

DEC KS10 and KS10 FPGA Instruction Timing Comparison

12.5 MHz FPGA Clock

DEC KS10 Timing	DEC KS10 (us)	KS10 FPGA Timing	KS10 FPGA (uS)	Speedup
1 - BASIC CLOCK CYCLE IS 151 NSEC.	0.151	1 - BASIC CLOCK CYCLE IS 32 NSEC.	0.032	4.72
2 - INDEXING TAKES 303 NSEC.	0.303	2 - INDEXING TAKES 80 NSEC.	0.080	3.79
3 - INDIRECT TAKES 910 NSEC.	0.910	3 - INDIRECT TAKES 240 NSEC.	0.240	3.79
4 - INDEXING AND INDIRECT TAKES 910 NSEC.	0.910	4 - INDEXING AND INDIRECT TAKES 240 NSEC.	0.240	3.79
5 - MOVEI TAKES 1.22 USEC.	1.220	5 - MOVEI TAKES 402 NSEC.	0.402	3.03
6 - MOVSI TAKES 1.52 USEC.	1.520	6 - MOVSI TAKES 482 NSEC.	0.482	3.15
7 - MOVE FROM AC TAKES 1.52 USEC.	1.520	7 - MOVE FROM AC TAKES 482 NSEC.	0.482	3.15
8 - MOVE FROM MEMORY TAKES 1.52 USEC.	1.520	8 - MOVE FROM MEMORY TAKES 482 NSEC.	0.562	2.70
9 - MOVE TO MEMORY TAKES 2.28 USEC.	2.280	9 - MOVE TO MEMORY TAKES 562 NSEC.	0.562	4.06
10 - HRR FROM MEMORY TAKES 1.82 USEC.	1.820	10 - HRR FROM MEMORY TAKES 562 NSEC.	0.562	3.24
11 - HRRZ FROM MEMORY TAKES 1.82 USEC.	1.820	11 - HRRZ FROM MEMORY TAKES 562 NSEC.	0.562	3.24
12 - HLRZ FROM MEMORY TAKES 2.13 USEC.	2.130	12 - HLRZ FROM MEMORY TAKES 642 NSEC.	0.642	3.32
13 - SETZ TAKES 1.52 USEC.	1.520	13 - SETZ TAKES 482 NSEC.	0.482	3.15
14 - SETZM TAKES 1.97 USEC.	1.970	14 - SETZM TAKES 482 NSEC.	0.482	4.09
15 - SETZB TAKES 2.28 USEC.	2.280	15 - SETZB TAKES 562 NSEC.	0.562	4.06
16 - SETO TAKES 1.52 USEC.	1.520	16 - SETO TAKES 482 NSEC.	0.482	3.15
17 - SETOM TAKES 1.97 USEC.	1.970	17 - SETOM TAKES 482 NSEC.	0.482	4.09
18 - SETOB TAKES 2.28 USEC.	2.280	18 - SETOB TAKES 562 NSEC.	0.562	4.06
19 - JRST TAKES 914 NSEC.	0.914	19 - JRST TAKES 241 NSEC.	0.241	3.79
20 - JRSTF @MEM TAKES 4.25 USEC.	4.250	20 - JRSTF @MEM TAKES 1.13 USEC.	1.130	3.76
21 - JUMPA TAKES 1.22 USEC.	1.220	21 - JUMPA TAKES 322 NSEC.	0.322	3.79
22 - JUMP THAT DOESN'T TAKES 1.97 USEC.	1.970	22 - JUMP THAT DOESN'T TAKES 482 NSEC.	0.482	4.09
23 - JUMP THAT DOES TAKES 1.97 USEC.	1.970	23 - JUMP THAT DOES TAKES 482 NSEC.	0.482	4.09
24 - JSR TAKES 2.74 USEC.	2.740	24 - JSR TAKES 644 NSEC.	0.644	4.25
25 - JSP TAKES 1.82 USEC.	1.820	25 - JSP TAKES 482 NSEC.	0.482	3.78
26 - AOBJN TAKES 1.97 USEC.	1.970	26 - AOBJN TAKES 482 NSEC.	0.482	4.09
27 - SOJ TAKES 1.82 USEC.	1.820	27 - SOJ TAKES 482 NSEC.	0.482	3.78

