbj TeWwXebfkfl
9G-AGE @!nj ""?prF" 7p	Vbai XegGb-agZxe8kTVgGbj TeWwXZTgi Xfkfl



### 3.2.4

#### 3.2.4.1 FMOV.{S/D}

fmov.s fd, fj fmov.d fd, fj

FMOV.{S/D} fj / fd fj  
/  
: ACJ" G  
: ACJ" X

IEEE 754

Cause Flags

#### 3.2.4.2 FSEL

fsel fd, fj, fk, ca

FSEL FSEL ca 0 fj  
fd fk fd  
: G9@

#### 3.2.4.3 MOVGR2FR.W, MOVGR2FRH.W

movgr2fr.w fd, rj  
movgr2frh.w fd, rj

MOVGR2FR.W rj fd 32 64 fd  
32  
ACJ; F& F" K

MOVGR2FRH.W rj fd 32 fd 32  
ACJ; F& F<" K



3.2.4.4 MOVFR2GR.S, MOVFRH2GR.S

movfr2gr.s	rd, fj
movfrh2gr.s	rd, fj

MOVFR2GR/MOVFRH2GR.S	fj	32 / 32	rd
----------------------	----	---------	----

ACJ: F& F" G

ACJ: F<& F" G

3.2.4.5 MOVGR2FCSR, MOVFCSR2GR

movgr2fcsr	fcsr, rj
movfcsr2gr	rd, fcsr

MOVGR2FCSR	rj	fcsr			
MOVGR2FCSR	FCSR0	Cause	Enables	1	FCSR1
Enables	FCSR2	Cause	Cause	Enables	1 MOVGR2FCSR

ACJ: F& 7GF

MOVFCSR2GR	fcsr	32	rd
------------	------	----	----

ACJ: 7GF& F

fcsr

3.2.4.6 MOVFR2CF, MOVCF2FR

movfr2cf	cd, fj
movcf2fr	fd, cj

MOVFR2CF	fj	cd
----------	----	----

ACJ: F&7:

MOVCF2FR	cj	fd	fd	0
----------	----	----	----	---

ACJ 7: & F





### 3.2.6

#### 3.2.6.1 FLD.{S/D}, FST.{S/D}

fld.s            fd, rj, si12











#### 4.2.2 Cache

#### 4.2.2





NE 1  
TLB 2





### 4.2.3.5 INVTLB

invtlb op, rj, rk

INVTLB TLB TLB

op 5

rj [9:0]

ASID

ASID”

0 op

ASID

rj

r0

rk

VA

op

rk

r0

op

op

bc	
#k#	
#k\$	bc0#
#k%	: 0\$
#k&	: 0#
#k'	: 0# 4F-7 4F-7
#k(	: 0# 4F-7 4F-7   4   4
#k)	: 0\$ 4F-7 4F-7   4   4

### 4.2.4

#### 4.2.4.1 ERTN

ertn

ERTN

PPLV PIE

CSR.CRMD

ERA

PPLV PIE

CSR.PRMD

ERA

CSR.ERA

ERTN

CSR.LLCTL KLO

1

LLbit 0

LLbit

#### 4.2.4.2 IDLE

idle

level

IDLE

IDLE





G)



store store TLB V=0

TLB V=0

TLB V=1  
CSR.CRMD.PLV

PLV

store TLB V=1

D 0

5.4.3.2 TLB

TLB TLB TLB

4.2.3

5.4.3.3 TLB CSR

TLB CSR TLB

TLB

BADV

TLBEHI

TLBELOO

TLBELO1

TLBIDX

ASID

PGDL

PGDH

PGD

TLBRENTY

CSR TLB 7.4 CSR

5.4.3.4 TLB

32 TLB INVTLB 0, r0, r0"



#### 5.4.4 TLB

##### TLB

```
# va:
# mem_type:          FETCH          LOAD   load   STORE   store
# plv                CSR.CRMD.PLV
# pa:
# mat:
# VALEN:
# PALEN:
# TLB[]: TLB[N]     TLB     N
# TLB_ENTRIES: TLB

#     TLB
```

