NEC

SX-Aurora TSUBASA

Vector Engine Assembly Language Reference Manual

Proprietary Notice

Related Documents

- SX-Aurora TSUBASA Architecture Manual

Remarks

Contents

List of tables

Chapter1 Assembler Operation

This chapter describes Vector Engine assembler command-line syntax.

1.1 Command-line Syntax

nas [options] file ...

Chapter2 Pseudo-Instructions

This chapter describes Vector Engine assembler pseudo-instructions which are supported by Vector Engine.

2.1 Section definition pseudo-instructions

2.1.1 .section

Format:

.**section** *name*[, "*flags*"[, *@type*[, *flag_specific_arguments*]]]

2.1.2 . text

Format:

.**text** [*subsection*]

2.1.3 . data

Format:

.**data** [*subsection*]

2.1.4 . bss

Format:

.**bss** [.*subsection*]

2.2 Data Definition Pseudo-Instructions

2.2.1 .2byte, .4byte, 8byte

Format:

.2byte EXPRESSIONS

.4byte EXPRESSIONS

.8byte EXPERSSIONS

Description:

These directives write unaligned 2, 4 or 8 byte values to the output section.

2.2.2 .byte

Format:

.**byte** EXPRESSIONS

Description:

.byte expects zero or more expressions, separated by commas. Each expression is assembled into the next byte.

2.2.3 .short

Format:

.**short** EXPRESSIONS

Description:

Expect zero or more EXPRESSIONS, of any section, separated by commas. For each expression, emit a number that, at run time, is the value of that expression. The byte order is little endian and bit size of the number is 16 bits (2 bytes).

2.2.4 .word

Format:

.**word** EXPRESSIONS

Description:

Expect zero or more EXPRESSIONS, of any section, separated by commas. For each expression, emit a number that, at run time, is the value of that expression. The byte order is little endian and bit size of the number is 32 bits (4 bytes).

2.2.5 .int

Format:

.**int** EXPRESSIONS

Description:

Expect zero or more EXPRESSIONS, of any section, separated by commas. For each expression, emit a number that, at run time, is the value of that expression. The byte order is little endian and bit size of the number is 32 bits (4 bytes).

2.2.6 .long

Format:

.**long** EXPRESSIONS

Description:

Expect zero or more EXPRESSIONS, of any section, separated by commas. For each expression, emit a number that, at run time, is the value of that expression. The byte order is little endian and bit size of the number is 64 bits (8 bytes).

2.2.7 .quad

Format:

.**quad** EXPRESSIONS

Description:

Expect zero or more EXPRESSIONS, of any section, separated by commas. For each expression, emit a number that, at run time, is the value of that expression. The byte order is little endian and bit size of the number is 64 bits (8 bytes).

2.2.8 .llong

Format:

.**llong** EXPRESSIONS

Description:

Expect zero or more EXPRESSIONS, of any section, separated by commas. For each expression, emit a number that, at run time, is the value of that expression. The byte order is little endian and bit size of the number is 64 bits (8 bytes).

2.3 Miscellaneous Pseudo-Instructions

2.3.1 .file

Format:

.**file** "*string*"

2.3.2 .ident

Format:

.**ident** "*string*"

Description:

string is emitted to the ".comment" section.

Chapter3 Assembler Syntax

3.1 Statement Syntax

A statement of the Vector Engine assembly language is represented as the following format.

[*label*] <*instruction*> [<*operand*>[, <*operand*> …]]

3.2 Operand Description Format

The register, immediate values, and effective address can only be described in the operand.

3.2.1 Register Notations

Table 3-1 shows the register notations used in the Vector Engine assembly language. See also Chapter 3 of SX-Aurora TSUBASA Architecture Manual for details.

Table 3-1 Register Notations

Register	Syntax
Scalar register	%s*n* (n=0 ? 63)
Vector register	%v*n* (n=0 ? 63)
Vector mask register	%vm*n* (n=0 ? 15)
Vector index register	%vix

Table 3-2 Register Aliases

Alias (actual register/immediate)	Syntax
Stack pointer (%s11)	%sp
Frame pointer (%s9)	%fp
Stack limit (%s8)	%sl
Link register (%s10)	%lr
Thread pointer (%s14)	%tp
Outer register(%s12)	%outer
Info area register(%s17)	%info
Global offset table register(%s15)	%got
Procedure linkage table register(%s16)	%plt
User clock counter (0)	%usrcc
Program status word (1)	%psw
Store address register (2)	%sar
Performance monitor mode register (7)	%pmmr

Performance monitor configuration register (8-11)	%pmcr*m* (m=0-3)
Performance monitor counter (16-30)	%pmc*n* (n=0-14)

3.2.2 Effective Address Notations

ASX are address syllable for RM and CF formats. The following are address syllable formats. See also Chapter 5 of SX-Aurora TSUBASA Architecture Manual for details.

(1) **disp**

(2) **disp** (, *base*)

(3) **disp** (*index*)

(4) **disp** (*index*, *base*)

(5) (, *base*)

(6) (*index*)

(7) (*index*, *base*)

base specifies a scalar register; *index* specifies a scalar register or immediate data in the range of -64 to 63; and **disp** specifies a label name or absolute value.
AS format is the same as ASX but it can not accept *index*. Therefore, the following are acceptable.

(1) **disp**

(2) **disp**(,*base*)

(3) (,*base*)

When it is RRM format, a comma is omitted as follows.

(1) **disp**

(2) **disp**(*base*)

(3) (*base*)

HM is address syllable for RRM format. The following are address syllable formats.

(1) *base*

(2) (*base*)

(3) **disp**(*base*)

base specifies a scalar register and **disp** specifies an immediate value.