28 - SOS TAKES 3.34 USEC.	3.340	28 - SOS TAKES 803 NSEC.	0.803	4.16
29 - AOJ TAKES 1.82 USEC.	1.820	29 - AOJ TAKES 482 NSEC.	0.482	3.78
30 - AOS TAKES 3.34 USEC.	3.340	30 - AOS TAKES 803 NSEC.	0.803	4.16
31 - JFFO (1B0) TAKES 3.95 USEC.	3.950	31 - JFFO (1B0) TAKES 1.04 USEC.	1.040	3.80
32 - JFFO (1B35) TAKES 14.55 USEC.	14.550	32 - JFFO (1B35) TAKES 3.85 USEC.	3.850	3.78
33 - PUSH TAKES 2.73 USEC.	2.730	33 - PUSH TAKES 643 NSEC.	0.643	4.25
34 - POP TAKES 3.79 USEC.	3.790	34 - POP TAKES 883 NSEC.	0.883	4.29
35 - MUUO TAKES 15.34 USEC.	15.340	35 - MUUO TAKES 3.05 USEC.	3.050	5.03
36 - LUUO TAKES 4.07 USEC.	4.070	36 - LUUO TAKES 722 NSEC.	0.722	5.64
37 - PUSHJ TAKES 2.73 USEC.	2.730	37 - PUSHJ TAKES 723 NSEC.	0.723	3.78
38 - ADD IMMEDIATE TAKES 1.67 USEC.	1.670	38 - ADD IMMEDIATE TAKES 482 NSEC.	0.482	3.46
39 - ADD FROM MEMORY TAKES 1.97 USEC.	1.970	39 - ADD FROM MEMORY TAKES 562 NSEC.	0.562	3.51
40 - ADD TO MEMORY TAKES 4.15 USEC.	4.150	40 - ADD TO MEMORY TAKES 903 NSEC.	0.903	4.60
41 - MUL (9 ADD/SUB - 18 SHIFTS) TAKES 15.76 USEC.	15.760	41 - MUL (9 ADD/SUB - 18 SHIFTS) TAKES 4.10 USEC.	4.100	3.84
42 - IMULI TAKES 14.70 USEC.	14.700	42 - IMULI TAKES 3.93 USEC.	3.930	3.74
43 - DIV TAKES 22.81 USEC.	22.810	43 - DIV TAKES 4.02 USEC.	4.020	5.67
44 - IDIVI TAKES 19.40 USEC.	19.400	44 - IDIVI TAKES 4.10 USEC.	4.100	4.73
45 - FIX A FLOATING POINT ONE TAKES 13.04 USEC.	13.040	45 - FIX A FLOATING POINT ONE TAKES 3.37 USEC.	3.370	3.87
46 - FLTR AN INTERGER ONE TAKES 17.74 USEC.	17.740	46 - FLTR AN INTERGER ONE TAKES 3.45 USEC.	3.450	5.14
47 - FAD (1 RIGHT SHIFT) TAKES 6.83 USEC.	6.830	47 - FAD (1 RIGHT SHIFT) TAKES 1.68 USEC.	1.680	4.07
48 - FAD (8 SHIFT RIGHT - 3 LEFT) TAKES 11.07 USEC.	11.070	48 - FAD (8 SHIFT RIGHT - 3 LEFT) TAKES 2.65 USEC.	2.650	4.18
49 - FMP (7 ADD/SUB - 14 SHIFTS) TAKES 18.34 USEC.	18.340	49 - FMP (7 ADD/SUB - 14 SHIFTS) TAKES 4.02 USEC.	4.020	4.56
50 - FDV TAKES 22.74 USEC.	22.740	50 - FDV TAKES 4.02 USEC.	4.020	5.66
51 - DMOVE FROM MEMORY TAKES 2.73 USEC.	2.730	51 - DMOVE FROM MEMORY TAKES 722 NSEC.	0.722	3.78
52 - DMOVEM TO MEMORY TAKES 3.50 USEC.	3.500	52 - DMOVEM TO MEMORY TAKES 803 NSEC.	0.803	4.36
53 - DFAD (1 RIGHT SHIFT) TAKES 12.73 USEC.	12.730	53 - DFAD (1 RIGHT SHIFT) TAKES 3.21 USEC.	3.210	3.97
54 - DFAD (8 SHIFT RIGHT - 1 LEFT) TAKES 14.86 USEC.	14.860	54 - DFAD (8 SHIFT RIGHT - 1 LEFT) TAKES 3.76 USEC.	3.760	3.95
