FP32-to-int8 Ranged Clip Instructions (Xsfvfnrclipxfqf) Extension Specification

Version 1.0

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Proprietary Notice

Revision History

Version	Date	Changes
1.0	September 7, 2023	• Initial release

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Xsfvfnrclipxfqf Extension: FP32-to-int8 Ranged Clip Instructions

This document defines the SiFive custom Xsfvfnrclipxfqf extension, which provides support for FP32-to-int8 Ranged Clip Instructions. These instructions convert an FP32 number to a signed or unsigned 8-bit integer, clipping the result to a range specified by a scalar register.

```
sf.vfnrclip.xu.f.qf vd, vs2, rs1   # unsigned; funct6=100010
sf.vfnrclip.x.f.qf  vd, vs2, rs1   # signed;   funct6=100011
```

These instructions are reserved if SEW!=8. `vs2` holds the input FP32 vector and has EMUL=LMUL*4 and EEW=SEW*4. `vd` holds the int8 result and has EMUL=LMUL and EEW=SEW. Standard overlap constraints for narrowing instructions apply.

`f[rs1]` holds the bounds within which to clip the results, with the lower bound specified as an 8-bit integer in bits 15:8 of `f[rs1]`, and the upper bound specified as an 8-bit integer in bits 7:0.

These bounds are of the same signedness as the result. Result element *i* is given by the expression `max(f[rs1][15:8], min(round(vs2[i]), f[rs1][7:0]))`, rounding according to the dynamic floating-point rounding mode, `frm`.

> **Note**
>
> By implication, if the lower bound is greater than the upper bound, the result always equals the lower bound.

> **Note**
>
> The lower bound is sometimes statically known to be zero. Placing the upper bound in the lower bits of rs1, while less intuitive, reduces instruction count in this case.

These instructions are encoded similarly to other vector instructions, but within the `custom-2` major opcode, with `funct3`=5 (OPFVF), and with `funct6` as specified above.

No floating-point exception flags are generated by this operation and `vxsat` is never asserted.

