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Understanding Embedded - FPGAs (Field Programmable Gate Array)

Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

Applications of Embedded - FPGAs

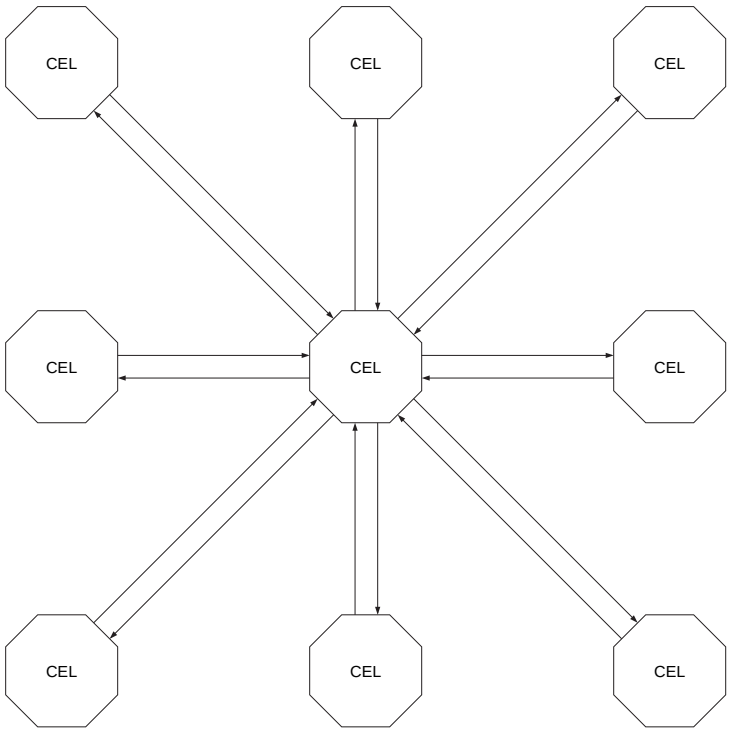
The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

Details	
Product Status	Obsolete
Number of LABs/CLBs	-
Number of Logic Elements/Cells	2304
Total RAM Bits	18432
Number of I/O	114
Number of Gates	50000
Voltage - Supply	3V ~ 3.6V
Mounting Type	Surface Mount
Operating Temperature	0°C ~ 70°C (TC)
Package / Case	144-LQFP
Supplier Device Package	144-TQFP (20x20)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/at40k40lv-3bqc

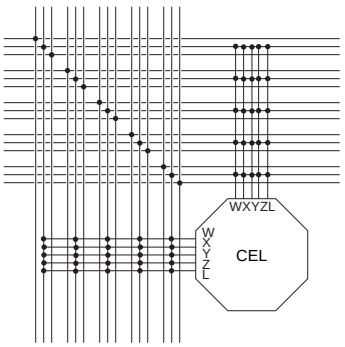
Cell Connections

Figure 4(a) depicts direct connections between a cell and its eight nearest neighbors. Figure 4(b) shows the connections between a cell five horizontal local buses (one per busing plane) and five vertical local buses (one per busing plane).

