

31	27	26	25	24	20	19	15	14	12	11	7	6	0	
funct7				rs2		rs1		funct3		rd		opcode		R-type
imm[11:0]						rs1		funct3		rd		opcode		I-type
imm[11:5]				rs2		rs1		funct3		imm[4:0]		opcode		S-type
imm[12 10:5]				rs2		rs1		funct3		imm[4:1 11]		opcode		B-type
imm[31:12]										rd		opcode		U-type
imm[20 10:1 11 19:12]										rd		opcode		J-type

RV32I Base Instruction Set

imm[31:12]					rd	0110111	LUI	
imm[31:12]					rd	0010111	AUIPC	
imm[20 10:1 11 19:12]					rd	1101111	JAL	
imm[11:0]			rs1	000	rd	1100111	JALR	
imm[12 10:5]		rs2	rs1	000	imm[4:1 11]	1100011	BEQ	
imm[12 10:5]		rs2	rs1	001	imm[4:1 11]	1100011	BNE	
imm[12 10:5]		rs2	rs1	100	imm[4:1 11]	1100011	BLT	
imm[12 10:5]		rs2	rs1	101	imm[4:1 11]	1100011	BGE	
imm[12 10:5]		rs2	rs1	110	imm[4:1 11]	1100011	BLTU	
imm[12 10:5]		rs2	rs1	111	imm[4:1 11]	1100011	BGEU	
imm[11:0]			rs1	000	rd	0000011	LB	
imm[11:0]			rs1	001	rd	0000011	LH	
imm[11:0]			rs1	010	rd	0000011	LW	
imm[11:0]			rs1	100	rd	0000011	LBU	
imm[11:0]			rs1	101	rd	0000011	LHU	
imm[11:5]		rs2	rs1	000	imm[4:0]	0100011	SB	
imm[11:5]		rs2	rs1	001	imm[4:0]	0100011	SH	
imm[11:5]		rs2	rs1	010	imm[4:0]	0100011	SW	
imm[11:0]			rs1	000	rd	0010011	ADDI	
imm[11:0]			rs1	010	rd	0010011	SLTI	
imm[11:0]			rs1	011	rd	0010011	SLTIU	
imm[11:0]			rs1	100	rd	0010011	XORI	
imm[11:0]			rs1	110	rd	0010011	ORI	
imm[11:0]			rs1	111	rd	0010011	ANDI	
0000000		rs2	rs1	000	rd	0110011	ADD	
0100000		rs2	rs1	000	rd	0110011	SUB	
0000000		rs2	rs1	001	rd	0110011	SLL	
0000000		rs2	rs1	010	rd	0110011	SLT	
0000000		rs2	rs1	011	rd	0110011	SLTU	
0000000		rs2	rs1	100	rd	0110011	XOR	
0000000		rs2	rs1	101	rd	0110011	SRL	
0100000		rs2	rs1	101	rd	0110011	SRA	
0000000		rs2	rs1	110	rd	0110011	OR	
0000000		rs2	rs1	111	rd	0110011	AND	
fm	pred		succ	rs1	000	rd	0001111	FENCE
0000000		00000	00000	000	00000	1110011	ECALL	
0000000		00001	00000	000	00000	1110011	EBREAK	
0000000		shamt	rs1	001	rd	0010011	SLLI	
0000000		shamt	rs1	101	rd	0010011	SRLI	
0100000		shamt	rs1	101	rd	0010011	SRAI	
1000001		10011	rs1	000	rd	0001111	FENCE.TSO	
0000000		10000	00000	000	00000	0001111	PAUSE	

31	27	26	25	24	20	19	15	14	12	11	7	6	0	
funct7				rs2		rs1		funct3		rd		opcode		R-type
imm[11:0]						rs1		funct3		rd		opcode		I-type
imm[11:5]				rs2		rs1		funct3		imm[4:0]		opcode		S-type