55 - DFMP (7 ADD/SUB - 32 SHIFTS) TAKES 63.35 USEC.	63.350	55 - DFMP (7 ADD/SUB - 32 SHIFTS) TAKES 3.78 USEC.	3.780	17.29
56 - DFDV TAKES 52.74 USEC.	52.740	56 - DFDV TAKES 3.78 USEC.	3.780	13.95
57 - CONO PI TAKES 7.28 USEC.	7.280	57 - CONO PI TAKES 1.61 USEC.	1.610	4.52
58 - CONI PI TAKES 2.88 USEC.	2.880	58 - CONI PI TAKES 723 NSEC.	0.723	3.98
59 - CONO PAG TAKES 109.13 USEC.	109.130	59 - CONO PAG TAKES 27.45 USEC.	27.450	3.98
60 - DATAO PAG LOAD UBR TAKES 109.94 USEC.	109.940	60 - DATAO PAG LOAD UBR TAKES 27.45 USEC.	27.450	4.01
61 - DATAO PAG LOAD AC BLK TAKES 3.65 USEC.	3.650	61 - DATAO PAG LOAD AC BLK TAKES 963 NSEC.	0.963	3.79

62 - WRIO TAKES 14.25 USEC.	14.250	62 - WRIO TAKES 2.45 USEC.	2.450	5.82
63 - RDIO TAKES 15.46 USEC.	15.460	63 - RDIO TAKES 2.78 USEC.	2.780	5.56
64 - LOGICAL SHIFT (35 PLACES LEFT) TAKES 7.43 USEC.	7.430	64 - LOGICAL SHIFT (35 PLACES LEFT) TAKES 2.19 USEC.	2.190	3.39
65 - LOGICAL SHIFT (35 PLACES RIGHT) TAKES 7.43 USEC.	7.430	65 - LOGICAL SHIFT (35 PLACES RIGHT) TAKES 2.19 USEC.	2.190	3.39
66 - LOGICAL SHIFT COMBINED (71 PLACES LEFT) TAKES 25.46 USEC.	25.460	66 - LOGICAL SHIFT COMBINED (71 PLACES LEFT) TAKES 2.25 USEC.	2.250	11.32
67 - LOGICAL SHIFT COMBINED (71 PLACES RIGHT) TAKES 25.76 USEC.	25.760	67 - LOGICAL SHIFT COMBINED (71 PLACES RIGHT) TAKES 2.25 USEC.	2.250	11.45
68 - INCREMENT BYTE POINTER TAKES 3.04 USEC.	3.040	68 - INCREMENT BYTE POINTER TAKES 724 NSEC.	0.724	4.20
69 - ILDB (7 BITS) TAKES 5.92 USEC.	5.920	69 - ILDB (7 BITS) TAKES 1.45 USEC.	1.450	4.08
70 - IDPB (7 BITS) TAKES 6.98 USEC.	6.980	70 - IDPB (7 BITS) TAKES 1.61 USEC.	1.610	4.34
71 - ILDB (6 BITS) TAKES 9.86 USEC.	9.860	71 - ILDB (6 BITS) TAKES 2.77 USEC.	2.770	3.56
72 - IDPB (6 BITS) TAKES 15.01 USEC.	15.010	72 - IDPB (6 BITS) TAKES 4.71 USEC.	4.710	3.19
73 - LDB (7 BITS - POS 6) TAKES 4.70 USEC.	4.700	73 - LDB (7 BITS - POS 6) TAKES 1.20 USEC.	1.200	3.92
74 - LDB (7 BITS - POS 13) TAKES 4.70 USEC.	4.700	74 - LDB (7 BITS - POS 13) TAKES 1.20 USEC.	1.200	3.92
75 - LDB (7 BITS - POS 20) TAKES 4.70 USEC.	4.700	75 - LDB (7 BITS - POS 20) TAKES 1.20 USEC.	1.200	3.92
76 - LDB (7 BITS - POS 27) TAKES 4.70 USEC.	4.700	76 - LDB (7 BITS - POS 27) TAKES 1.20 USEC.	1.200	3.92
77 - LDB (7 BITS - POS 34) TAKES 4.70 USEC.	4.700	77 - LDB (7 BITS - POS 34) TAKES 1.20 USEC.	1.200	3.92