Figure 4. Cell Connections

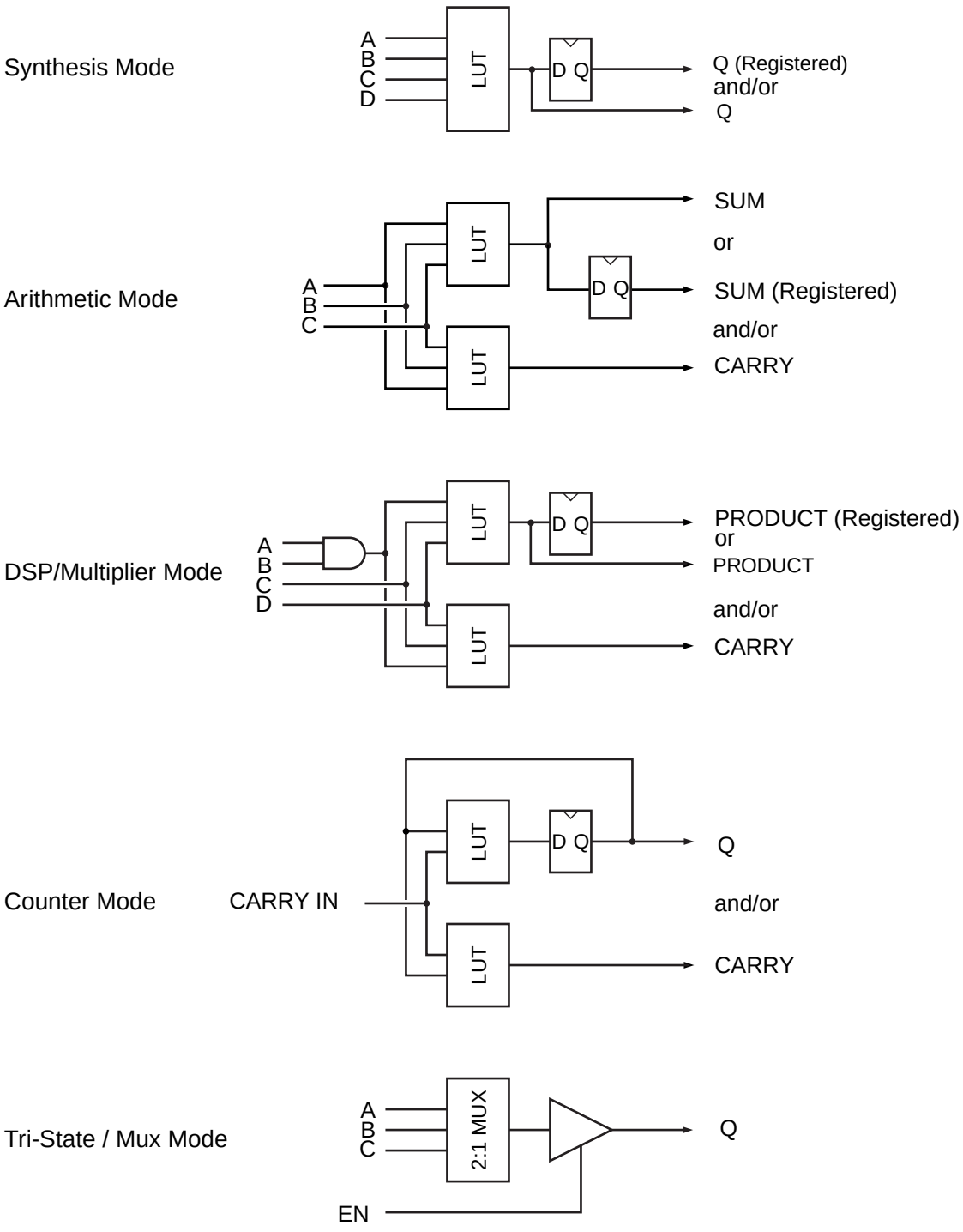


(a) Cell to Cell Connections



(b) Cell to Bus Connections

Figure 6. Some Single Cell Modes



RAM

32 x 4 Dual-Ported RAM blocks are dispersed throughout the array as shown in Figure 7. A four-bit Input Data Bus connects to four horizontal local buses distributed over four sector rows (plane 1). A four-bit Output Data Bus connects to four horizontal local buses distributed over four sector rows (plane 2). A five-bit Input-Address Bus connects to five vertical express buses in same column. A five-bit Output-Address Bus connects to five vertical express buses in same column. WAddr (Write Address) and RAddr (Read Address) alternate positions in horizontally aligned RAM blocks. For the left-most RAM blocks, RAddr is on the left and WAddr is on the right. For the right-most RAM blocks, WAddr is on the left and RAddr is tied off. For single-ported RAM, WAddr is the READ/WRITE address port and Din is the (bi-directional) data port. Right-most RAM blocks can be used only for single-ported memories. /WE & /OE connect to the vertical express buses in the same column. WAddr, RAddr, /WE and /OE connect to express buses that are full length at array edge.

Figure 7. RAM Connections (One Ram Block)

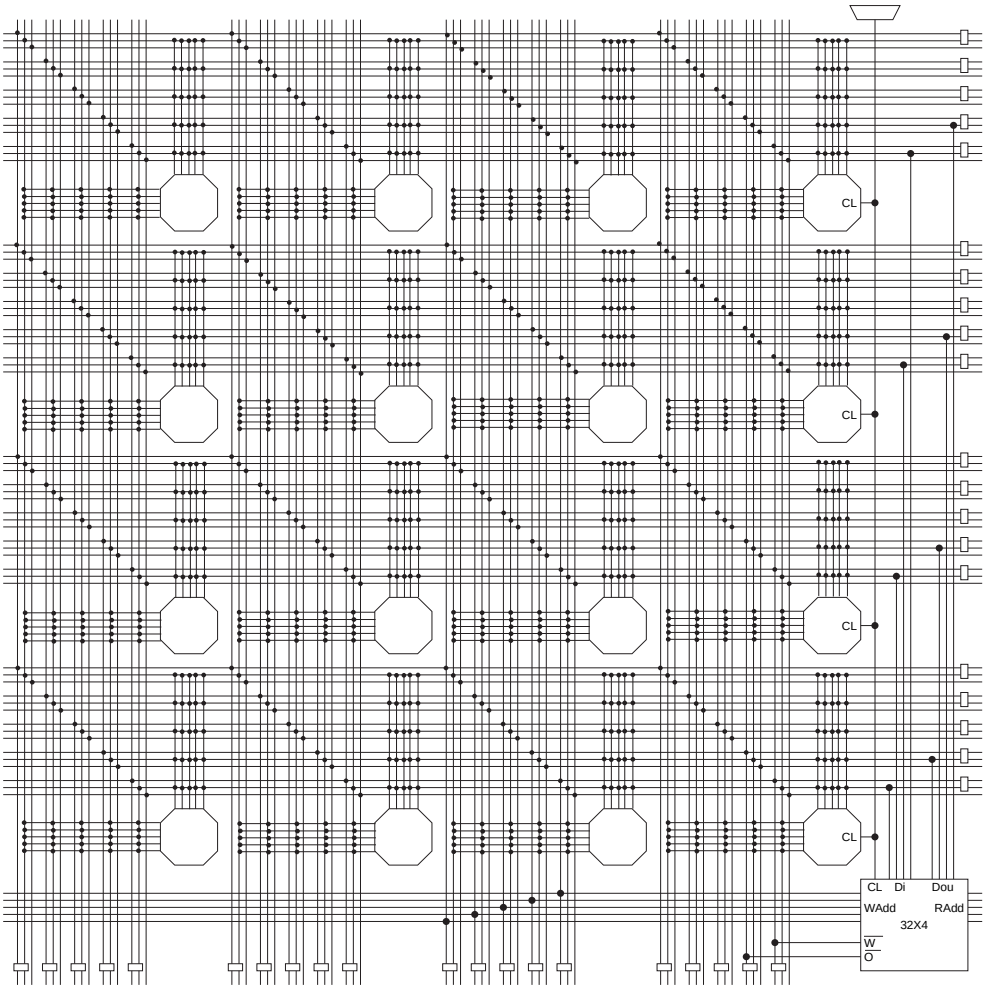


Figure 10. Clocking (for one column of cells)