#

# TLB

#

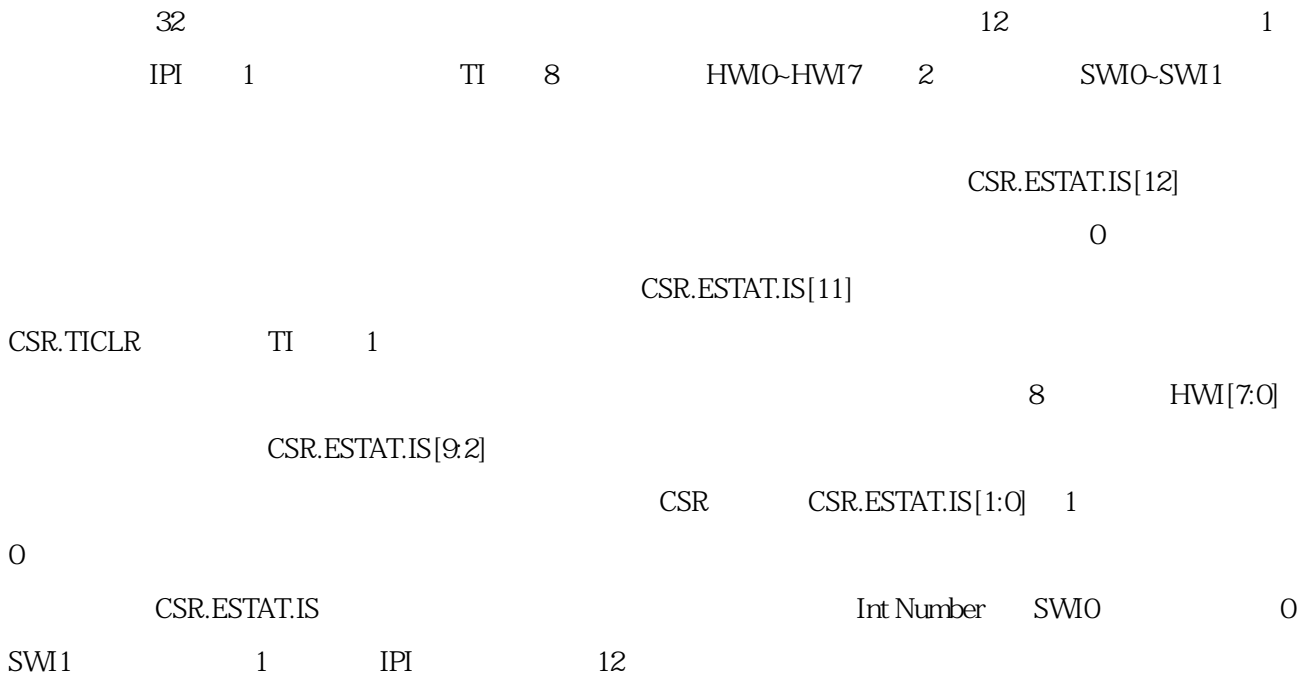




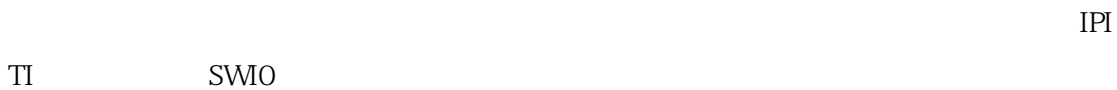
# 6

## 6.1

### 6.1.1



### 6.1.2



### 6.1.3

### 6.2.1

### 6.1.4





6.2.3

6.2

6.2.1

TLB	CSR.TLBREENTRY	CSR.EENTRY	CSR.ESTA
Ecode IS			

6.2.2

TLB

(ALE) > TLB <sup>1</sup>

6.2.3

CSR.CRMD	PLV	IE	CSR.PRMD	PPLV	PIE	CSR.CRMD	PLV
0	IE	0					
		PC	CSR.ERA				
	ERTN						
CSR.PRMD	PPLV	PIE	CSR.CRMD	PLV	IE		
CSR.ERA							
						CSR.PRMD	PPLV
PIE			CSR.PRMD				