1.1 C Intrinsics

A full list of C intrinsics compatible with `Xsfvfnrclipxfqf` are provided below:

```
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_i8mf8(vfloat32mf2_t vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_i8mf4(vfloat32m1_t vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_i8mf2(vfloat32m2_t vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_i8m1(vfloat32m4_t vs2, float rs1, size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_i8m2(vfloat32m8_t vs2, float rs1, size_t vl)
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_i8mf8_m(vbool64_t mask, vfloat32mf2_t vs2, float rs1,
size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_i8mf4_m(vbool32_t mask, vfloat32m1_t vs2, float rs1,
size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_i8mf2_m(vbool16_t mask, vfloat32m2_t vs2, float rs1,
size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_i8m1_m(vbool8_t mask, vfloat32m4_t vs2, float rs1, size_t
vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_i8m2_m(vbool4_t mask, vfloat32m8_t vs2, float rs1, size_t
vl)

vint8mf8_t __riscv_sf_vfnrclip_x_f_qf(vfloat32mf2_t vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf(vfloat32m1_t vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf(vfloat32m2_t vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf(vfloat32m4_t vs2, float rs1, size_t vl)
```

```
vint8m2_t __riscv_sf_vfnrclip_x_f_qf(vfloat32m8_t vs2, float rs1, size_t vl)
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf(vbool64_t mask, vfloat32mf2_t vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf(vbool32_t mask, vfloat32m1_t vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf(vbool16_t mask, vfloat32m2_t vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf(vbool8_t mask, vfloat32m4_t vs2, float rs1, size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf(vbool4_t mask, vfloat32m8_t vs2, float rs1, size_t vl)

vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_i8mf8_tu(vint8mf8_t maskedoff, vfloat32mf2_t vs2, float
rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_i8mf4_tu(vint8mf4_t maskedoff, vfloat32m1_t vs2, float
rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_i8mf2_tu(vint8mf2_t maskedoff, vfloat32m2_t vs2, float
rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_i8m1_tu(vint8m1_t maskedoff, vfloat32m4_t vs2, float rs1,
size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_i8m2_tu(vint8m2_t maskedoff, vfloat32m8_t vs2, float rs1,
size_t vl)
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_i8mf8_tum(vbool64_t mask, vint8mf8_t maskedoff,
vfloat32mf2_t vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_i8mf4_tum(vbool32_t mask, vint8mf4_t maskedoff,
vfloat32m1_t vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_i8mf2_tum(vbool16_t mask, vint8mf2_t maskedoff,
vfloat32m2_t vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_i8m1_tum(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t
vs2, float rs1, size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_i8m2_tum(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t
vs2, float rs1, size_t vl)
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_i8mf8_tumu(vbool64_t mask, vint8mf8_t maskedoff,
vfloat32mf2_t vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_i8mf4_tumu(vbool32_t mask, vint8mf4_t maskedoff,
vfloat32m1_t vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_i8mf2_tumu(vbool16_t mask, vint8mf2_t maskedoff,
vfloat32m2_t vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_i8m1_tumu(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t
vs2, float rs1, size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_i8m2_tumu(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t
vs2, float rs1, size_t vl)
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_i8mf8_mu(vbool64_t mask, vint8mf8_t maskedoff,
vfloat32mf2_t vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_i8mf4_mu(vbool32_t mask, vint8mf4_t maskedoff,
vfloat32m1_t vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_i8mf2_mu(vbool16_t mask, vint8mf2_t maskedoff,
vfloat32m2_t vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_i8m1_mu(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t
vs2, float rs1, size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_i8m2_mu(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t
vs2, float rs1, size_t vl)

vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_tu(vint8mf8_t maskedoff, vfloat32mf2_t vs2, float rs1,
size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_tu(vint8mf4_t maskedoff, vfloat32m1_t vs2, float rs1,
size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_tu(vint8mf2_t maskedoff, vfloat32m2_t vs2, float rs1,
size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_tu(vint8m1_t maskedoff, vfloat32m4_t vs2, float rs1,
size_t vl)
```

```
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_tu(vint8m2_t maskedoff, vfloat32m8_t vs2, float rs1,
size_t vl)
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_tum(vbool64_t mask, vint8mf8_t maskedoff, vfloat32mf2_t
vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_tum(vbool32_t mask, vint8mf4_t maskedoff, vfloat32m1_t
vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_tum(vbool16_t mask, vint8mf2_t maskedoff, vfloat32m2_t
vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_tum(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t vs2,
float rs1, size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_tum(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t vs2,
float rs1, size_t vl)
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_tumu(vbool64_t mask, vint8mf8_t maskedoff, vfloat32mf2_t
vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_tumu(vbool32_t mask, vint8mf4_t maskedoff, vfloat32m1_t
vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_tumu(vbool16_t mask, vint8mf2_t maskedoff, vfloat32m2_t
vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_tumu(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t vs2,
float rs1, size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_tumu(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t vs2,
float rs1, size_t vl)
vint8mf8_t __riscv_sf_vfnrclip_x_f_qf_mu(vbool64_t mask, vint8mf8_t maskedoff, vfloat32mf2_t
vs2, float rs1, size_t vl)
vint8mf4_t __riscv_sf_vfnrclip_x_f_qf_mu(vbool32_t mask, vint8mf4_t maskedoff, vfloat32m1_t
vs2, float rs1, size_t vl)
vint8mf2_t __riscv_sf_vfnrclip_x_f_qf_mu(vbool16_t mask, vint8mf2_t maskedoff, vfloat32m2_t
vs2, float rs1, size_t vl)
vint8m1_t __riscv_sf_vfnrclip_x_f_qf_mu(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t vs2,
float rs1, size_t vl)
vint8m2_t __riscv_sf_vfnrclip_x_f_qf_mu(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t vs2,