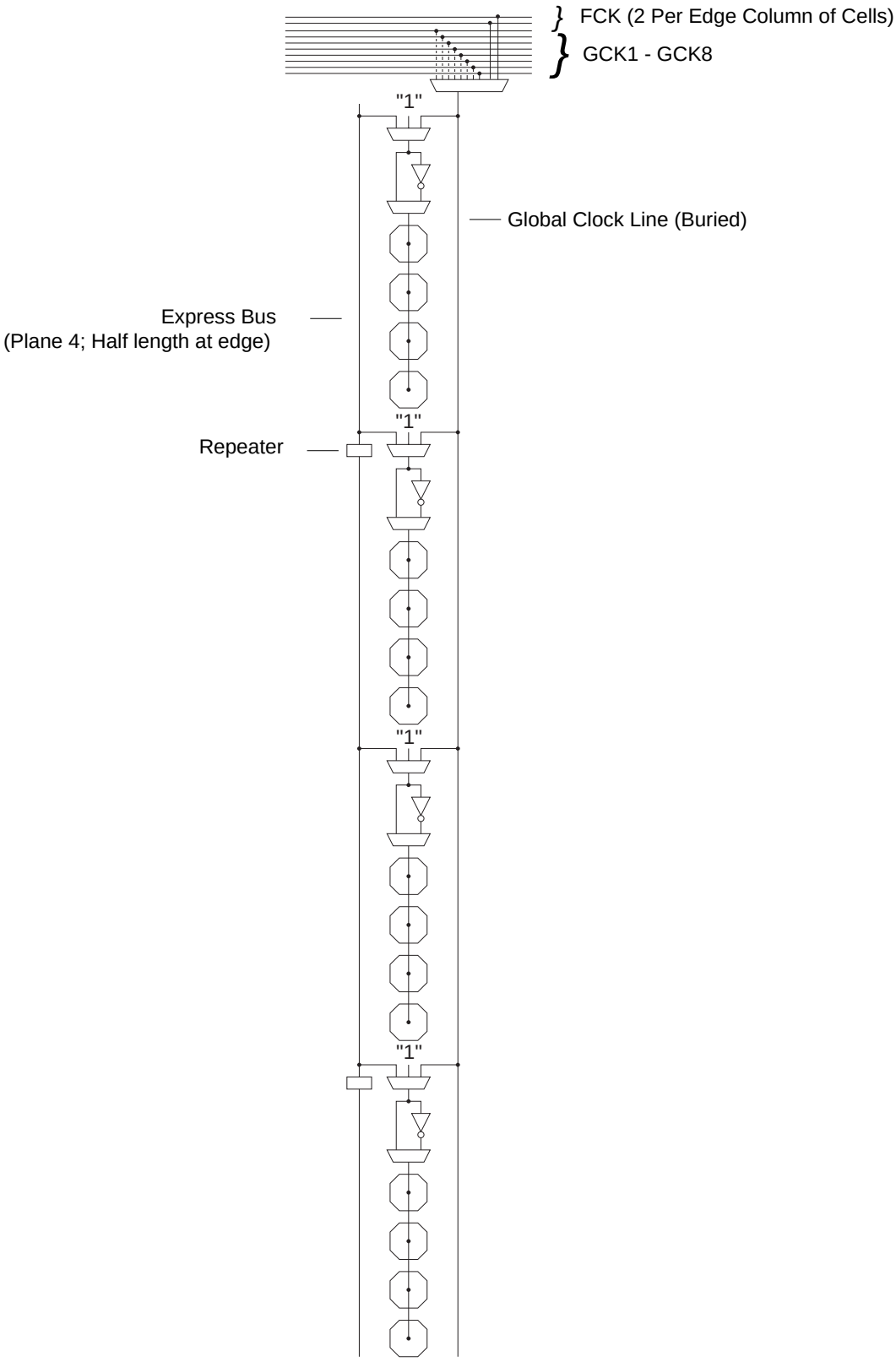
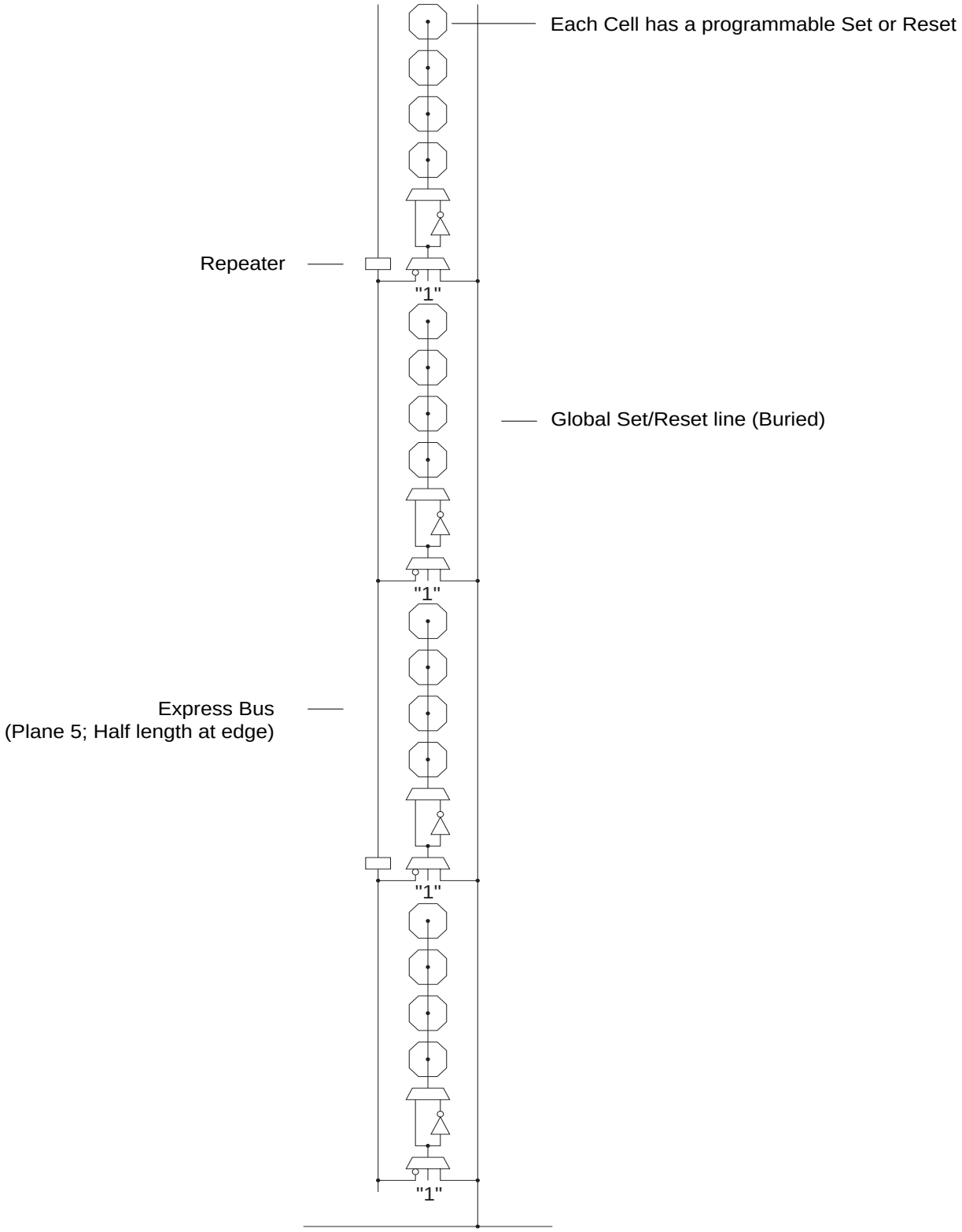
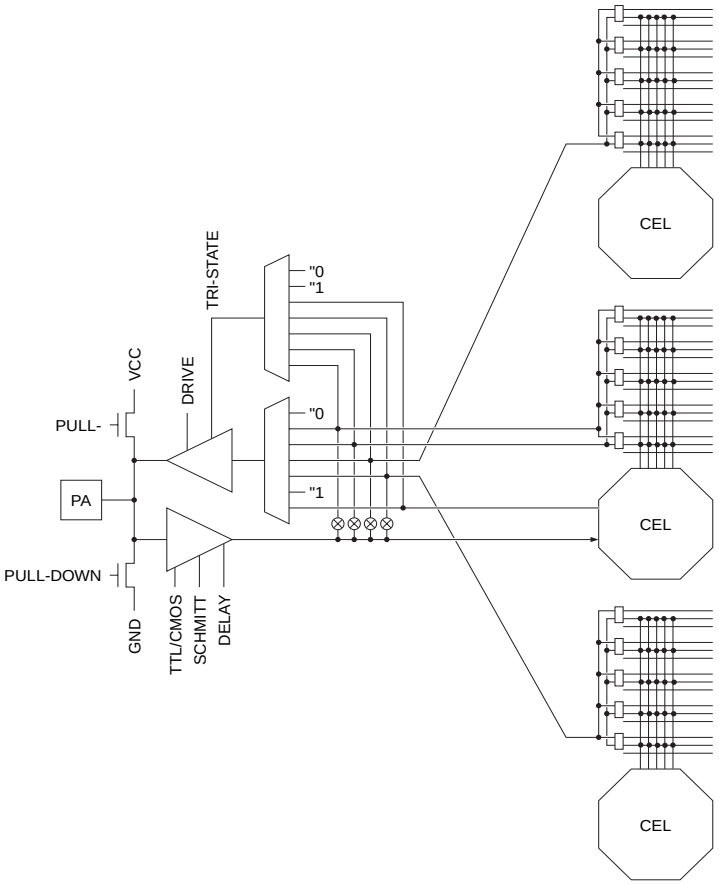