3.2.3 Immediate value Notations

Table 3-3 shows immediate value notations. See also Chapter 5 of SX-Aurora TSUBASA Architecture Manual for details.

Table 3-3 Immediate Value Notations

Manual Description	Syntax	Meaning
I	Expression including only integer constants D (octal, decimal or hexadecimal constants)	Immediate value to be set in Ry of RR-type instruction. The lower 7 bits of the integer constant specified by the expression are set.
N	Expression including only integer constants (octal, decimal or hexadecimal constants)	
M	(m)0 or (m)1 M: Integer in the range 0-63	When (m)0 is specified, 64-bit immediate value having m zeros from left and (64-m) ones. When (m)1 is specified, 64-bit immediate value having m ones from left and (64-m) zeros.
Z		Immediate 0 (zero) value if whatever immediate value is specified

3.2.4 Prefix Notations

Table 3-4 Prefix Notations

Prefix	Meaning
%hi(*label*)	Get upper 32-bit of the address '*label*' or the immediate value
%lo(*label*)	Get lower 32-bit of the address '*label*' or the immediate value

Note It'll be expected to eliminate this Pseudo-Instruction from now on.

3.2.5 Suffix Notations

Table 3-5 Suffix Notations

Suffix	Meaning
label **@hi**	Get upper 32-bit of the address '*label*' or the immediate value
label **@lo**	Get lower 32-bit of the address '*label*' or the immediate value
label **@pc_hi**	Get upper 32-bit of the relative address to '*label*'
label **@pc_lo**	Get lower 32-bit of the relative address to '*label*'
label **@got_hi**	Get upper 32-bit of the address of GOT entry of '*label*'
label **@got_lo**	Get lower 32-bit of the address of GOT entry of '*label*'
label **@gotoff_hi**	Get upper 32-bit of the relative address from GOT to '*label*'
label **@gotoff_lo**	Get lower 32-bit of the relative address from GOT to '*label*'
label **@plt_hi**	Get upper 32-bit of the address of PLT entry of '*label*'
label **@plt_lo**	Get lower 32-bit of the address of PLT entry of '*label*'

3.3 Instruction Mnemonics

This section describes the syntax of the instruction mnemonics.

3.3.1 List of Notations

Table 3-6 List notations used in the descriptions of the syntax of instruction mnemonics.

See also Chapter 5 of SX-Aurora TSUBASA Architecture Manual for details.

Table 3-6 List of Notations (operands)

Notation	Description
AS	Address syllable
ASX	Address syllable
HM	Address syllable for host memory
%sx, %sy, %sz	Scalar register
%vx, %vy, %vz	Vector register
%vm	Vector mask register
%vix	Vector index register
I	Immediate value (used for arithmetic operations) in the range from -64 to 63.

N	Immediate value (used for the number of shifts, element number, interelement distance, etc) in the range from 0 to 127.
M	(m)0 or (m)1 format is specified, m is an integer in the range from 0 to 63.
Z	Immediate value 0 (zero)

Some instructions can change their function when their mnemonics are followed by suffixes as Table 3-7.

Table 3-7 Lists of Notation (Mnemonic suffix)

Suffix	Description
df	Data format l: 64 bit integer w: 32 bit integer d: 64 bit floating point s: 32 bit floating point
ex	Extension sx: Sign extension zx or *NONE*: Zero extension
bp	Branch Prediction *NONE*: No branch prediction nt: Not taken t: Taken
cf	Condition Field af: Always false gt: Greater than lt: Less than ne: Not equal eq: Equal ge: Greater than or equal le: Less than or equal num: Is number nan: Is NaN (Not a number) gtnan: Greater than or NaN ltnan: Less then or NaN nenan: Not equal or NaN eqnan: Equal or NaN genan: Greater than equal or NaN lenan: Greater than equal or NaN at or *NONE*: Always true
rd	Rounding Mode *NONE*: According to PSW rz: Round toward Zero rp: Round toward Plus infinity

	rm: Round toward Minus infinity rn: Round to Nearest (ties to Even) ra: Round to Nearest (ties to Away)
nc	Not cached on ADB
ot	Overtake
nex	No Exception
pos	Position fst: First element lst: Last element

Table 3-8 Lits of notation (Description)

Operator	Description
M(A,B)	B-byte memory contents or location at the effective address given by the contents of A. B can be omitted, and in that case B is regarded as 1. Operation address, calculated by each fields of an instruction.
EA	Operation address, calculated by each fields of an instruction.
A[i:j]	from bit i to bit j of register A
A ← B	Storing (moving) of the contents of B into A.
Sx	Immediate value or S register designated by x field of instruction word.
Sy	Immediate value or S register designated by y
Sz	Immediate value or S register designated by z
mod(A, B)	The remainder of A divided by B
sext(A, B)	B-bit value is generated by expanding sign bit (Most significant bit) of A.
cond(A, B, C)	The result of comparison B and C in A condition. C can be omitted and in this case C is handled as 0. Refer to the chapter 5 for system interpretation of comparison condition
max(A, B)	Maximum value of A and B.
min(A, B)	Minimum value of A and B.

3.3.2 Instruction Set

This section lists the syntax and function of instruction mnemonics. See also Chapter 8 of SX-Aurora TSUBASA Architecture Manual for details.