float rs1, size_t vl)

vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_u8mf8(vfloat32mf2_t vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_u8mf4(vfloat32m1_t vs2, float rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_u8mf2(vfloat32m2_t vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_u8m1(vfloat32m4_t vs2, float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_u8m2(vfloat32m8_t vs2, float rs1, size_t vl)
vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_u8mf8_m(vbool64_t mask, vfloat32mf2_t vs2, float rs1,
size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_u8mf4_m(vbool32_t mask, vfloat32m1_t vs2, float rs1,
size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_u8mf2_m(vbool16_t mask, vfloat32m2_t vs2, float rs1,
size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_u8m1_m(vbool8_t mask, vfloat32m4_t vs2, float rs1,
size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_u8m2_m(vbool4_t mask, vfloat32m8_t vs2, float rs1,
size_t vl)

vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf(vfloat32mf2_t vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf(vfloat32m1_t vs2, float rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf(vfloat32m2_t vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf(vfloat32m4_t vs2, float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf(vfloat32m8_t vs2, float rs1, size_t vl)
vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf(vbool64_t mask, vfloat32mf2_t vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf(vbool32_t mask, vfloat32m1_t vs2, float rs1, size_t vl)
```

```
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf(vbool16_t mask, vfloat32m2_t vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf(vbool8_t mask, vfloat32m4_t vs2, float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf(vbool4_t mask, vfloat32m8_t vs2, float rs1, size_t vl)

vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_u8mf8_tu(vuint8mf8_t maskedoff, vfloat32mf2_t vs2,
float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_u8mf4_tu(vuint8mf4_t maskedoff, vfloat32m1_t vs2, float
rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_u8mf2_tu(vuint8mf2_t maskedoff, vfloat32m2_t vs2, float
rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_u8m1_tu(vuint8m1_t maskedoff, vfloat32m4_t vs2, float
rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_u8m2_tu(vuint8m2_t maskedoff, vfloat32m8_t vs2, float
rs1, size_t vl)
vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_u8mf8_tum(vbool64_t mask, vuint8mf8_t maskedoff,
vfloat32mf2_t vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_u8mf4_tum(vbool32_t mask, vuint8mf4_t maskedoff,
vfloat32m1_t vs2, float rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_u8mf2_tum(vbool16_t mask, vuint8mf2_t maskedoff,
vfloat32m2_t vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_u8m1_tum(vbool8_t mask, vuint8m1_t maskedoff,
vfloat32m4_t vs2, float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_u8m2_tum(vbool4_t mask, vuint8m2_t maskedoff,
vfloat32m8_t vs2, float rs1, size_t vl)
vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_u8mf8_tumu(vbool64_t mask, vuint8mf8_t maskedoff,
vfloat32mf2_t vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_u8mf4_tumu(vbool32_t mask, vuint8mf4_t maskedoff,
vfloat32m1_t vs2, float rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_u8mf2_tumu(vbool16_t mask, vuint8mf2_t maskedoff,
vfloat32m2_t vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_u8m1_tumu(vbool8_t mask, vuint8m1_t maskedoff,
vfloat32m4_t vs2, float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_u8m2_tumu(vbool4_t mask, vuint8m2_t maskedoff,
vfloat32m8_t vs2, float rs1, size_t vl)
vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_u8mf8_mu(vbool64_t mask, vuint8mf8_t maskedoff,
vfloat32mf2_t vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_u8mf4_mu(vbool32_t mask, vuint8mf4_t maskedoff,
vfloat32m1_t vs2, float rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_u8mf2_mu(vbool16_t mask, vuint8mf2_t maskedoff,
vfloat32m2_t vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_u8m1_mu(vbool8_t mask, vuint8m1_t maskedoff,
vfloat32m4_t vs2, float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_u8m2_mu(vbool4_t mask, vuint8m2_t maskedoff,
vfloat32m8_t vs2, float rs1, size_t vl)

vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_tu(vint8mf8_t maskedoff, vfloat32mf2_t vs2, float rs1,
size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_tu(vint8mf4_t maskedoff, vfloat32m1_t vs2, float rs1,
size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_tu(vint8mf2_t maskedoff, vfloat32m2_t vs2, float rs1,
size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_tu(vint8m1_t maskedoff, vfloat32m4_t vs2, float rs1,
size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_tu(vint8m2_t maskedoff, vfloat32m8_t vs2, float rs1,
size_t vl)
vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_tum(vbool64_t mask, vint8mf8_t maskedoff, vfloat32mf2_t
```

```
vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_tum(vbool32_t mask, vint8mf4_t maskedoff, vfloat32m1_t
vs2, float rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_tum(vbool16_t mask, vint8mf2_t maskedoff, vfloat32m2_t
vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_tum(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t
vs2, float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_tum(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t
vs2, float rs1, size_t vl)
vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_tumu(vbool64_t mask, vint8mf8_t maskedoff,
vfloat32mf2_t vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_tumu(vbool32_t mask, vint8mf4_t maskedoff, vfloat32m1_t
vs2, float rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_tumu(vbool16_t mask, vint8mf2_t maskedoff, vfloat32m2_t
vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_tumu(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t
vs2, float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_tumu(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t
vs2, float rs1, size_t vl)
vuint8mf8_t __riscv_sf_vfnrclip_xu_f_qf_mu(vbool64_t mask, vint8mf8_t maskedoff, vfloat32mf2_t
vs2, float rs1, size_t vl)
vuint8mf4_t __riscv_sf_vfnrclip_xu_f_qf_mu(vbool32_t mask, vint8mf4_t maskedoff, vfloat32m1_t
vs2, float rs1, size_t vl)
vuint8mf2_t __riscv_sf_vfnrclip_xu_f_qf_mu(vbool16_t mask, vint8mf2_t maskedoff, vfloat32m2_t
vs2, float rs1, size_t vl)
vuint8m1_t __riscv_sf_vfnrclip_xu_f_qf_mu(vbool8_t mask, vint8m1_t maskedoff, vfloat32m4_t vs2,
float rs1, size_t vl)
vuint8m2_t __riscv_sf_vfnrclip_xu_f_qf_mu(vbool4_t mask, vint8m2_t maskedoff, vfloat32m8_t vs2,
float rs1, size_t vl)
```