<sup>1</sup> TLB

TLB



## 6.3

PC 0x1C000000

MMU







7

7.1

7-1

#k#		6E@7
#k\$		CE@7
#k%		8H8A
#k'		869:
#k(		8FG4G
#k)		8E 4
#k*		547I
#kV		88AGE L
#k\$#	G?5	G?5?7K
#k\$\$	G?5	G?58; <
#k\$%	G?5 #	G?58?B#
#k\$&	G?5 \$	G?58?B\$
#k\$+		4F?7
#k\$		C: 7?
#k\$4		C: 7;
#k\$5		C: 7
#k%#		6CH?7
#k&#q#k&&		F4I 8#qF4I 8&
#k' #		G?7
#k' \$		G69:
#k' %		GI 4?
#k' '		G?6?E
#k)#	??5g	??56G?
#k++	G?5	G?5E 8AGE L
#k, +		6G4:
#k\$#q#k\$+\$		7@J #q7@J \$



## 7.2

### 7.2.1

RW---

R---

RO---

0

0

CSR

W1---

1

0

0

### 7.2.2

CSR

CSR

0

CSRWR

CSRXCHG

rd

0

## 7.3

## 7.4

### 7.4.1

CRMD







7.4.2 PRMD

7-3

\$#	CC?I	EJ	8EGA 6FE!6E@7 C?I 6FE!6E@7 C?I
%	C-8	EJ	8EGA 6FE!6E@7 -8 6FE!6E@7 -8
&\$&	#	E#	#

7.4.3 EUEN

7-4

#	9C8	EJ	# &% 9C7
&\$&	#	E#	#

7.4.4 ECFG

7-5

, # ?-8N #P EJ 6FE!8FG4G 4N #P \$



8vW	8U6vW		
#k6	#	5E>	
#k7	#	A8	
#k8	#	C8	
#k9	#	9C7	
#k%	#	9C8	
#k\$!z #k&8			
#k&9	#	G?5E	G?5

7.4.6 ERA

PC  
7-8

&\$#	C6	EJ	C6

7.4.7 BADV

TLB

ADEF

PC

ALE

load

PIL

store

PIS

PIF

PME

@



7.4.8

EENTRY

TLB





%	>?B	EJ	8EGA \$ #	??5g 8EGA >?B \$	??5g # 8EGA
&\$&	#	E#	#		

## 7.5

### 7.5.1 TLB TLBIDX

TLB TLB

7-14 Inde



\$/##	#	E	#
&\$\$&	I CCA	EJ	G?5E 7 G?5 I CCA G?5FE 6; G?5 I CCA G?5J E G?59?? G?5 I CCA G?5 bTW fgeX N&\$\$P

7.5.3 TLB TLBELOO, TLBELO1

TLBELOO TLBELO1 TLB TLB  
 32 TLB TLB  
 TLBELOO TLBELO1 TLBELOO TLBELO1  
 7-16  
 TLBWR TLBFILL TLB G PPNO VO PLVO MATO DO PPN1 V1 PLV1  
 MAT1 D1 TLBELOO TLBELO1  
 TLBRD TLB TLBELOO TLBELO1

7-16 TLB

#	I	EJ	I
\$	7	EJ	7
&%	C?I	EJ	C?I
(-)	@4G	EJ	@4G
)	:	EJ	G?59?? G?5J E G?58?B# G?58?B\$ : \$ G?5 : \$ G?5E 7 G?5 : \$ G?58?B# G?58?B\$ :
*	#	E	#
C4?8AZ(+)	CCA	EJ	CCA
&\$C4?8AZ'	#	E	# C4?8AO&)



7.5.4

ASID

TLB

ASID

ASID

ASID

7-17





7.5.7 PGD

CSR

7-20

\$#	#	E	#
&\$%	5TFX	E	6FE!547I # 6FE!C: 7? 5TFX 6FE!C: 7: 5TFX

7.5.8 TLB TLBENTRY

TLB

TLB

7-21 TLB

(#	#	E	G?5 N #P #
&\$)	C4	EJ	G?5 N\$)P

7.5.9 DMW0-DMW1

5.2.1

7-22

#	C?I #	EJ	\$ C?I #
%)\$	#	E#	#
&	C?I &	EJ	\$ C?I &
(-)	@4G	EJ	
%-)	#	E#	#
%)%(	CF8:	EJ	N&\$% P
%)	#	E#	#
&\$%	I F8:	EJ	N&\$% P