Table 3-9 Transferring Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
LEA	**lea** %sx, ASX	Load Effective Address
06 / RM	**lea.sl** %sx, ASX	

LDS 01 / RM	**ld** %sx, ASX	Load S
LDU 02 / RM	**ldu** %sx, ASX	Load S Upper
LDL 03 / RM	**ldl**[.*ex*] %sx, ASX	Load S Lower
LD2B 04 / RM	**ld2b**[.*ex*] %sx, ASX	Load 2B
LD1B 05 / RM	**ld1b**[.*ex*] %sx, ASX	Load 1B
STS 11 / RM	**st** %sx, ASX	Store S
STU 12 / RM	**stu** %sx, ASX	Store S Upper
STL 13 / RM	**stl** %sx, ASX	Store S Lower
ST2B 14 / RM	**st2b** %sx, ASX	Store 2B
ST1B 15 / RM	**st1b** %sx, ASX	Store 1B
DLDS 09 / RM	**dld** %sx, ASX	Dismissable Load S
DLDU 0A / RM	**dldu** %sx, ASX	Dismissable Load Upper
DLDL 0B / RM	**dldl**[.*ex*] %sx, ASX	Dismissable Load Lower
PFCH 0C / RM	**pfch** ASX	Pre Fetch
CMOV 3B / RR	**cmov.***df*[**.***cf* **]** %sx, {%sz|M}, {%sy|I}	Conditional Move

Table 3-10 Fixed-Point Arithmetic Operation Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
ADD 48 / RR	**addu.l** %sx,{%sy|I}, {%sz|M} **addu.w** %sx,{%sy|I}, {%sz|M}	Add
ADS 4A / RR	**adds.w**[.*ex*] %sx, {%sy|I}, {%sz|M}	Add Single
ADX 59 / RR	**adds**. **l** %sx, {%sy|I}, {%sz|M}	Add
SUB 58 / RR	**subu.l** %sx, {%sy|I}, {%sz|M} **subu.w** %sx, {%sy|I},	Subtract

	{%sz|M}	
SBS 5A / RR	**subs.w**[.*ex*] %sx, {%sy|I}, {%sz|M}	Subtract Single
SBX 5B / RR	**subs.l** %sx, {%sy | I}, {%sz | M}	Subtract
MPY 49 / RR	**mulu.l** %sx, {%sy|I}, {%sz|M} **mulu.w** %sx, {%sy|I}, {%sz|M}	Multiply
MPS 4B / RR	**muls.w**[.*ex*] %sx, {%sy|I}, {%sz|M}	Multiply Single
MPX 6E / RR	**muls.l** %sx, {%sy|I}, {%sz|M}	Multiply
MPD 6B / RR	**muls.l.w** %sx, {%sy|I}, {%sz|M}	Multiply
DIV 6F / RR	**divu.l** %sx, {%sy|I}, {%sz|M} **divu.w** %sx, {%sy|I}, {%sz|M}	Divde
DVS 7B / RR	**divs.w**[.*ex*] %sx, {%sy|I}, {%sz|M}	Divide Single
DVX 7F / RR	**divs.l** %sx, {%sy|I}, {%sz|M}	Divide
CMP 55 / RR	**cmpu.l** %sx, {%sy|I}, {%sz|M} **cmpu.w** %sx, {%sy|I}, {%sz|M}	Compare
CPS 7A / RR	**cmps.w**[.*ex*] %sx, {%sy|I}, {%sz|M}	Compare Single
CPX 6A / RR	**cmps.l** %sx, {%sy|I}, {%sz|M}	Compare
CMS 78 / RR	**maxs.w**[.*ex*] %sx, {%sy|I}, {%sz|M} **mins.w**[.*ex*] %sx, {%sy|I}, {%sz|M}	Compare and Select Maximum/Mininum Single
CMX 68 / RR	**maxs.l** %sx, {%sy|I}, {%sz|M} **mins.l** %sx, {%sy|I}, {%sz|M}	Compare and Select Maximum/Minimum

Table 3-11 Logical Arithmetic Operation Instructions

Instruction Code/Format	**Assembler Mnemonic Syntax**	**Description**
AND 44 / RR	**and** %sx, {%sy|I}, {%sz|M}	AND

OR 45 / RR	**or** %sx, {%sy|I}, {%sz|M}	OR
XOR 46 / RR	**xor** %sx, {%sy|I}, {%sz|M}	Exclusive OR
EQV 47 / RR	**eqv** %sx, {%sy|I}, {%sz|M}	Equivalence
NND 54 / RR	**nnd** %sx, {%sy|I}, {%sz|M}	Negate AND
MRG 56 / RR	**mrg** %sx, {%sy|I}, {%sz|M}	Merge
LDZ 67 / RR	**ldz** %sx, {%sz|M}	Leading Zero Count
PCNT 38 / RR	**pcnt** %sx, {%sz|M}	Population Count
BRV 39 / RR	**brv** %sx, {%sz|M}	Bit Reverse

Table 3-12 Shift Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
SLL 65 / RR	**sll** %sx, {%sz|M}, {%sy|N}	Shift Left Logical
SLD 64 / RR	**sld** %sx, {%sz|M}, {%sy|N}	Shift Left Double
SRL 75 / RR	**srl** %sx, {%sz|M}, {%sy|N}	Shift Right Logical
SRD 74 / RR	**srd** %sx, {%sz|M}, {%sy|N}	Shift Right Double
SLA 66 / RR	**sla.w**[.*ex*] %sx, {%sz|M}, {%sy|N}	Shift Left Arithmetic
SLAX 57 / RR	**sla.l** %sx, {%sz|M}, {%sy|N}	Shift Left Arithmetic
SRA 76 / RR	**sra.w**[.*ex*] %sx, {%sz|M}, {%sy|N}	Shift Right Arithmetic
SRAX 77 / RR	**sra.l** %sx, {%sz|M}, {%sy|N}	Shift Right Arithmetic

