There are 8 files namely alu.vhd, register\_file.vhd, data\_memory.vhd, program\_memory.vhd, testbench\_alu.vhd, testbench\_dm.vhd and testbench\_pm.vhd.

#### 1. alu.vhd:

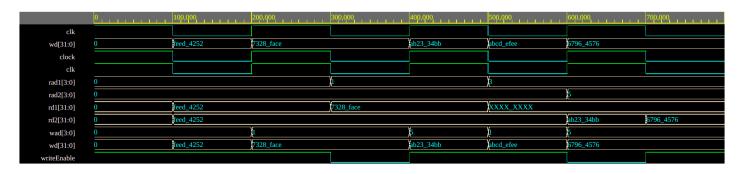
#### (a) EPWave

	0		200,000		400,000		600,000	1111	800,000		1,000,000		1,200,000		1,400,000	
carry_in																
carry_out																
opcode[3:0]	0	(1	2	3	4	5	6	7	8	9	a	b	c	đ	e	)f
operand1[31:0]	100_11bc	ff11	aaa0_1111	1111	ffcd_1111	1431	9870_1111	4111	de0_1111	£000_1111	aa00_1111	a_c111	b_b111	cde1	fe11	6351
operand2[31:0]	ad_1001	cd0_1001	bbb0_1001	1001	ffff_1001	380_1001	340_1001	d0_1001	a000_1001	bb0_1001	cc00_1001	a_d001	bf_c001	b_cda1	3_4501	5_4261
result[31:0]	1000	cd0_ef10	eef0_0110	ffff_fef0	ffcc_2112	880_2432	9530_010f	cf_ceef	1001	fbb0_0110	de00_0110	15_9112	bf_f111	b_cda1	ba10	fffa_bd9e

```
# Info: Device Utilization for 7A100TCSG324
Used Avail Utilization
# Info: Resource
# Info: -----
                                  102 210
                                              48.57%
                                 0 32 0.00%
420 63400 0.66%
105 15850 0.66%
0 126800 0.00%
# Info: Global Buffers
# Info: LUTs
# Info: CLB Slices
# Info: Dffs or Latches
                                       135
# Info: Block RAMs
                                 0
                                               0.00%
# Info: DSP48E1s
                                       240
                                               0.00%
# Info: ***************************
# Info: Library: work Cell: ALU View: rtl
# Info: *****************************
# Info: Number of ports:
                                          102
# Info: Number of nets:
                                          832
# Info: Number of instances :
                                          763
# Info: Number of references to this view :
# Info: Total accumulated area :
# Info: Number of LUTs:
                                          420
# Info: Number of Primitive LUTs :
                                          421
# Info: Number of LUTs with LUTNM/HLUTNM :
                                           2
# Info: Number of MUX CARRYs :
                                          142
# Info: Number of accumulated instances :
                                          763
# Info: *****************
# Info: IO Register Mapping Report
# Info: *****************
# Info: Design: work.ALU.rtl
```

## 2. register\_file.vhd:

## (a) EPWave



```
# Info: Device Utilization for 7A100TCSG324
# Info: Resource
                           Used
                              Avail Utilization
# Info: -----
# Info: IOs
                                      52.38%
                           110
                                210
# Info: Global Buffers
                           1
                                32
                                      3.12%
# Info: LUTs
                           272
                                63400
                                      0.43%
# Info: CLB Slices
                           68
                                15850
                                      0.43%
# Info: Dffs or Latches
                           512
                                126800
                                      0.40%
# Info: Block RAMs
                           0
                                135
                                       0.00%
# Info: DSP48E1s
                                240
                                       0.00%
# Info: -----
# Info: Number of ports:
                                 110
# Info: Number of nets:
                                 218
# Info: Number of instances:
                                 110
# Info: Number of references to this view :
                                  0
# Info: Total accumulated area:
# Info: Number of Dffs or Latches:
                                 512
# Info: Number of LUTs:
                                 272
# Info: Number of Primitive LUTs :
                                 272
# Info: Number of MUXF7:
                                 128
# Info: Number of MUXF8:
                                  64
# Info: Number of accumulated instances :
                                 1086
# Info: ****************
# Info: IO Register Mapping Report
# Info: ****************
# Info: Design: work.Register_File_16x32.behavioral
```

