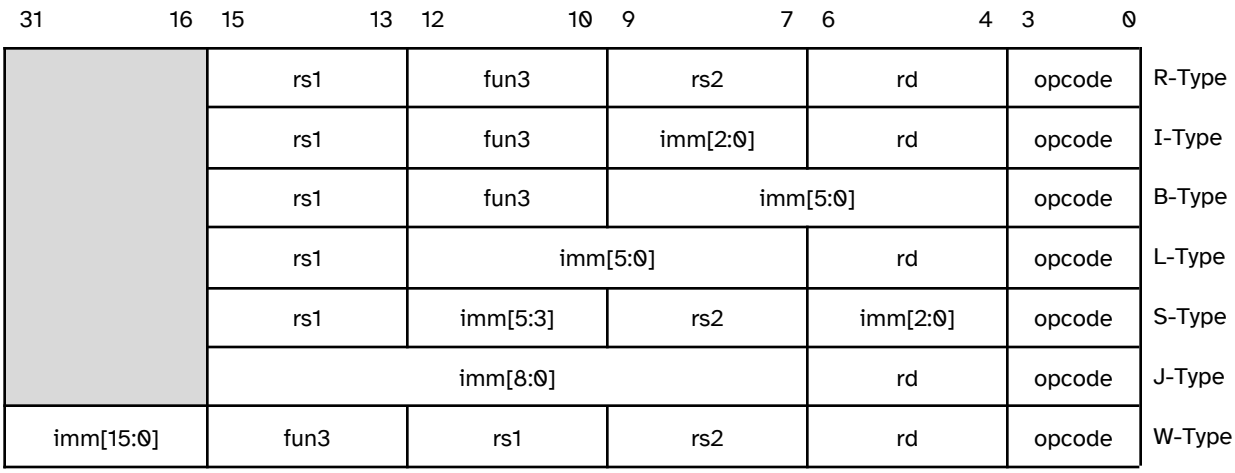
Instruction Formats



Instructions

Instr	Name	Ty	Op	Fun3	Description
add	Add	R	0000	000	rd, CRY = rs1 + rs2
sub	Subtract	R	0000	001	rd, CRY = rs1 - rs2
sl	Shift Left	R	0000	010	rd, CRY = rs1 << rs2
sr	Shift Right	R	0000	011	rd, CRY = rs1 >> rs2 *arithmetic shift
mul	Multiply	R	0000	100	rd, CRY = rs1 * rs2
or	Or	R	0000	101	rd = rs1 | rs2
xor	Exclusive Or	R	0000	110	rd = rs1 ^ rs2
and	And	R	0000	111	rd = rs1 & rs2
addc	Add Carry	R	0001	000	rd, CRY = rs1 + rs2 + CRY
subc	Subtract Carry	R	0001	001	rd, CRY = rs1 - rs2 - CRY
slc	Shift Left Carry	R	0001	010	rd, CRY = rs1 << rs2 *carry-filled
src	Shift Right Carry	R	0001	011	rd, CRY = rs1 >> rs2 *carry-filled
mulc	Multiply Carry	R	0001	100	rd, CRY = rs1 * rs2 + CRY
addi	Add Immediate	I	0010	000	rd, CRY = rs1 + imm *imm is unsigned
subi	Subtract Immediate	I	0010	001	rd, CRY = rs1 - imm *imm is unsigned
sli	Shift Left Immediate	I	0010	010	rd, CRY = rs1 << imm *imm is unsigned
sri	Shift Right Immediate	I	0010	011	rd, CRY = rs1 >> imm *imm is unsigned
muli	Multiply Immediate	I	0010	100	rd, CRY = rs1 * imm