Table 3-13 Floating-point Arithmetic Operation Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
FAD 4C / RR	**fadd.d** %sx, {%sy|I}, {%sz|M} **fadd.s** %sx, {%sy|I},	Floating Add

	{%sz|M}	
FSB	**fsub.d** %sx, {%sy|I},	Floating Subtract
5C / RR	{%sz|M}	
	fsub.s %sx, {%sy|I},	
	{%sz|M}	
FMP	**fmul.d** %sx, {%sy|I},	Floating Multiply
4D / RR	{%sz|M}	
	fmul.s %sx, {%sy|I},	
	{%sz|M}	
FDV	**fdiv.d** %sx, {%sy|I},	Floating Divide
5D / RR	{%sz|M}	
	fdiv.s %sx, {%sy|I},	
	{%sz|M}	
FCP	**fcmp.d** %sx, {%sy|I},	Floating Compare
7E / RR	{%sz|M}	
	fcmp.s %sx, {%sy|I},	
	{%sz|M}	
FCM	**fmax.d** %sx, {%sy|I},	Floating Compare and Select
3E / RR	{%sz|M}	Maximum/Minimum
	fmax.s %sx, {%sy|I},	
	{%sz|M}	
	fmin.d %sx, {%sy|I},	
	{%sz|M}	
	fmin.s %sx, {%sy|I},	
	{%sz|M}	
FAQ	**fadd.q** %sx, {%sy|I},	Floating Add Quadruple
6C / RR	{%sz|M}	
FSQ	**fsub.q** %sx, {%sy|I},	Floating Subtract Quadruple
7C / RR	{%sz|M}	
FMQ	**fmul.q** %sx, {%sy|I},	Floating Multiply Quadruple
6D / RR	{%sz|M}	
FCQ	**fcmp.q** %sx, {%sy|I},	Floating Compare Quadruple
7D / RR	{%sz|M}	
FIX	**cvt.w.d**[.*ex*][.*rd*] %sx,	Convert to Fixed Point
4E / RR	{%sy|I}	
	cvt.w.s[.*ex*][.*rd*] %sx,	
	{%sy|I}	
FIXX	**cvt.l.d**[.*rd*] %sx, {%sy|I}	Convert to Fixed Point
4F / RR		
FLT	**cvt.d.w** %sx, {%sy|I}	Convert to Floating Point
5E / RR	**cvt.s.w** %sx, {%sy|I}	
FLTX	**cvt.d.l** %sx, {%sy|I}	Convert to Floating Point
5F / RR		
CVD	**cvt.d.s** %sx, {%sy|I}	Convert to Double-format
0F / RR	**cvt.d.q** %sx, {%sy|I}	
CVS	**cvt.s.d** %sx, {%sy|I}	Convert to Single-format
1F / RR	**cvt.s.q** %sx, {%sy|I}	

CVQ 2D / RR	**cvt.q.d** %sx, {%sy|I} **cvt.q.s** %sx, {%sy|I}	Convert to Quadruple-format

Table 3-14 Branch Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
BC 19 / CF	**b[***cf***].l**[.bp] [{%sy | I},] AS	Branch on Condition If *cf* is “af” or “at”, %sz can be omitted. If *cf* is “at”, *cf* can be omitted.
BCS 1B / CF	**b[***cf***].w**[.bp] [{%sy | I},] AS	Branch on Condition Single If *cf* is “af” or “at”, %sz can be omitted. If *cf* is “at”, *cf* can be omitted.
BCF 1C / CF	**b[***cf***].d**[.bp] [{%sy | I},] AS **b[***cf***].s**[.bp] [{%sy | I},] AS	Branch on Condition Floating Point If *cf* is “af” or “at”, %sz can be omitted. If *cf* is “at”, *cf* can be omitted.
BCR 18 / CF	**br[***cf***].l**[.bp] {%sy|I}, {%sz | Z}, AS **br[***cf***].w**[.bp] {%sy|I}, {%sz | Z}, AS **br[***cf***].d**[.bp] {%sy|I}, {%sz | Z}, AS **br[***cf***].s**[.bp] {%sy|I}, {%sz | Z}, AS	Branch on Condition Relative If *cf* is “af” or “at”, both %sy and %sz can be omitted. If *cf* is “at”, *cf* can be omitted. "AS" is disp only. If "disp" of “AS” is label and suffix is set in "disp" of "AS", suffix is ignored.
BSIC 08 / RM	**bsic** %sx, ASX	Branch and Save IC

Table 3-15 Vector Transfer Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
VLD 81 / RVM	**vld**[*.nc*] {%vx | %vix}, {%sy | I}, {%sz | Z}	Vector Load
VLDU 82 / RVM	**vldu**[*.nc*] {%vx | %vix}, {%sy | I}, {%sz | Z}	Vector Load Upper
VLDL 83 / RVM	**vldl**[*.ex*][*.nc*] {%vx | %vix}, {%sy | I}, {%sz | Z}	Vector Load Lower
VLD2D	**vld2d**[*.nc*] {%vx | %vix},	Vector Load 2D