Figure 11. Set/Reset (for one column of cells)

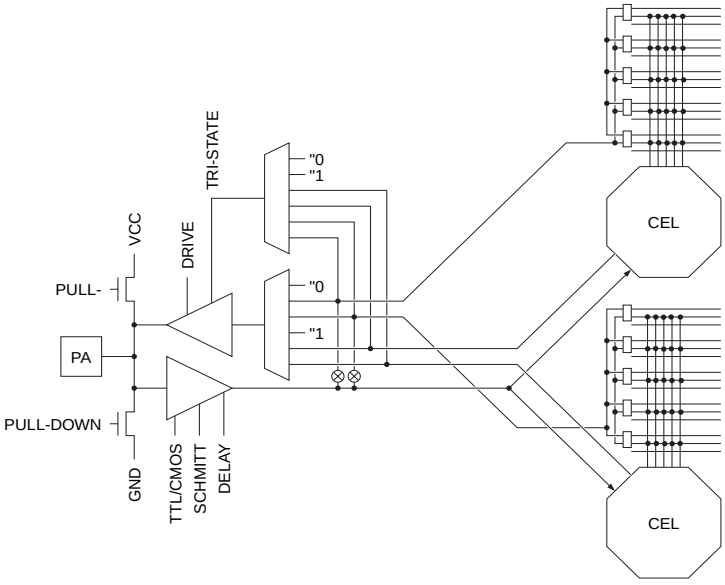


Any User I/O can drive Global Set/Reset line

Figure 12. West I/O (Mirrored for East I /O)