Instr	Name	Ty	Op	Fun3	Description
ori	Or Immediate	I	0010	101	`rd = rs1 | imm`
xori	Exclusive Or Immediate	I	0010	110	`rd = rs1 ^ imm`
andi	And Immediate	I	0010	111	`rd = rs1 & imm`
addsi	Add Self Immediate	I	0011	000	`rs1, CRY = rs1 + imm  *imm is unsigned`
subsi	Subtract Self Immediate	I	0011	001	`rs1, CRY = rs1 - imm  *imm is unsigned`
slsi	Shift Left Self Immediate	I	0011	010	`rs1, CRY = rs1 << imm  *imm is unsigned`
srsi	Shift Right Self Immediate	I	0011	011	`rs1, CRY = rs1 >> imm  *imm is unsigned`
mulsi	Multiply Self Immediate	I	0011	100	`rs1, CRY = rs1 * imm`
orsi	Or Self Immediate	I	0011	101	`rs1 = rs1 | imm`
xorsi	Exclusive Or Self Immediate	I	0011	110	`rs1 = rs1 ^ imm`
andsi	And Self Immediate	I	0011	111	`rs1 = rs1 & imm`
addiw	Add Immediate Word	W	0100	000	`rd, CRY = rs1 + imm`
subiw	Subtract Immediate Word	W	0100	001	`rd, CRY = rs1 - imm`
muliw	Multiply Immediate Word	W	0100	100	`rd, CRY = rs1 * imm`
oriw	Or Immediate Word	W	0100	101	`rd = rs1 | imm`
xoriw	Exclusive Or Immediate Word	W	0100	110	`rd = rs1 ^ imm`
andiw	And Immediate Word	W	0100	111	`rd = rs1 & imm`
li	Load Immediate	J	0101		`rd = imm`
liw	Load Immediate Word	W	0110		`rd = imm`
lw	Load Word	L	0111		`rd = M[rs1 + imm]`
sw	Store Word	S	1000		`M[rs1 + imm] = rs2`
beqz	Branch Equal Zero	B	1001	000	`if rs1 == 0 then PC += imm`
bnez	Branch Not Equal Zero	B	1001	001	`if rs1 ≠ 0 then PC += imm`
bgtz	Branch Greater Than Zero	B	1001	010	`if rs1 > 0 then PC += imm`
blez	Branch Less or Equal Zero	B	1001	011	`if rs1 ⩽ 0 then PC += imm`
bltz	Branch Less Than Zero	B	1001	110	`if rs1 < 0 then PC += imm`
bgez	Branch Greater Or Equal Zero	B	1001	111	`if rs1 ⩾ 0 then PC += imm`
j	Jump	J	1010		`PC += imm`
jr	Jump Register	I	1011		`PC = rs1 + imm`
jal	Jump and Link	J	1100		`rd = PC + 1; PC += imm`

Instr	Name	Ty	Op	Fun3	Description
jwal	Jump Word and Link	W	1101		`rd = PC + 2; PC = imm`
iact	Interrupt Activation	I	1110	000	`IE[imm[2:0]] = 0`
iact	Interrupt Activation	I	1110	001	`IE[imm[2:0]] = 1`
iloc	Interrupt Location	I	1110	010	`IL[imm[2:0]] = rs1`
itrg	Interrupt Trigger	I	1110	011	`trigger interrupt imm[2:0]`
iret	Return From Interrupt	I	1110	100	`PC = IR; IA=0`
lcry	Load Carry	I	1111	000	`rd = CRY`
stmr	Store Timer	I	1110	010	`TMR[imm[1:0]] = rs1`
ltmr	Load Timer	I	1110	011	`rd = TMR[imm[1:0]]`
sbrom	Select Bootloader ROM	I	1111	100	`BS = imm[0]`
break	Breakpoint	I	1111	111	`Pause execution`

User Registers

Register	Asm. Name	Description	Saver
n	ra	Return Address	Caller
x1	sp	Stack Pointer	
x2-x3	t0-t1	Temporary	Caller
x4-x5	s0-s1	Saved	Callee
x6-x7	a0-a1	Argument/Return	Caller

Special Registers

Register	Name	Description
PC	Program counter	Location of program execution
CRY	Carry	Holds the carry result from arithmetic
M	Memory	Anything in the address space
IE	Interrupt enable	Enables or disables interrupts
IL	Interrupt location	Interrupt handler addresses
IA	Interrupt active	Is an interrupt being handled, alternative user registers are used if true
IR	Interrupt return	Return address for interrupt
TMR	Timer	Decrements every microsecond
BS	Bootloader Select	Swaps lower address spaces, non-volatile

Address space

Range	Name	Description
`0000-0FFF`	Bootloader	4K ROM with write-protected startup code
`1000-1FFF`	User Storage	4K EEPROM with user data or code
`2000-3FFF`	Memory	8K RAM for user code