C1 / RVM	{%sy | I}, {%sz | Z}	
VLDU2D	**vldu2d**[.*nc*] {%vx | %vix},	Vector Load Upper 2D
C2 / RVM	{%sy | I}, {%sz | Z}	
VLDL2D	**vldl2d**[.*ex*][.*nc*] {%vx	Vector Load Lower 2D
C3 / RVM	| %vix}, {%sy | I}, {%sz | Z}	
VST	**vst**[.*nc*][.*ot*] {%vx | %vix},	Vector Store
91 / RVM	{%sy | I}, {%sz | Z} [, %vm]	
VSTU	**vstu**[.*nc*][.*ot*] {%vx	Vector Store Upper
92 / RVM	| %vix}, {%sy | I}, {%sz | Z} [, %vm]	
VSTL	**vstl**[.*nc*][.*ot*] {%vx	Vector Store Lower
93 / RVM	| %vix}, {%sy | I}, {%sz | Z} [, %vm]	
VST2D	**vst2d**[.*nc*][.*ot*] {%vx	Vector Store 2D
D1 / RVM	| %vix}, {%sy | I}, {%sz | Z} [, %vm]	
VSTU2D	**vstu2d**[.*nc*][.*ot*] {%vx	Vector Store Upper 2D
D2 / RVM	| %vix}, {%sy | I}, {%sz | Z} [, %vm]	
VSTL2D	**vstl2d**[.*nc*][.*ot*] {%vx	Vector Store Lower 2D
D3 / RVM	| %vix}, {%sy | I}, {%sz | Z} [, %vm]	
PFCHV	**pfchv**[.*nc*] {%sy | I}, {%sz	Pre Fetch Vector
80 / RVM	| Z}	
LSV	**lsv** {%vx | %vix}({%sy	Load S to V
8E / RR	|N}), {%sz | M}	
LVS	**lvs** %sx, {%vx	Load V to S
9E / RR	| %vix}({%sy | N})	
LVM	**lvm** %vmx, {%sy | N},	Load VM
B7 / RR	{%sz | M}	
		`N = 0 - 3`
SVM	**svm** %sx, %vmz, {%sy |	Save VM
A7 / RR	N}	
		`N = 0 - 3`
VBRD	**vbrd** {%vx | %vix}, {%sy |	Vector Broadcast
8C / RV	I} [, %vm]	
	vbrdl {%vx | %vix}, {%sy	
	| I} [, %vm]	
	vbrdu {%vx | %vix}, {%sy	
	| I} [, %vm]	
	pvbrd {%vx | %vix}, {%sy	
	| I} [, %vm]	
VMV	**vmv** {%vx | %vix}, {%sy |	Vector Move
9C / RV	N}, {%vz | %vix} [, %vm]	

Table 3-16 Vector Fixed-Point Arithmetic Operation Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
VADD C8 / RV	**vaddu**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvaddu.lo** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvaddu.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvaddu** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Add
VADS CA / RV	**vadds.w**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvadds.lo**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvadds.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvadds** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Add Single
VADX 8B / RV	**vadds.l** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Add
VSUB D8 / RV	**vsubu.***df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvsubu.lo** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvsubu.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvsubu** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Subtract
VSBS DA / RV	**vsubs.w**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy	Vector Subtract Single

	| I}, {%vz | %vix} [, %vm]	
	pvsubs.lo[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	
	pvsubs.up {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	
	pvsubs {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	
VSBX 9B / RV	**vsubs.l** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Subtract
VMPY C9 / RV	**vmulu.***df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Multiply
VMPS CB / RV	**vmuls.w**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Multiply Single
VMPX DB / RV	**vmuls.l** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Multiply
VMPD D9 / RV	**vmuls.l.w** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [,%vm]	Vector Multiply
VDIV E9 / RV	**vdivu**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix | %sy | I} [, %vm]	Vector Divide
VDVS EB / RV	**vdivs.w**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix | %sy | I} [,%vm]	Vector Divide Single
VDVX FB / RV	**vdivs.l** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix | %sy | I} [, %vm]	Vector Divide
VCMP B9 / RV	**vcmpu**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Compare
	pvcmpu.lo {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	
	pvcmpu.up {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	
	pvcmpu {%vx | %vix},	

	{%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	
VCPS FA / RV	**vcmps.w**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvcmps.lo**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvcmps.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvcmps** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Compare Single
VCPX BA / RV	**vcmps.l** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Compare
VCMS 8A / RV	**vmaxs.w**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvmaxs.lo**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvmaxs.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvmaxs** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **vmins.w**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvmins.lo**[.*ex*] {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvmins.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvmins** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Compare and Select Maximum/Minimum Single
VCMX 9A / RV	**vmaxs.l** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **vmins.l** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Compare and Select Maximum/Minimum

Table 3-17 Vector Logical Arithmetic Operation Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
VAND C4 / RV	**vand** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvand.lo** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvand.up** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvand** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm]	Vector AND
VOR C5 / RV	**vor** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvor.lo** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvor.up** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvor** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm]	Vector OR
VXOR C6 / RV	**vxor** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvxor.lo** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvxor.up** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pvxor** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm]	Vector Exclusive OR
VEQV C7 / RV	**veqv** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pveqv.lo** {%vx | %vix}, {%vy | %vix | %sy | M},	Vector Equivalence

	{%vz | %vix} [, %vm] **pveqv.up** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm] **pveqv** {%vx | %vix}, {%vy | %vix | %sy | M}, {%vz | %vix} [, %vm]	
VLDZ E7 / RV	**vldz** {%vx | %vix}, {%vz | %vix} [, %vm] **pvldz.lo** {%vx | %vix}, {%vz | %vix} [, %vm] **pvldz.up** {%vx | %vix}, {%vz | %vix} [, %vm] **pvldz** {%vx | %vix}, {%vz | %vix} [, %vm]	Vector Leading Zero Count
VPCNT AC / RV	**vpcnt** {%vx | %vix}, {%vz | %vix} [, %vm] **pvpcnt.lo** {%vx | %vix}, {%vz | %vix} [, %vm] **pvpcnt.up** {%vx | %vix}, {%vz | %vix} [, %vm] **pvpcnt** {%vx | %vix}, {%vz | %vix} [, %vm]	Vector Population Count
VBRV F7 / RV	**vbrv** {%vx | %vix}, {%vz | %vix} [, %vm] **pvbrv.lo** {%vx | %vix}, {%vz | %vix} [, %vm] **pvbrv.up** {%vx | %vix}, {%vz | %vix} [, %vm] **pvbrv** {%vx | %vix}, {%vz | %vix} [, %vm]	Vector Bit Reverse
VSEQ 99 / RV	**vseq** {%vx | %vix} [, %vm] **pvseq.lo** {%vx | %vix} [, %vm] **pvseq.up** {%vx | %vix} [, %vm] **pvseq** {%vx | %vix} [, %vm]	Vector Sequential Number