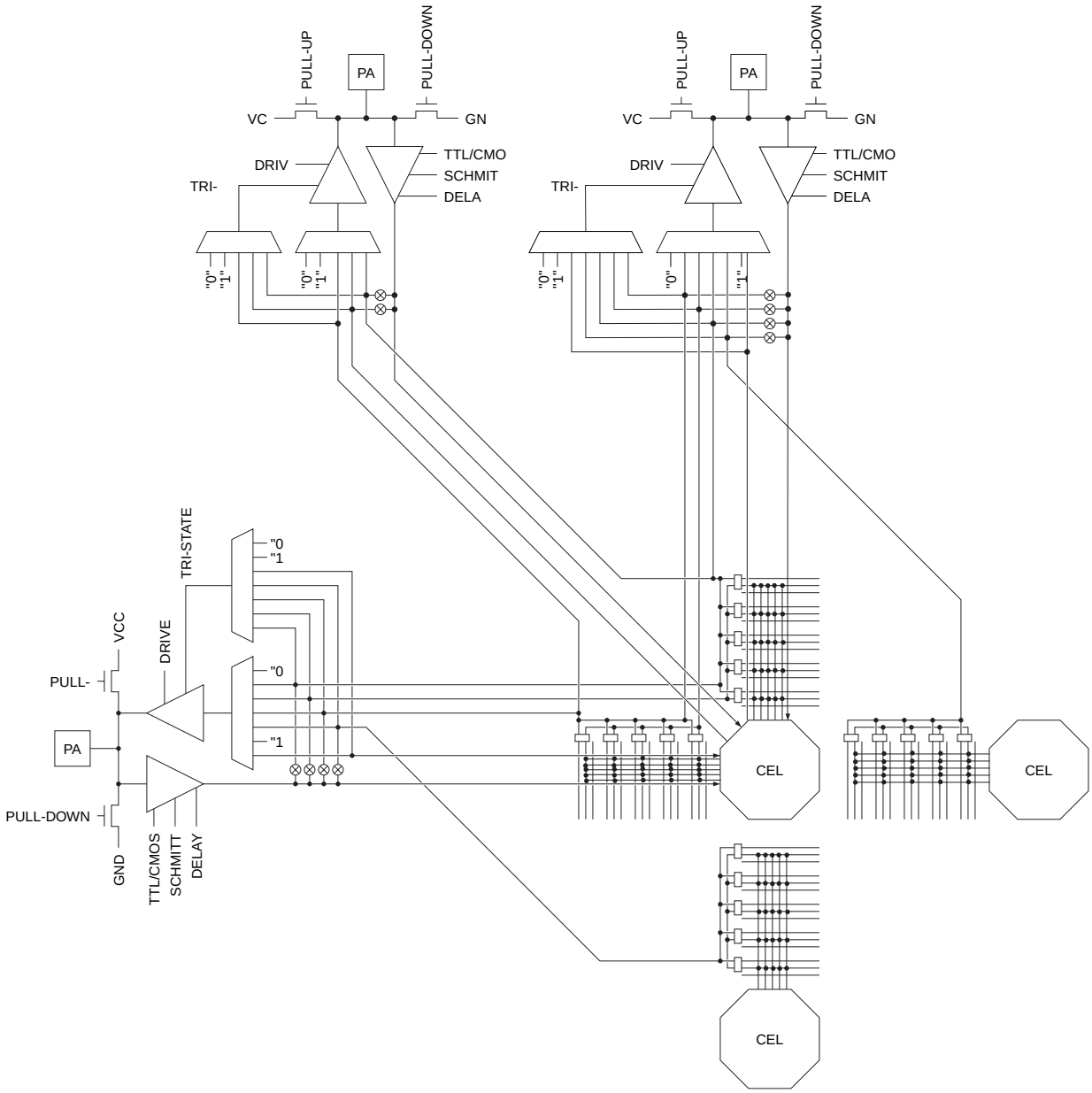


(a) Primary



(a) Secondary

Figure 14. North/West Corner, (similar for NE/SE/SW corners)



AC Timing Characteristics - 5V Operation

Delays are based on fixed loads and are described in the notes.
Maximum times based on worst case: V_{CC} = 4.75V, temperature = 70°C
Minimum times based on best case: V_{CC} = 5.25V, temperature = 0°C
Max delays are the average of t_{PDLH} and t_{PDHL}.

Clocks and Reset Input buffers are measured from a V_{IH} of 1.5V at the input pad to the internal V_{IH} of 50% of V_{CC}.
Maximum times for clock input buffers and internal drivers are measured for rising edge delays only.

Cell Function	Parameter	Path	Device	-2	Units	Notes
Global Clocks and Set/Reset						
GCLK Input buffer	t_{PD}(max)	pad -> clock	AT40K05	1.1	ns	rising edge clock
		pad -> clock	AT40K10	1.2	ns	
		pad -> clock	AT40K20	1.2	ns	
		pad -> clock	AT40K40	1.4	ns	
FCLK Input buffer	t_{PD}(max)	pad -> clock	AT40K05	0.7	ns	rising edge clock
		pad -> clock	AT40K10	0.8	ns	
		pad -> clock	AT40K20	0.8	ns	
		pad -> clock	AT40K40	0.8	ns	
Clock column driver	t_{PD}(max)	clock -> colclk	AT40K05	0.8	ns	rising edge clock
		clock -> colclk	AT40K10	0.9	ns	
		clock -> colclk	AT40K20	1.0	ns	
		clock -> colclk	AT40K40	1.1	ns	
Clock sector driver	t_{PD}(max)	colclk -> secclk	AT40K05	0.5	ns	rising edge clock
		colclk -> secclk	AT40K10	0.5	ns	
		colclk -> secclk	AT40K20	0.5	ns	
		colclk -> secclk	AT40K40	0.5	ns	
GSRN Input buffer	t_{PD}(max)	pad -> GSRN	AT40K05	3.0	ns	
		colclk -> secclk	AT40K10	3.7	ns	
		colclk -> secclk	AT40K20	4.3	ns	
		colclk -> secclk	AT40K40	5.6	ns	
Global clock to output	t_{PD}(max)	clock pad -> out	AT40K05	8.3	ns	rising edge clock
		clock pad -> out	AT40K10	8.4	ns	fully loaded clock tree
		clock pad -> out	AT40K20	8.6	ns	rising edge DFF
		clock pad -> out	AT40K40	8.8	ns	20mA output buffer
						50 pf pin load
Output, fast	t_{PD}(max)	clock pad -> out	AT40K05	7.9	ns	rising edge clock
		clock pad -> out	AT40K10	8.0	ns	fully loaded clock tree
		clock pad -> out	AT40K20	8.1	ns	rising edge DFF
		clock pad -> out	AT40K40	8.3	ns	20mA output buffer
						50 pf pin load