RV64I Base Instruction Set (in addition to RV32I)

imm[11:0]		rs1	110	rd	0000011	LWU
imm[11:0]		rs1	011	rd	0000011	LD
imm[11:5]		rs2	011	imm[4:0]	0100011	SD
000000	shamt	rs1	001	rd	0010011	SLLI
000000	shamt	rs1	101	rd	0010011	SRLI
010000	shamt	rs1	101	rd	0010011	SRAI
imm[11:0]		rs1	000	rd	0011011	ADDIW
0000000	shamt	rs1	001	rd	0011011	SLLIW
0000000	shamt	rs1	101	rd	0011011	SRLIW
0100000	shamt	rs1	101	rd	0011011	SRAIW
0000000	rs2	rs1	000	rd	0111011	ADDW
0100000	rs2	rs1	000	rd	0111011	SUBW
0000000	rs2	rs1	001	rd	0111011	SLLW
0000000	rs2	rs1	101	rd	0111011	SRLW
0100000	rs2	rs1	101	rd	0111011	SRAW

RV32/RV64 Zifencei Standard Extension

imm[11:0]				rs1		001		rd		0001111		FENCE.I	
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RV32/RV64 Zicsr Standard Extension

csr				rs1		001		rd		1110011		CSRRW	
csr				rs1		010		rd		1110011		CSRRS	
csr				rs1		011		rd		1110011		CSRRC	
csr				uimm		101		rd		1110011		CSRRWI	
csr				uimm		110		rd		1110011		CSRRSI	
csr				uimm		111		rd		1110011		CSRRCI	

RV32M Standard Extension

0000001				rs2		rs1		000		rd		0110011		MUL
0000001				rs2		rs1		001		rd		0110011		MULH
0000001				rs2		rs1		010		rd		0110011		MULHSU
0000001				rs2		rs1		011		rd		0110011		MULHU
0000001				rs2		rs1		100		rd		0110011		DIV
0000001				rs2		rs1		101		rd		0110011		DIVU
0000001				rs2		rs1		110		rd		0110011		REM
0000001				rs2		rs1		111		rd		0110011		REMU

RV64M Standard Extension (in addition to RV32M)

0000001				rs2		rs1		000		rd		0111011		MULW
0000001				rs2		rs1		100		rd		0111011		DIVW
0000001				rs2		rs1		101		rd		0111011		DIVUW
0000001				rs2		rs1		110		rd		0111011		REMW
0000001				rs2		rs1		111		rd		0111011		REMUW

31	27	26	25	24	20	19	15	14	12	11	7	6	0	
funct7				rs2		rs1		funct3		rd		opcode		R-type

RV32A Standard Extension

00010	aq	rl	00000	rs1	010	rd	0101111	LR.W
00011	aq	rl	rs2	rs1	010	rd	0101111	SC.W
00001	aq	rl	rs2	rs1	010	rd	0101111	AMOSWAP.W
00000	aq	rl	rs2	rs1	010	rd	0101111	AMOADD.W
00100	aq	rl	rs2	rs1	010	rd	0101111	AMOXOR.W
01100	aq	rl	rs2	rs1	010	rd	0101111	AMOAND.W
01000	aq	rl	rs2	rs1	010	rd	0101111	AMOODR.W
10000	aq	rl	rs2	rs1	010	rd	0101111	AMOMIN.W
10100	aq	rl	rs2	rs1	010	rd	0101111	AMOMAX.W
11000	aq	rl	rs2	rs1	010	rd	0101111	AMOMINU.W
11100	aq	rl	rs2	rs1	010	rd	0101111	AMOMAXU.W

RV64A Standard Extension (in addition to RV32A)