#### 3. data\_memory.vhd:

### (a) EPWave

	0		200,000		400,000		600,000		800,000		1,000,000
clock											
in1[7:0]	0	8c	()	4	8	c	Þ	<b>/</b> 4	<b>8</b>	kc	
in2[31:0]	0		a00b_23cd	a042_33cd	a00b_2354	a00b_23bb					
in3[3:0]	0		f		3	đ	Ю				4
out1[31:0]	XXXX_XXXX			a042_33cd	XXXX_2354	a00b_XXbb	XXXX_XXXX	a042_33cd	XXXX_2354	a00b_XXbb	
ad[7:0]	0	8c	0	4	8	c c	Ю	4	8	)c	
clk											
rd[31:0]	XXXX_XXXX			a042_33cd	XXXX_2354	a00b_XXbb	XXXX_XXXX a042_33cd XXXX_2354 a00b_XXbb				
wd[31:0]	0		a00b_23cd	a042_33cd	a00b_2354	a00b_23bb					
writeEnable[3:0]	0		f		3	d	0				4

```
# Info: Device Utilization for 7A100TCSG324
# Info: Resource
                           Used Avail Utilization
# Info: -----
# Info: IOs
                            77
                                 210
                                  32
                                       0.00%
# Info: Global Buffers
                            0
# Info: LUTs
                            898 63400
                                       1.42%
# Info: CLB Slices
                            256
                                 15850
                                        1.62%
# Info: Dffs or Latches
                            2048 126800 1.62%
# Info: Block RAMs
                                        0.00%
                            0
                                 135
# Info: DSP48E1s
                            0
                                  240
                                         0.00%
# Info: -----
# Info: Library: work Cell: Data_Memory_64x32 View: behavioral
# Info: Number of ports:
                                   77
# Info: Number of nets:
                                   148
# Info: Number of instances :
                                    75
# Info: Number of references to this view :
# Info: Total accumulated area :
# Info: Number of Dffs or Latches:
                                  2048
# Info: Number of LUTs:
                                   898
# Info: Number of Primitive LUTs:
                                   900
# Info: Number of LUTs with LUTNM/HLUTNM :
                                   4
# Info: Number of MUXF7:
                                    64
# Info: Number of MUXF8:
                                    32
# Info: Number of accumulated instances :
                               3120
# Info: *****************
# Info: IO Register Mapping Report
# Info: *****************
# Info: Design: work.Data_Memory_64x32.behavioral
```

#### 4. program\_memory.vhd:

### (a) EPWave

	0	200,000		400,000	1111	600,000		800,000
in1[7:0]	0	4	8	c	10	44	a8	8c
out1[31:0]	1239_843f	0	1239_843f	0	1239_843f	0	1239_843f	<b>X</b> O
ad[7:0]	0	4	8	c	10	44	a8	8c
rd[31:0]	1239_843f	0	1239_843f	0	1239_843f	0	1239_843f	0

```
# Info: Device Utilization for 7A100TCSG324
# Info: Resource
                         Used Avail Utilization
# Info: -----
                         40 210
                                  19.05%
# Info: IOs
# Info: Global Buffers
                         0
                             32
                                   0.00%
                            63400 0.00%
15850 0.01%
126800 0.00%
# Info: LUTs
                         1
# Info: CLB Slices
                        1
                        0
# Info: Dffs or Latches
# Info: Block RAMs
                        0
                             135
                                   0.00%
# Info: DSP48E1s
                              240
# Info: -----
# Info: Number of ports:
                                40
# Info: Number of nets:
                                36
# Info: Number of instances :
                                35
# Info: Number of references to this view :
                                0
# Info: Total accumulated area :
# Info: Number of LUTs :
                               1
# Info: Number of Primitive LUTs :
                                1
# Info: Number of accumulated instances :
                               35
# Info: ******************
# Info: IO Register Mapping Report
# Info: ******************
# Info: Design: work.Program_Memory_64x32.behavioral
```