Table 3-18 Vector Shift Instructions

Instruction Code/Format	**Assembler Mnemonic Syntax**	**Description**
VSLL E5 / RV	**vsll** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy	Vector Shift Left Logical

	| N} [, %vm] **pvsll.lo** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm] **pvsll.up** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy} [, %vm] **pvsll** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy} [, %vm]	
VSLD E4 / RV	**vsld** {%vx | %vix}, ({%vy | %vix}, {%vz | %vix}), {%sy | N} [, %vm]	Vector Shift Left Double
VSRL F5 / RV	**vsrl** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm] **pvsrl.lo** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm] **pvsrl.up** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy} [, %vm] **pvsrl** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy} [, %vm]	Vector Shift Right Logical
VSRD F4 / RV	**vsrd** {%vx | %vix}, ({%vy | %vix}, {%vz | %vix}), {%sy | N} [, %vm]	Vector Shift Right Double
VSLA E6 / RV	**vsla.w**[.*ex*] {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm] **pvsla.lo**[.*ex*] {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm] **pvsla.up** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy} [, %vm] **pvsla** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy} [, %vm]	Vector Shift Left Arighmetic
VSLAX D4 / RV	**vsla.l** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm]	Vector Shift Left Arithmetic
VSRA F6 / RV	**vsra.w**[.*ex*] {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm]	Vector Shift Right Arithmetic

	pvsra.lo[.*ex*] {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm] **pvsra.up** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy} [, %vm] **pvsra** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy} [, %vm]	
VSRAX D5 / RV	**vsra.l** {%vx | %vix}, {%vz | %vix}, {%vy | %vix | %sy | N} [, %vm]	Vector Shift Right Arithmetic
VSFA D7 / RV	**vsfa** {%vx | %vix}, {%vz | %vix}, {%sy | N}, {%sz | M} [, %vm]	Vector Shift Left and Add

Table 3-19 Vector Floating-Point Operation Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
VFAD CC / RV	**vfadd**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfadd.lo** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfadd.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfadd** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Floating Add
VFSB DC / RV	**vfsub**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfsub.lo** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfsub.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfsub** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Floating Subtract
VFMP	**vfmul**.*df* {%vx | %vix},	Vector Floating Multiply

CD / RV	{%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfmul.lo** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfmul.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfmul** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	
VFDV DD / RV	**vfdiv**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix | %sy | I} [, %vm]	Vector Floating Divide
VFSQRT ED / RV	**vfsqrt**.*df* {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Floating Square Root
VFCP FC / RV	**vfcmp**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfcmp.lo** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfcmp.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfcmp** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Floating Compare
VFCM BD / RV	**vfmax**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfmax.lo** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfmax.up** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfmax** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **vfmin**.*df* {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfmin.lo** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Floating Compare and Select Maximum/Minimum

	pvfmin.up {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **pvfmin** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	
VFMAD E2 / RV	**vfmad**.*df* {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} }| { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfmad.lo** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfmad.up** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix} , {%sy | I} } }, {%vw | %vix} [, %vm] **pvfmad** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } |{ {%sy | I}, {%vz | %vix} }| { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm]	
VFMSB F2 / RV	**vfmsb**.*df* {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfmsb.lo** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfmsb.up** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } },	Vector Floating Fused Multiply Add Vector Floating Fused Multiply Subtract

	{%vw | %vix} [, %vm] **pvfmsb** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm]	
VFNMAD E3 / RV	**vfnmad**.*df* {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfnmad.lo** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfnmad.up** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfnmad** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm]	Vector Floating Fused Negative Multiply Add
VFNMSB F3 / RV	**vfnmsb**.*df* {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfnmsb.lo** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfnmsb.up** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy	Vector Floating Fused Negative Multiply Subtract

	| %vix}, {%sy | I} } }, {%vw | %vix} [, %vm] **pvfnmsb** {%vx | %vix}, { { {%vy | %vix}, {%vz | %vix} } | { {%sy | I}, {%vz | %vix} } | { {%vy | %vix}, {%sy | I} } }, {%vw | %vix} [, %vm]	
VRCP E1 / RV	**vrcp**.*df* {%vx | %vix}, {%vy | %vix} [, %vm] **pvrcp.lo** {%vx | %vix}, {%vy | %vix} [, %vm] **pvrcp.up** {%vx | %vix}, {%vy | %vix} [, %vm] **pvrcp** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Floating Reciprocal
VRSQRT F1 / RV	**vrsqrt**.*df*[.*nex*] {%vx | %vix}, {%vy | %vix} [, %vm] **pvrsqrt.lo**[.*nex*] {%vx | %vix}, {%vy | %vix} [, %vm] **pvrsqrt.up**[.*nex*] {%vx | %vix}, {%vy | %vix} [, %vm] **pvrsqrt**[.*nex*] {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Floating Reciprocal Square Root
VFIX E8 / RV	**vcvt.w**.*df*[.*ex*][.*rd*] {%vx | %vix}, {%vy | %vix} [, %vm] **pvcvt.w.s.lo**[.*rd*] {%vx | %vix}, {%vy | %vix} [, %vm] **pvcvt.w.s.up**[.*rd*] {%vx | %vix}, {%vy | %vix} [, %vm] **pvcvt.w.s**[.*rd*] {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Convert to Fixed Point
VFIXX A8 / RV	**vcvt.l.d[***.rd***]** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Convert to Fixed Point
VFLT F8 / RV	**vcvt**.*df*.**w** {%vx | %vix}, {%vy | %vix} [, %vm] **pvcvt.s.w.lo** {%vx | %vix}, {%vy | %vix} [, %vm] **pvcvt.s.w.up** {%vx	Vector Convert to Floating Point