00010	aq	rl	00000	rs1	011	rd	0101111	LR.D
00011	aq	rl	rs2	rs1	011	rd	0101111	SC.D
00001	aq	rl	rs2	rs1	011	rd	0101111	AMOSWAP.D
00000	aq	rl	rs2	rs1	011	rd	0101111	AMOADD.D
00100	aq	rl	rs2	rs1	011	rd	0101111	AMOXOR.D
01100	aq	rl	rs2	rs1	011	rd	0101111	AMOAND.D
01000	aq	rl	rs2	rs1	011	rd	0101111	AMOODR.D
10000	aq	rl	rs2	rs1	011	rd	0101111	AMOMIN.D
10100	aq	rl	rs2	rs1	011	rd	0101111	AMOMAX.D
11000	aq	rl	rs2	rs1	011	rd	0101111	AMOMINU.D
11100	aq	rl	rs2	rs1	011	rd	0101111	AMOMAXU.D

31	27	26	25	24	20	19	15	14	12	11	7	6	0	
funct7				rs2		rs1		funct3		rd		opcode		R-type
rs3		funct2		rs2		rs1		funct3		rd		opcode		R4-type
imm[11:0]						rs1		funct3		rd		opcode		I-type
imm[11:5]				rs2		rs1		funct3		imm[4:0]		opcode		S-type

RV32F Standard Extension

imm[11:0]			rs1	010	rd	0000111	FLW
imm[11:5]		rs2	rs1	010	imm[4:0]	0100111	FSW
rs3	00	rs2	rs1	rm	rd	1000011	FMADD.S
rs3	00	rs2	rs1	rm	rd	1000111	FMSUB.S
rs3	00	rs2	rs1	rm	rd	1001011	FNMSUB.S
rs3	00	rs2	rs1	rm	rd	1001111	FNMADD.S
0000000		rs2	rs1	rm	rd	1010011	FADD.S
0000100		rs2	rs1	rm	rd	1010011	FSUB.S
0001000		rs2	rs1	rm	rd	1010011	FMUL.S
0001100		rs2	rs1	rm	rd	1010011	FDIV.S
0101100		00000	rs1	rm	rd	1010011	FSQRT.S
0010000		rs2	rs1	000	rd	1010011	FSGNJ.S
0010000		rs2	rs1	001	rd	1010011	FSGNJN.S
0010000		rs2	rs1	010	rd	1010011	FSGNJX.S
0010100		rs2	rs1	000	rd	1010011	FMIN.S
0010100		rs2	rs1	001	rd	1010011	FMAX.S
1100000		00000	rs1	rm	rd	1010011	FCVT.W.S
1100000		00001	rs1	rm	rd	1010011	FCVT.WU.S
1110000		00000	rs1	000	rd	1010011	FMV.X.W
1010000		rs2	rs1	010	rd	1010011	FEQ.S
1010000		rs2	rs1	001	rd	1010011	FLT.S
1010000		rs2	rs1	000	rd	1010011	FLE.S
1110000		00000	rs1	001	rd	1010011	FCLASS.S
1101000		00000	rs1	rm	rd	1010011	FCVT.S.W
1101000		00001	rs1	rm	rd	1010011	FCVT.S.WU
1111000		00000	rs1	000	rd	1010011	FMV.W.X

RV64F Standard Extension (in addition to RV32F)

1100000				00010		rs1		rm		rd		FCVT.L.S
1100000				00011		rs1		rm		rd		FCVT.LU.S
1101000				00010		rs1		rm		rd		FCVT.S.L
1101000				00011		rs1		rm		rd		FCVT.S.LU

31	27	26	25	24	20	19	15	14	12	11	7	6	0	
funct7				rs2	rs1	funct3	rd	opcode				R-type		
rs3		funct2		rs2	rs1	funct3	rd	opcode				R4-type		
imm[11:0]					rs1	funct3	rd	opcode				I-type		
imm[11:5]				rs2	rs1	funct3	imm[4:0]	opcode				S-type		