78 - DPB (7 BITS - POS 6) TAKES 5.76 USEC.	5.760	78 - DPB (7 BITS - POS 6) TAKES 1.37 USEC.	1.370	4.20
79 - DPB (7 BITS - POS 13) TAKES 5.76 USEC.	5.760	79 - DPB (7 BITS - POS 13) TAKES 1.37 USEC.	1.370	4.20
80 - DPB (7 BITS - POS 20) TAKES 5.76 USEC.	5.760	80 - DPB (7 BITS - POS 20) TAKES 1.37 USEC.	1.370	4.20
81 - DPB (7 BITS - POS 27) TAKES 5.76 USEC.	5.760	81 - DPB (7 BITS - POS 27) TAKES 1.37 USEC.	1.370	4.20
82 - DPB (7 BITS - POS 34) TAKES 5.76 USEC.	5.760	82 - DPB (7 BITS - POS 34) TAKES 1.37 USEC.	1.370	4.20
83 - LDB (6 BITS - POS 5) TAKES 9.70 USEC.	9.700	83 - LDB (6 BITS - POS 5) TAKES 2.23 USEC.	2.230	4.35
84 - LDB (6 BITS - POS 11) TAKES 8.79 USEC.	8.790	84 - LDB (6 BITS - POS 11) TAKES 2.02 USEC.	2.020	4.35
85 - LDB (6 BITS - POS 17) TAKES 7.88 USEC.	7.880	85 - LDB (6 BITS - POS 17) TAKES 2.01 USEC.	2.010	3.92
86 - LDB (6 BITS - POS 23) TAKES 9.40 USEC.	9.400	86 - LDB (6 BITS - POS 23) TAKES 2.11 USEC.	2.110	4.45
87 - LDB (6 BITS - POS 29) TAKES 8.49 USEC.	8.490	87 - LDB (6 BITS - POS 29) TAKES 2.13 USEC.	2.130	3.99
88 - LDB (6 BITS - POS 35) TAKES 7.58 USEC.	7.580	88 - LDB (6 BITS - POS 35) TAKES 1.96 USEC.	1.960	3.87
89 - DPB (6 BITS - POS 5) TAKES 14.86 USEC.	14.860	89 - DPB (6 BITS - POS 5) TAKES 5.02 USEC.	5.020	2.96
90 - DPB (6 BITS - POS 11) TAKES 13.95 USEC.	13.950	90 - DPB (6 BITS - POS 11) TAKES 4.66 USEC.	4.660	2.99
91 - DPB (6 BITS - POS 17) TAKES 13.04 USEC.	13.040	91 - DPB (6 BITS - POS 17) TAKES 4.10 USEC.	4.100	3.18
92 - DPB (6 BITS - POS 23) TAKES 12.13 USEC.	12.130	92 - DPB (6 BITS - POS 23) TAKES 3.42 USEC.	3.420	3.55
93 - DPB (6 BITS - POS 29) TAKES 11.22 USEC.	11.220	93 - DPB (6 BITS - POS 29) TAKES 3.13 USEC.	3.130	3.58
94 - DPB (6 BITS - POS 35) TAKES 10.31 USEC.	10.310	94 - DPB (6 BITS - POS 35) TAKES 2.75 USEC.	2.750	3.75
95 - JFCL TAKES 1.67 USEC.	1.670	95 - JFCL TAKES 402 NSEC.	0.402	4.15

96 - CAI NO-OP TAKES 1.22 USEC.	1.220	96 - CAI NO-OP TAKES 322 NSEC.	0.322	3.79
97 - CAI THAT DOESN'T SKIP TAKES 2.13 USEC.	2.130	97 - CAI THAT DOESN'T SKIP TAKES 482 NSEC.	0.482	4.42
98 - CAI THAT SKIPS TAKES 2.13 USEC.	2.130	98 - CAI THAT SKIPS TAKES 483 NSEC.	0.483	4.41
99 - CAM NO-OP TO AC TAKES 1.97 USEC.	1.970	99 - CAM NO-OP TO AC TAKES 482 NSEC.	0.482	4.09