	| %vix}, {%vy | %vix} [, %vm]	
	pvcvt.s.w {%vx | %vix}, {%vy | %vix} [, %vm]	
VFLTX B8 / RV	**vcvt.d.l** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Convert to Floating Point
VCVD 8F / RV	**vcvt.d.s** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Convert to Single-Format
VCVS 9F / RV	**vcvt.s.d** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Convert to Double-Format

Table 3-20 Vector Mask Arithmetic Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
VMRG D6 / RV	**vmrg** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **vmrg.l** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm] **vmrg.w** {%vx | %vix}, {%vy | %vix | %sy | I}, {%vz | %vix} [, %vm]	Vector Merge
VSHF BC / RV	**vshf** {%vx | %vix}, {%vy | %vix}, {%vz | %vix}, {%sy | N}	Vector Shuffle `N = 0 - 15`
VCP 8D / RV	**vcp** {%vx | %vix}, {%vz | %vix}[, %vm]	Vector Compress
VEX 9D / RV	**vex** {%vx | %vix}, {%vz | %vix}[, %vm]	Vector Expand
VFMK B4 / RV	**vfmk.l**.*cf* %vmx, {%vz | %vix} [, %vm]	Vector Form Mask If *cf* is “af” or “at”, %vz can be omitted. If *cf* is “at”, *cf* can be omitted.
VFMS B5 / RV	**vfmk.w**.*cf* %vmx, {%vz | %vix} [, %vm] **pvfmk.w.lo**.*cf* %vmx, {%vz | %vix} [, %vm] **pvfmk.w.up**.*cf* %vmx, {%vz | %vix} [, %vm]	Vector Form Mask Single If *cf* is “af” or “at”, %vz can be omitted. If *cf* is “at”, *cf* can be omitted.
VFMF B6 / RV	**vfmk**.*df*.*cf* %vmx, {%vz | %vix} [, %vm] **pvfmk.s.lo**.*cf* %vmx, {%vz | %vix} [, %vm]	Vector Form Mask Floating Point If *cf* is “af” or “at”, %vz can be omitted.

	pvfmk.s.up.*cf* %vmx, {%vz | %vix} [, %vm]	If *cf* is "at", *cf* can be omitted.

Table 3-21 Vector Recursive Relation Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
VSUMS EA / RV	**vsum.w**[.*ex*] {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Sum Single
VSUMX AA / RV	**vsum.l** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Sum
VFSUM EC / RV	**vfsum**.*df* {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Floating Sum
VMAXS BB / RV	**vrmaxs.w**.*pos*[.*ex*] {%vx | %vix}, {%vy | %vix} [, %vm] **vrmins.w**.*pos*[.*ex*] {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Maximum/Minimum Single
VMAXX AB / RV	**vrmaxs.l**.*pos* {%vx | %vix}, {%vy | %vix} [, %vm] **vrmins.l**.*pos* {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Maximum/Minimum
VFMAX AD / RV	**vfrmax**.*df*.*pos* {%vx | %vix}, {%vy | %vix} [, %vm] **vfrmin**.*df*.*pos* {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Floating Maximum/Minimum
VRAND 88 / RV	**vrand** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Reduction AND
VROR 98 / RV	**vror** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Reduction OR
VRXOR 89 / RV	**vrxor** {%vx | %vix}, {%vy | %vix} [, %vm]	Vector Reduction Exclusive OR
VFIA CE / RV	**vfia**.*df* {%vx | %vix}, {%vy | %vix}, {%sy | I}	Vector Floating Iteration Add
VFIS DE / RV	**vfis**.*df* {%vx | %vix}, {%vy | %vix}, {%sy | I}	Vector Floating Iteration Subtract
VFIM CF / RV	**vfim**.*df* {%vx | %vix}, {%vy | %vix}, {%sy | I}	Vector Floating Iteration Multiply
VFIAM EE / RV	**vfiam**.*df* {%vx | %vix}, {%vy | %vix}, {%vz	Vector Floating Iteration Add and Multiply

	| %vix}, {%sy | I}	
VFISM FE / RV	**vfism**.*df* {%vx | %vix}, {%vy | %vix}, {%vz | %vix}, {%sy | I}	Vector Floating Iteration Subtract and Multiply
VFIMA EF / RV	**vfima**.*df* {%vx | %vix}, {%vy | %vix}, {%vz | %vix}, {%sy | I}	Vector Floating Iteration Multiply and Add
VFIMS FF / RV	**vfims**.*df* {%vx | %vix}, {%vy | %vix}, {%vz | %vix}, {%sy | I}	Vector Floating Iteration Multiply and Subtract