RV32D Standard Extension

imm[11:0]				rs1	011	rd	0000111	FLD
imm[11:5]				rs2	rs1	011	imm[4:0]	FSD
rs3	01	rs2	rs1	rm	rd	1000011		FMADD.D
rs3	01	rs2	rs1	rm	rd	1000111		FMSUB.D
rs3	01	rs2	rs1	rm	rd	1001011		FNMSUB.D
rs3	01	rs2	rs1	rm	rd	1001111		FNMADD.D
0000001				rs2	rs1	rm	rd	FADD.D
0000101				rs2	rs1	rm	rd	FSUB.D
0001001				rs2	rs1	rm	rd	FMUL.D
0001101				rs2	rs1	rm	rd	FDIV.D
0101101				00000	rs1	rm	rd	FSQRT.D
0010001				rs2	rs1	000	rd	FSGNJ.D
0010001				rs2	rs1	001	rd	FSGNJN.D
0010001				rs2	rs1	010	rd	FSGNJX.D
0010101				rs2	rs1	000	rd	FMIN.D
0010101				rs2	rs1	001	rd	FMAX.D
0100000				00001	rs1	rm	rd	FCVT.S.D
0100001				00000	rs1	rm	rd	FCVT.D.S
1010001				rs2	rs1	010	rd	FEQ.D
1010001				rs2	rs1	001	rd	FLT.D
1010001				rs2	rs1	000	rd	FLE.D
1110001				00000	rs1	001	rd	FCLASS.D
1100001				00000	rs1	rm	rd	FCVT.W.D
1100001				00001	rs1	rm	rd	FCVT.WU.D
1101001				00000	rs1	rm	rd	FCVT.D.W
1101001				00001	rs1	rm	rd	FCVT.D.WU

RV64D Standard Extension (in addition to RV32D)

1100001				00010	rs1	rm	rd	1010011	FCVT.L.D
1100001				00011	rs1	rm	rd	1010011	FCVT.LU.D
1110001				00000	rs1	000	rd	1010011	FMV.X.D
1101001				00010	rs1	rm	rd	1010011	FCVT.D.L
1101001				00011	rs1	rm	rd	1010011	FCVT.D.LU
1111001				00000	rs1	000	rd	1010011	FMV.D.X

31	27	26	25	24	20	19	15	14	12	11	7	6	0		
funct7				rs2	rs1	funct3	rd	opcode						R-type	
rs3		funct2			rs2	rs1	funct3	rd	opcode						R4-type
imm[11:0]					rs1	funct3	rd	opcode						I-type	
imm[11:5]				rs2	rs1	funct3	imm[4:0]	opcode						S-type	

RV32Q Standard Extension

imm[11:0]			rs1	100	rd	0000111	FLQ
imm[11:5]		rs2	rs1	100	imm[4:0]	0100111	FSQ
rs3	11	rs2	rs1	rm	rd	1000011	FMADD.Q
rs3	11	rs2	rs1	rm	rd	1000111	FMSUB.Q
rs3	11	rs2	rs1	rm	rd	1001011	FNMSUB.Q
rs3	11	rs2	rs1	rm	rd	1001111	FNMADD.Q
0000011		rs2	rs1	rm	rd	1010011	FADD.Q
0000111		rs2	rs1	rm	rd	1010011	FSUB.Q
0001011		rs2	rs1	rm	rd	1010011	FMUL.Q
0001111		rs2	rs1	rm	rd	1010011	FDIV.Q
0101111		00000	rs1	rm	rd	1010011	FSQRT.Q
0010011		rs2	rs1	000	rd	1010011	FSGNJ.Q
0010011		rs2	rs1	001	rd	1010011	FSGNJN.Q
0010011		rs2	rs1	010	rd	1010011	FSGNJX.Q
0010111		rs2	rs1	000	rd	1010011	FMIN.Q
0010111		rs2	rs1	001	rd	1010011	FMAX.Q
0100000		00011	rs1	rm	rd	1010011	FCVT.S.Q
0100011		00000	rs1	rm	rd	1010011	FCVT.Q.S
0100001		00011	rs1	rm	rd	1010011	FCVT.D.Q
0100011		00001	rs1	rm	rd	1010011	FCVT.Q.D
1010011		rs2	rs1	010	rd	1010011	FEQ.Q
1010011		rs2	rs1	001	rd	1010011	FLT.Q
1010011		rs2	rs1	000	rd	1010011	FLE.Q
1110011		00000	rs1	001	rd	1010011	FCLASS.Q
1100011		00000	rs1	rm	rd	1010011	FCVT.W.Q
1100011		00001	rs1	rm	rd	1010011	FCVT.WU.Q
1101011		00000	rs1	rm	rd	1010011	FCVT.Q.W
1101011		00001	rs1	rm	rd	1010011	FCVT.Q.WU