Absolute Maximum Ratings - 3.3V Commercial/Industrial*

Symbol	Parameter	Conditions	Min	Max	Units
V_{CC}	Supply Voltage	With respect to GND	-0.5	7.0	V
V_I	DC Input Voltage(1)	With respect ot GND	-0.5	7.0	V
V_O	DC Output Voltaage	With respect ot GND	-0.5	7.0	V
T_{STG}	Storage Temperature		-65°C	+150°C	
T_J	Junction Temperature			+150°C	
T_L	Lead Temperature (Soldering, 10 sec.)			+250°C	
ESD		R_{ZAP} = 1.5K, C_{ZAP} = 100 pF		2000	V

Note: 1. Minimum voltage of -0.5V DC which may undershoot to -2.0V for pulses of less than 20 ns.

*NOTICE: Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC and AC Operating Range - 3.3V Operation

		AT40K05LV-4/3/2 AT40K10LV-4/3/2 AT40K20LV-4/3/2 AT40K40LV-4/3/2 Commercial	**AT40K05LV-4/3/2 AT40K10LV-4/3/2 AT40K20LV-4/3/2 AT40K40LV-4/3/2 Industrial**
Operating Temperature (Case)		0°C - 70°C	-40°C - 85°C
V_{CC} Power Supply		3.3V ± 0.3V	3.3V ± 0.3V
Input Voltage Level (CMOS)	High (V_{IHC})	70% - 100% V_{CC}	70% - 100% V_{CC}
	Low (V_{ILC})	0 - 30% V_{CC}	0 - 30% V_{CC}

DC Characteristics - 3.3V Operation - Commercial/Industrial

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IH}	High-Level Input Voltage	CMOS	70% V_{CC}			V
		TTL	2.0			V
V_{IL}	Low-Level Input Voltage	CMOS	-0.3		30% V_{CC}	V
		TTL	-0.3		0.8	V
V_{OH}	High-Level Output Voltage	I_{OH} = 4 mA V_{CC} = V_{CC} min	2.1			V
		I_{OH} = 12 mA V_{CC} = 3.0V	2.1			V
		I_{OH} = 16 mA V_{CC} = 3.0V	2.1			V
V_{OL}	Low-Level Output Voltage	I_{OL} = -4 mA V_{CC} = 3.0V			0.4	V
		I_{OL} = -12 mA V_{CC} = 3.0V			0.4	V
		I_{OL} = -16 mA V_{CC} = 3.0V			0.4	V
I_{IH}	High-Level Input Current	V_{IN} = V_{CC} max			10	µA
		With pulldown, V_{IN} = V_{CC}	75	150	300	µA
I_{IL}	Low-Level Input Current	V_{IN} = V_{SS}	-10			µA
		With pullup, V_{IN} = V_{SS}	-300	-150	-75	µA
I_{OZH}	High-Level Tristate Output leakage current	Without pulldown, V_{IN} = V_{CC} max			10	µA
		With pulldown, V_{IN} = V_{CC} max	75	150	300	µA
I_{OZL}	Low-Level Tristate Output leakage current	Without pullup, V_{IN} = V_{SS}	-10			µA
		With pullup, V_{IN} = V_{SS}	-300	-150	-75	µA
I_{CC}	Standby Current Consumption	Standby, unprogrammed		0.6	1	mA
C_{IN}	Input Capacitance	All pins			10	pF

Note: 1. Parameter based on characterization and simulation; it is not tested in production.