7.6.4

TICLR









Ubb\_XTa

Ug

\agZXe

Ugff\_Z1fl

A

M\eb8kgKaWfi\_Z1fl

A

FZa8kgKaWfi\_Z1fl

A

\FA TAfi\_fi

fZaT\_laZ ATA 4q

LP







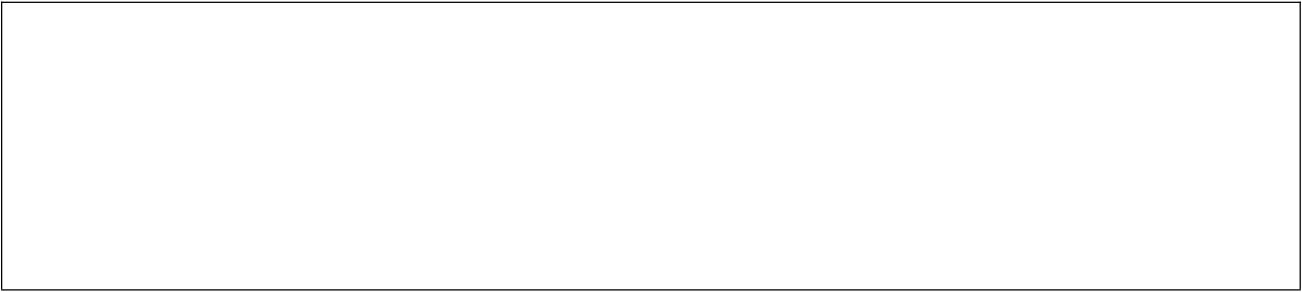
8.2.1



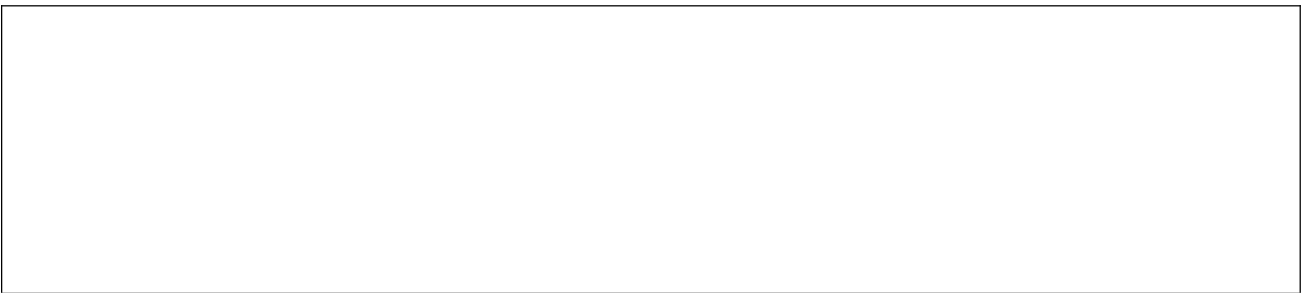
8.2.2



8.2.3



8.2.4

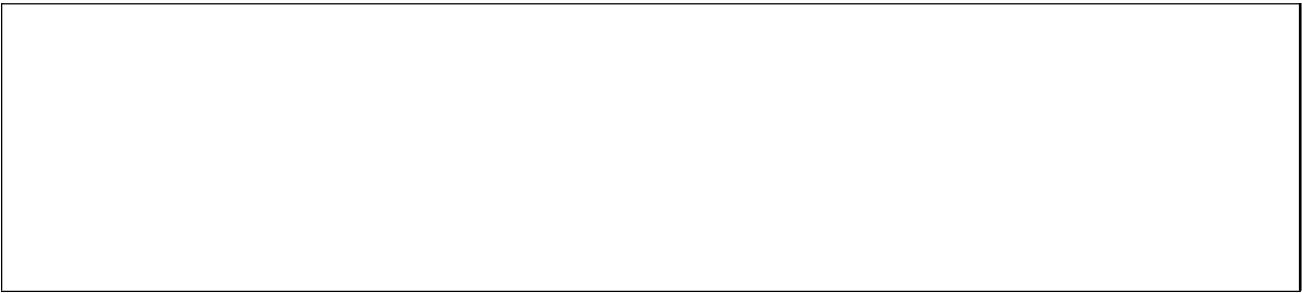




8.2.5



8.2.6



8.2.7

c