RV64Q Standard Extension (in addition to RV32Q)

1100011				00010	rs1	rm	rd	1010011	FCVT.L.Q
1100011				00011	rs1	rm	rd	1010011	FCVT.LU.Q
1101011				00010	rs1	rm	rd	1010011	FCVT.Q.L
1101011				00011	rs1	rm	rd	1010011	FCVT.Q.LU

31	27	26	25	24	20	19	15	14	12	11	7	6	0	
funct7				rs2		rs1		funct3		rd		opcode		R-type
rs3		funct2		rs2		rs1		funct3		rd		opcode		R4-type
imm[11:0]						rs1		funct3		rd		opcode		I-type
imm[11:5]				rs2		rs1		funct3		imm[4:0]		opcode		S-type

RV32Zfh Standard Extension

imm[11:0]			rs1	001	rd	0000111	FLH
imm[11:5]		rs2	rs1	001	imm[4:0]	0100111	FSH
rs3	10	rs2	rs1	rm	rd	1000011	FMADD.H
rs3	10	rs2	rs1	rm	rd	1000111	FMSUB.H
rs3	10	rs2	rs1	rm	rd	1001011	FNMSUB.H
rs3	10	rs2	rs1	rm	rd	1001111	FNMADD.H
0000010		rs2	rs1	rm	rd	1010011	FADD.H
0000110		rs2	rs1	rm	rd	1010011	FSUB.H
0001010		rs2	rs1	rm	rd	1010011	FMUL.H
0001110		rs2	rs1	rm	rd	1010011	FDIV.H
0101110		00000	rs1	rm	rd	1010011	FSQRT.H
0010010		rs2	rs1	000	rd	1010011	FSGNJ.H
0010010		rs2	rs1	001	rd	1010011	FSGNJN.H
0010010		rs2	rs1	010	rd	1010011	FSGNJX.H
0010110		rs2	rs1	000	rd	1010011	FMIN.H
0010110		rs2	rs1	001	rd	1010011	FMAX.H
0100000		00010	rs1	rm	rd	1010011	FCVT.S.H
0100010		00000	rs1	rm	rd	1010011	FCVT.H.S
1010010		rs2	rs1	010	rd	1010011	FEQ.H
1010010		rs2	rs1	001	rd	1010011	FLT.H
1010010		rs2	rs1	000	rd	1010011	FLE.H
1110010		00000	rs1	001	rd	1010011	FCLASS.H
1100010		00000	rs1	rm	rd	1010011	FCVT.W.H
1100010		00001	rs1	rm	rd	1010011	FCVT.WU.H
1110010		00000	rs1	000	rd	1010011	FMV.X.H
1101010		00000	rs1	rm	rd	1010011	FCVT.H.W
1101010		00001	rs1	rm	rd	1010011	FCVT.H.WU
1111010		00000	rs1	000	rd	1010011	FMV.H.X
0100001		00010	rs1	rm	rd	1010011	FCVT.D.H
0100010		00001	rs1	rm	rd	1010011	FCVT.H.D
0100011		00010	rs1	rm	rd	1010011	FCVT.Q.H
0100010		00011	rs1	rm	rd	1010011	FCVT.H.Q

RV64Zfh Standard Extension (in addition to RV32Zfh)

1100010				00010		rs1		rm		rd		FCVT.L.H
1100010				00011		rs1		rm		rd		FCVT.LU.H
1101010				00010		rs1		rm		rd		FCVT.H.L
1101010				00011		rs1		rm		rd		FCVT.H.LU

Table 1: Instruction listing for RISC-V