AT40K05	AT40K10	AT40K20	AT40K40	Left Side (Top to Bottom)										
128 I/O	192 I/O	256 I/O	384 I/O	PC84	RQ100	VQ100	TQ144	PQ160	PQ208	BG225	PQ240	PQ304	BG352	BG432
	I/O18	I/O22	I/O30							F1	21	279	J25	L30
			GND											GND*
			I/O31											M30
			I/O32											M28
128 I/O	192 I/O	256 I/O	384 I/O	PC84	RQ100	VQ100	TQ144	PQ160	PQ208	BG225	PQ240	PQ304	BG352	BG432
			I/O33										J26	M29
			I/O34										L23	M31
		I/O23	I/O35									278	L24	N31
		I/O24	I/O36									277	K25	N28
		GND	GND								22		GND(1)	GND(1)
			VCC										VCC(1)	VCC(1)
			I/O37											N29
			I/O38											N30
		I/O25	I/O39									276	L25	P30
		I/O26	I/O40									275	L26	P28
	I/O19	I/O27	I/O41						19	G4	23	274	M23	P29
	I/O20	I/O28	I/O42						20	G3	24	273	M24	R31
			GND											GND(1)
I/O13	I/O21	I/O29	I/O43				13	15	21	G2	25	272	M25	R30
I/O14	I/O22	I/O30	I/O44		11	8	14	16	22	G1	26	271	M26	R28
			I/O45											
			I/O46											
I/O15 (A22)	I/O23 (A22)	I/O31 (A22)	I/O47 (A22)	19	12	9	15	17	23	G5	27	270	N24	R29
I/O16 (A23)	I/O24 (A23)	I/O32 (A23)	I/O48 (A23)	20	13	10	16	18	24	H3	28	269	N25	T31
GND	GND	GND	GND	21	14	11	17	19	25	GND(1)	29	268	GND(1)	GND(1)
VCC	VCC	VCC	VCC	22	15	12	18	20	26	VCC(1)	30	267	VCC(1)	VCC(1)
I/O17	I/O25	I/O33	I/O49	23	16	13	19	21	27	H4	31	266	N26	T30
I/O18	I/O26	I/O34	I/O50	24	17	14	20	22	28	H5	32	265	P25	T29
			I/O51											
			I/O52											
I/O19	I/O27	I/O35	I/O53		18	15	21	23	29	J2	33	264	P23	U31
I/O20	I/O28	I/O36	I/O54				22	24	30	J1	34	263	P24	U30
			GND											GND(1)
	I/O29	I/O37	I/O55						31	J3	35	262	R26	U28
	I/O30	I/O38	I/O56						32	J4	36	261	R25	U29
		I/O39	I/O57									260	R24	V30
		I/O40	I/O58									259	R23	V29
			I/O59											V28
			I/O60											W31
			VCC										VCC(1)	VCC(1)
		GND	GND								37		GND(1)	GND(1)
		I/O41	I/O61									258	T26	W30
		I/O42	I/O62									257	T25	W29

Note: 1. Pads labelled GND or VCC are internally bonded to Ground or VCC planes within the package. They have no direct connection to any specific package pin.

AT40K05	AT40K10	AT40K20	AT40K40	Left Side (Top to Bottom)										
128 I/O	192 I/O	256 I/O	384 I/O	PC84	RQ100	VQ100	TQ144	PQ160	PQ208	BG225	PQ240	PQ304	BG352	BG432
I/O32, GCK2	I/O48, GCK2	I/O64, GCK2	I/O96, GCK2	29	24	21	33	37	47	P1	57	232	AC24	AJ30
M1	M1	M1	M1	30	25	22	34	38	48	N3	58	231	AB23	AH29
GND	GND	GND	GND	31	26	23	35	39	49	GND(1)	59	230	GND(1)	GND(1)
M0	M0	M0	M0	32	27	24	36	40	50	P2	60	229	AD24	AH28

AT40K05	AT40K10	AT40K20	AT40K40	Bottom Side (Left to Right)										
128 I/O	192 I/O	256 I/O	384 I/O	PC84	RQ100	VQ100	TQ144	PQ160	PQ208	BG225	PQ240	PQ304	BG352	BG432
VCC	VCC	VCC	VCC	33	28	25	37	41	55	VCC*	61	228	VCC(1)	VCC(1)
M2	M2	M2	M2	34	29	26	38	42	56	M4	62	227	AC23	AJ28
I/O33, GCK3	I/O49, GCK3	I/O65, GCK3	I/O97, GCK3	35	30	27	39	43	57	R2	63	226	AE24	AK29
I/O34 (HDC)	I/O50 (HDC)	I/O66 (HDC)	I/O98 (HDC)	36	31	28	40	44	58	P3	64	225	AD23	AH27
I/O35	I/O51	I/O67	I/O99				41	45	59	L5	65	224	AC22	AK28
I/O36	I/O52	I/O68	I/O100				42	46	60	N4	66	223	AF24	AJ27
I/O37	I/O53	I/O69	I/O101		32	29	43	47	61	R3	67	222	AD22	AL28
I/O38 (LDC)	I/O54 (LDC)	I/O70 (LDC)	I/O102 (LDC)	37	33	30	44	48	62	P4	68	221	AE23	AH26
			GND											GND(1)
			I/O103											AK27
			I/O104											AJ26
			I/O105										AC21	AL27
			I/O106										AD21	AH25
		I/O71	I/O107									220	AE22	AK26
		I/O72	I/O108									219	AF23	AL26
		VCC	VCC										VCC(1)	VCC(1)
		GND	GND										GND(1)	GND(1)
I/O39	I/O55	I/O73	I/O109					49	63	K7	69	218	AD20	AH24
I/O40	I/O56	I/O74	I/O110					50	64	M5	70	217	AE21	AJ25
	I/O57	I/O75	I/O111						65	R4	71	216	AF21	AK25
	I/O58	I/O76	I/O112						66	N5	72	215	AC19	AJ24
			I/O113											AH23
			I/O114											AK24
														VCC(1)
			GND											GND(1)
			I/O115											
			I/O116											
	I/O59	I/O77	I/O117							P5	73	214	AD19	AL24
	I/O60	I/O78	I/O118							L6	74	213	AE20	AH22
		I/O79	I/O119									212	AF20	AJ23
		I/O80	I/O120									211	AC18	AK23
GND	GND	GND	GND				45	51	67	GND(1)	75	210	GND(1)	GND(1)

Note: 1. Pads labelled GND or VCC are internally bonded to Ground or VCC planes within the package. They have no direct connection to any specific package pin.

