BFMLAL (multiple and single vector)

Multi-vector BFloat16 floating-point multiply-add long by vector

This BFloat16 floating-point multiply-add long instruction widens all 16-bit BFloat16 elements in the one, two, or four first source vectors and the second source vector to single-precision format, then multiplies the corresponding elements and destructively adds these values without intermediate rounding to the overlapping 32-bit single-precision elements of the ZA double-vector groups. The lowest of the two consecutive vector numbers forming the double-vector group within all of, each half of, or each quarter of the ZA array are selected by the sum of the vector select register and immediate offset, modulo all, half, or quarter the number of ZA array vectors.

The vector group symbol, VGx2 or VGx4, indicates that the ZA operand consists of two or four ZA double-vector groups respectively. The vector group symbol is preferred for disassembly, but optional in assembler source code.

This instruction follows SME ZA-targeting floating-point behaviors.

This instruction is unpredicated.

It has encodings from 3 classes: One ZA double-vector , Two ZA double-vectors and Four ZA double-vectors

One ZA double-vector
(FEAT_SME2)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	0	0	0	0	0	1	0	0	1	0	Zm				0	Rv		0	1	1	Zn					1	0	off3		
																												S			

BFMLAL ZA.S[<Wv>, <offs1>:<offs2>], <Zn>.H, <Zm>.H

```
if !HaveSME2() then UNDEFINED;
integer v = UInt('010':Rv);
integer n = UInt(Zn);
integer m = UInt('0':Zm);
integer offset = UInt(off3:'0');
boolean sub_op = FALSE;
constant integer nreg = 1;
```

Two ZA double-vectors
(FEAT_SME2)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	0	0	0	0	0	1	0	0	1	0	Zm				0	Rv		0	1	0	Zn					1	0	0	off2	
																												S			

BFMLAL ZA.S[<Wv>, <offs1>:<offs2>{, VGx2}], { <Zn1>.H-<Zn2>.H }, <Zm>

```
if !HaveSME2() then UNDEFINED;
integer v = UInt('010':Rv);
integer n = UInt(Zn);
integer m = UInt('0':Zm);
integer offset = UInt(off2:'0');
boolean sub_op = FALSE;
constant integer nreg = 2;
```

Four ZA double-vectors
(FEAT_SME2)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	0	0	0	0	0	1	0	0	1	1	Zm				0	Rv		0	1	0	Zn					1	0	0	off2	
																												S			

BFMLAL ZA.S[<Wv>, <offs1>:<offs2>{, VGx4}], { <Zn1>.H-<Zn4>.H }, <Zm>

```
if !HaveSME2() then UNDEFINED;
integer v = UInt('010':Rv);
integer n = UInt(Zn);
integer m = UInt('0':Zm);
integer offset = UInt(off2:'0');
boolean sub_op = FALSE;
constant integer nreg = 4;
```

Assembler Symbols

<Wv>	Is the 32-bit name of the vector select register W8-W11, encoded in the "Rv" field.
<offs1>	For the one ZA double-vector variant: is the vector select offset, pointing to first of two consecutive vectors, encoded as "off3" field times 2. For the four ZA double-vectors and two ZA double-vectors variant: is the vector select offset, pointing to first of two consecutive vectors, encoded as "off2" field times 2.
<offs2>	For the one ZA double-vector variant: is the vector select offset, pointing to last of two consecutive vectors, encoded as "off3" field times 2 plus 1. For the four ZA double-vectors and two ZA double-vectors variant: is the vector select offset, pointing to last of two consecutive vectors, encoded as "off2" field times 2 plus 1.
<Zn>	Is the name of the first source scalable vector register, encoded in the "Zn" field.
<Zn1>	Is the name of the first scalable vector register of a multi-vector sequence, encoded as "Zn".
<Zn4>	Is the name of the fourth scalable vector register of a multi-vector sequence, encoded as "Zn" plus 3 modulo 32.

<Zn2>	Is the name of the second scalable vector register of a multi-vector sequence, encoded as "Zn" plus 1 modulo 32.
<Zm>	Is the name of the second source scalable vector register Z0-Z15, encoded in the "Zm" field.

Operation

```
CheckStreamingSVEAndZAEnabled();
constant integer VL = CurrentVL;
constant integer elements = VL DIV 32;
integer vectors = VL DIV 8;
integer vstride = vectors DIV nreg;
bits(32) vbase = X[v, 32];
integer vec = (UInt(vbase) + offset) MOD vstride;
bits(VL) result;
vec = vec - (vec MOD 2);

for r = 0 to nreg-1
    bits(VL) operand1 = Z[(n+r) MOD 32, VL];
    bits(VL) operand2 = Z[m, VL];
    for i = 0 to 1
        bits(VL) operand3 = ZAvector[vec + i, VL];
        for e = 0 to elements-1
            bits(16) element1 = Elem[operand1, 2 * e + i, 16];
            bits(16) element2 = Elem[operand2, 2 * e + i, 16];
            bits(32) element3 = Elem[operand3, e, 32];
            if sub_op then element1 = BFNeg(element1);
            Elem[result, e, 32] = BFMulAddH_ZA(element3, element1, elem
        ZAvector[vec + i, VL] = result;
    vec = vec + vstride;
```


Internal version only: isa v33.64, AdvSIMD v29.12, pseudocode no_diffs_2023_09_RC2, sve v2023-06_rel ; Build timestamp: 2023-09-18T17:56