100 - CAM TO AC THAT DOESN'T SKIP TAKES 2.43 USEC.	2.430	100 - CAM TO AC THAT DOESN'T SKIP TAKES 562 NSEC.	0.562	4.32
101 - CAM TO AC THAT SKIPS TAKES 2.43 USEC.	2.430	101 - CAM TO AC THAT SKIPS TAKES 563 NSEC.	0.563	4.32
102 - CAM NO-OP TO MEMORY TAKES 1.97 USEC.	1.970	102 - CAM NO-OP TO MEMORY TAKES 482 NSEC.	0.482	4.09
103 - CAM TO MEMORY THAT DOESN'T SKIP TAKES 2.43 USEC.	2.430	103 - CAM TO MEMORY THAT DOESN'T SKIP TAKES 562 NSEC.	0.562	4.32
104 - CAM TO MEMORY THAT SKIPS TAKES 2.43 USEC.	2.430	104 - CAM TO MEMORY THAT SKIPS TAKES 563 NSEC.	0.563	4.32
105 - TLN NO SKIP TAKES 2.28 USEC.	2.280	105 - TLN NO SKIP TAKES 562 NSEC.	0.562	4.06
106 - TLN SKIP TAKES 2.28 USEC.	2.280	106 - TLN SKIP TAKES 563 NSEC.	0.563	4.05
107 - TRN NO SKIP TAKES 1.97 USEC.	1.970	107 - TRN NO SKIP TAKES 482 NSEC.	0.482	4.09
108 - TRN SKIP TAKES 1.98 USEC.	1.980	108 - TRN SKIP TAKES 483 NSEC.	0.483	4.10
109 - TDN NO SKIP TAKES 2.28 USEC.	2.280	109 - TDN NO SKIP TAKES 562 NSEC.	0.562	4.06
110 - TDN SKIP TAKES 2.28 USEC.	2.280	110 - TDN SKIP TAKES 563 NSEC.	0.563	4.05
111 - TSN NO SKIP TAKES 2.58 USEC.	2.580	111 - TSN NO SKIP TAKES 642 NSEC.	0.642	4.02
112 - TSN SKIP TAKES 2.59 USEC.	2.590	112 - TSN SKIP TAKES 644 NSEC.	0.644	4.02
113 - SKIP TO AC THAT DOESN'T TAKES 2.58 USEC.	2.580	113 - SKIP TO AC THAT DOESN'T TAKES 642 NSEC.	0.642	4.02
114 - SKIP TO AC THAT DOES TAKES 2.59 USEC.	2.590	114 - SKIP TO AC THAT DOES TAKES 644 NSEC.	0.644	4.02
115 - SKIP TO MEMORY THAT DOESN'T TAKES 2.58 USEC.	2.580	115 - SKIP TO MEMORY THAT DOESN'T TAKES 642 NSEC.	0.642	4.02
116 - SKIP TO MEMORY THAT DOES TAKES 2.59 USEC.	2.590	116 - SKIP TO MEMORY THAT DOES TAKES 644 NSEC.	0.644	4.02
117 - EQV AC TO AC TAKES 1.82 USEC.	1.820	117 - EQV AC TO AC TAKES 562 NSEC.	0.562	3.24
118 - EQV MEMORY TO AC TAKES 1.82 USEC.	1.820	118 - EQV MEMORY TO AC TAKES 562 NSEC.	0.562	3.24
119 - EXCHANGE AN AC WITH AN AC TAKES 2.58 USEC.	2.580	119 - EXCHANGE AN AC WITH AN AC TAKES 642 NSEC.	0.642	4.02
120 - EXCHANGE AN AC WITH MEMORY TAKES 2.58 USEC.	2.580	120 - EXCHANGE AN AC WITH MEMORY TAKES 642 NSEC.	0.642	4.02
121 - EXECUTE TAKES 2.12 USEC.	2.120	121 - EXECUTE TAKES 561 NSEC.	0.561	3.78
122 - BLT MEMORY TO MEMORY TAKES 7.43 USEC.	7.430	122 - BLT MEMORY TO MEMORY TAKES 1.77 USEC.	1.770	4.20
123 - BLT AC TO MEMORY TAKES 7.43 USEC.	7.430	123 - BLT AC TO MEMORY TAKES 1.77 USEC.	1.770	4.20