Table 3-22 Vector Gatering/Scattering Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
VGT A1 / RVM	**vgt**[.{nc}] {%vx | %vix}, {%vy | %vix | %sw}, {%sy | I}, {%sz | Z} [,%vm]	Vector Gather
VGTU A2 / RVM	**vgtu**[.{nc}] {%vx | %vix}, {%vy | %vix | %sw}, {%sy | I}, {%sz | Z} [,%vm]	Vector Gather Upper
VGTL A3 / RVM	**vgtl**[.*ex*][.{nc}] {%vx | %vix}, {%vy | %vix | %sw}, {%sy | I}, {%sz | Z} [,%vm]	Vector Gather Lower
VSC B1 / RVM	**vsc**[.*nc*][.*ot*] {%vx | %vix}, {%vy | %vix | %sw}, {%sy | I}, {%sz | Z} [, %vm]	Vector Scatter
VSCU B2 / RVM	**vscu**[.*nc*][.*ot*] {%vx | %vix}, {%vy | %vix | %sw}, {%sy | I}, {%sz | Z} [, %vm]	Vector Scatter Upper
VSCL B3 / RVM	**vscl**[.*nc*][.*ot*] {%vx | %vix}, {%vy | %vix | %sw}, {%sy | I}, {%sz | Z} [, %vm]	Vector Scatter Lower

Table 3-23 Vector Mask Register Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
ANDM 84 / RV	**andm** %vmx, %vmy, %vmz	AND VM
ORM 85 / RV	**orm** %vmx, %vmy, %vmz	OR VM
XORM 86 / RV	**xorm** %vmx, %vmy, %vmz	Exclusive OR VM

EQVM 87 / RV	**eqvm** %vmx, %vmy, %vmz	Equivalence VM
NNDM 94 / RV	**nndm** %vmx, %vmy, %vmz	Negate AND VM
NEGM 95 / RV	**negm** %vmx, %vmy	Negate VM
PCVM A4 / RV	**pcvm** %sx, %vmy	Population Count of VM
LZVM A5 / RV	**lzvm** %sx, %vmy	Leading Zero of VM
TOVM A6 / RV	**tovm** %sx, %vmy	Trailing One of VM

Table 3-24 Vector Control Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
LVL BF / RR	**lvl** {%sy | I}	Load VL
SVL 2F / RR	**svl** %sx	Save VL
SMVL 2E / RR	**smvl** %sx	Save Maximum Vector Length
LVIX AF / RR	**lvix** {%sy | N}	Load Vector Data Index N = 0 - 63

Table 3-25 Control Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
SIC 28 / RR	**sic** %sx	Save Instruction Counter
LPM 3A / RR	**lpm** %sy	Load Program Mode Flags
SPM 2A / RR	**spm** %sx	Save Program Mode Flags
LFR 69 / RR	**lfr {**%sy | N}	Load Flag Register N = 0 - 63
SFR 29 / RR	**sfr** %sx	Safe Flag Register
SMIR 22 / RR	**smir** %sx, I **smir** %sx, %usrcc **smir** %sx, %psw	Save Miscellaneous Register I = 0 - 2, 7 - 11, 16 - 30

	smir %sx, %sar	`MM = 0 - 3`
	smir %sx, %pmmr	`NN = 0 - 14`
	smir %sx, %pmcrMM	
	smir %sx, %pmcNN	
NOP	**nop**	No Operation
79 / RR		
MONC	**monc** [N, N, N]	Monitor Call
3F / RR	**monc.hdb** [N, N, N]	
		`2nd and 3rd operand : N = 0 - 255`
LCR	**lcr** %sx, {%sy|I}, {%sz|Z}	Load Communication Register
40 / RR		
SCR	**scr** %sx, {%sy|I}, {%sz|Z}	Store Communication Register
50 / RR		
TSCR	**tscr** %sx, {%sy|I}, {%sz|Z}	Test and Set Communication Register
41 / RR		
FIDCR	**fidcr** %sx, {%sy|I}, I	Fetch and Increment/Decrement CR
51 / RR		
		`3rd operand : N = 0 - 7`
TS1AM	**ts1am.l** %sx, {%sz | AS},	Test and Set 1 AM
42 / RRM	{%sy|N}	
	ts1am.w %sx, {%sz | AS}, {%sy|N}	
TS2AM	**ts2am** %sx, {%sz | AS},	Test and Set 2 AM
43 / RRM	{%sy|N}	
TS3AM	**ts3am** %sx, {%sz | AS},	Test and Set 3 AM
52 / RRM	{%sy|N}	
		`N = 0 or 1`
ATMAM	**atmam** %sx, {%sz | AS},	Atomic AM
53 / RRM	{%sy|N}	
		`N = 0 - 2`
CAS	**cas.l** %sx, {%sz | AS},	Compare and Swap
62 / RRM	{%sy|I}	
	cas.w %sx, {%sz | AS}, {%sy|I}	
FENCE	**fencei**	Fence
20 / RR	**fencem** I	
	fencec I	`fencem : I = 1 - 3`
		`Fencec : I = 1 - 7`
SVOB	**svob**	Set Vector Out-of-order memory
30 / RR		access Boundary
BSWP	**bswp** %sx, {%sz | M}, I	Byte Swap
2B / RR		
		I = 0 or 1

Table 3-26 Host Memory Access Instructions

Instruction Code/Format	Assembler Mnemonic Syntax	Description
LHM	**lhm.b** %sx, HM	Load Host Memory
21 / RRM	**lhm.h** %sx, HM	
	lhm.w %sx, HM	
	lhm.l %sx, HM	
SHM	**shm.b** %sx, HM	Store Host Memory
31 / RRM	**shm.h** %sx, HM	
	shm.w %sx, HM	
	shm.l %sx, HM	

Appendix A History

A.1 History table

Nov. 2018	Rev. 1	Create a new entry
Apr. 2018	Rev.1.1	Revise
Dec. 2018	Rev.1.2	Revise

A.2 Change notes

The following changes are done in this edition.

- The design of document is changed.