AT40K05	AT40K10	AT40K20	AT40K40	Right Side (Bottom to Top)										
128 I/O	192 I/O	256 I/O	384 I/O	PC84	RQ100	VQ100	TQ144	PQ160	PQ208	BG225	PQ240	PQ304	BG352	BG432
			I/O211											
			I/O212											
	I/O107	I/O141	I/O213						117	L14	133	138	W3	AC3
	I/O108	I/O142	I/O214						118	K11	134	137	Y2	AD1
		I/O143	I/O215									136	Y1	AC2
		I/O144	I/O216									135	V4	AB4
GND	GND	GND	GND				81	91	119	GND(1)	135	134	GND(1)	GND(1)
	I/O109	I/O145	I/O217							L15	136	133	V3	AB3
	I/O110	I/O146	I/O218							K12	137	132	W2	AB2
I/O73, FCK3	I/O111, FCK3	I/O147, FCK3	I/O219, FCK3				82	92	120	K13	138	131	U4	AB1
I/O74	I/O112	I/O148	I/O220				83	93	121	K14	139	130	U3	AA3
	VCC	VCC	VCC							VCC(1)	140	129	VCC(1)	VCC(1)
I/O75 (D5)	I/O113 (D5)	I/O149 (D5)	I/O221 (D5)	59	60	57	84	94	122	K15	141	127	V2	AA2
I/O76 (CS0)	I/O114 (CS0)	I/O150 (CS0)	I/O222 (CS0)	60	61	58	85	95	123	J12	142	126	V1	Y2
			GND											GND(1)
			I/O223										T4	Y4
			I/O224										T3	Y3
			I/O225											Y1
			I/O226											W1
		I/O151	I/O227									125	U2	W4
		I/O152	I/O228									124	T2	W3
		GND	GND								143		GND(1)	GND(1)
			VCC										VCC(1)	VCC(1)
			I/O229											W2
			I/O230											V2
		I/O153	I/O231									123	T1	V4
		I/O154	I/O232									122	R4	V3
	I/O115	I/O155	I/O233						124	J13	144	121	R3	U1
	I/O116	I/O156	I/O234						125	J14	145	120	R2	U2
			GND											GND(1)
I/O77	I/O117	I/O157	I/O235		62	59	86	96	126	J15	146	119	R1	U4
I/O78	I/O118	I/O158	I/O236		63	60	87	97	127	J11	147	118	P3	U3
			I/O237											
			I/O238											
I/O79(D4)	I/O119(D4)	I/O159(D4)	I/O239(D4)	61	64	61	88	98	128	H13	148	117	P2	T1
I/O80	I/O120	I/O160	I/O240	62	65	62	89	99	129	H14	149	116	P1	T2
VCC	VCC	VCC	VCC	63	66	63	90	100	130	VCC(1)	150	115	VCC(1)	VCC(1)
GND	GND	GND	GND	64	67	64	91	101	131	GND(1)	151	114	GND(1)	GND(1)
I/O81 (D3)	I/O121 (D3)	I/O161 (D3)	I/O241 (D3)	65	68	65	92	102	132	H12	152	113	N2	T3
I/O82 (/CHECK)	I/O122 (/CHECK)	I/O162 (/CHECK)	I/O242 (/CHECK)	66	69	66	93	103	133	H11	153	112	N4	R1
			I/O243											

Note: 1. Pads labelled GND or VCC are internally bonded to Ground or VCC planes within the package. They have no direct connection to any specific package pin.

AT40K05	AT40K10	AT40K20	AT40K40	Top Side (Right to Left)										
128 I/O	192 I/O	256 I/O	384 I/O	PC84	RQ100	VQ100	TQ144	PQ160	PQ208	BG225	PQ240	PQ304	BG352	BG432
		GND	GND										GND(1)	GND(1)
	I/O151	I/O201	I/O301	75	79	76	109	121	159	F9	189	66	C7	D8
	I/O152	I/O202	I/O302							D11	190	65	B6	C7
I/O103	I/O153	I/O203	I/O303				117	129	167	A12	191	64	A6	B7
I/O104	I/O154	I/O204	I/O304	75(2)	79(2)	76(2)	109(2)	130	168	C11	192	63	D8	D9
			I/O305										C8	B8
			I/O306											A8
														VCC(1)
			GND											GND(1)
			I/O307											
			I/O308											
	I/O155	I/O205	I/O309						169	B11	193	62	B7	D10
	I/O156	I/O206	I/O310						170	E10	194	61	A7	C9
		I/O207	I/O311								195	60	D9	B9
		I/O208	I/O312									59	C9	C10
GND	GND	GND	GND				118	131	171	GND(1)	196	58	GND(1)	GND(1)v
I/O105	I/O157	I/O209	I/O313				119	132	172	A11	197	57	B8	B10
I/O106	I/O158	I/O210	I/O314				120	133	173	D10	198	56	D10	A10
	I/O159	I/O211	I/O315							C10	199	55	C10	C11
	I/O160	I/O212	I/O316							B10	200	54	B9	D12
	VCC	VCC	VCC							VCC*	201	52	VCC(1)	VCC(1)
		I/O213	I/O317									51	A9	B11
		I/O214	I/O318									50	D11	C12
			GND											GND(1)
			I/O319											D13
			I/O320											B12
			I/O321										C11	C13
			I/O322										B10	A12
		I/O215	I/O323									49	B11	D14
		I/O216	I/O324									48	A11	B13
		GND	GND										GND(1)	GND(1)
			VCC										VCC(1)	VCC(1)
I/O107 (A4)	I/O161 (A4)	I/O217 (A4)	I/O325 (A4)	81	85	82	121	134	174	A10	202	47	D12	C14
I/O108 (A5)	I/O162 (A5)	I/O218 (A5)	I/O326 (A5)	82	86	83	122	135	175	D9	203	46	C12	A13
	I/O163	I/O219	I/O327						176	C9	205	45	B12	B14
	I/O164	I/O220	I/O328					136	177	B9	206	44	A12	D15
I/O109	I/O165	I/O221	I/O329		87	84	123	137	178	A9	207	43	C13	C15
I/O110	I/O166	I/O222	I/O330		88	85	124	138	179	E9	208	42	B13	B15

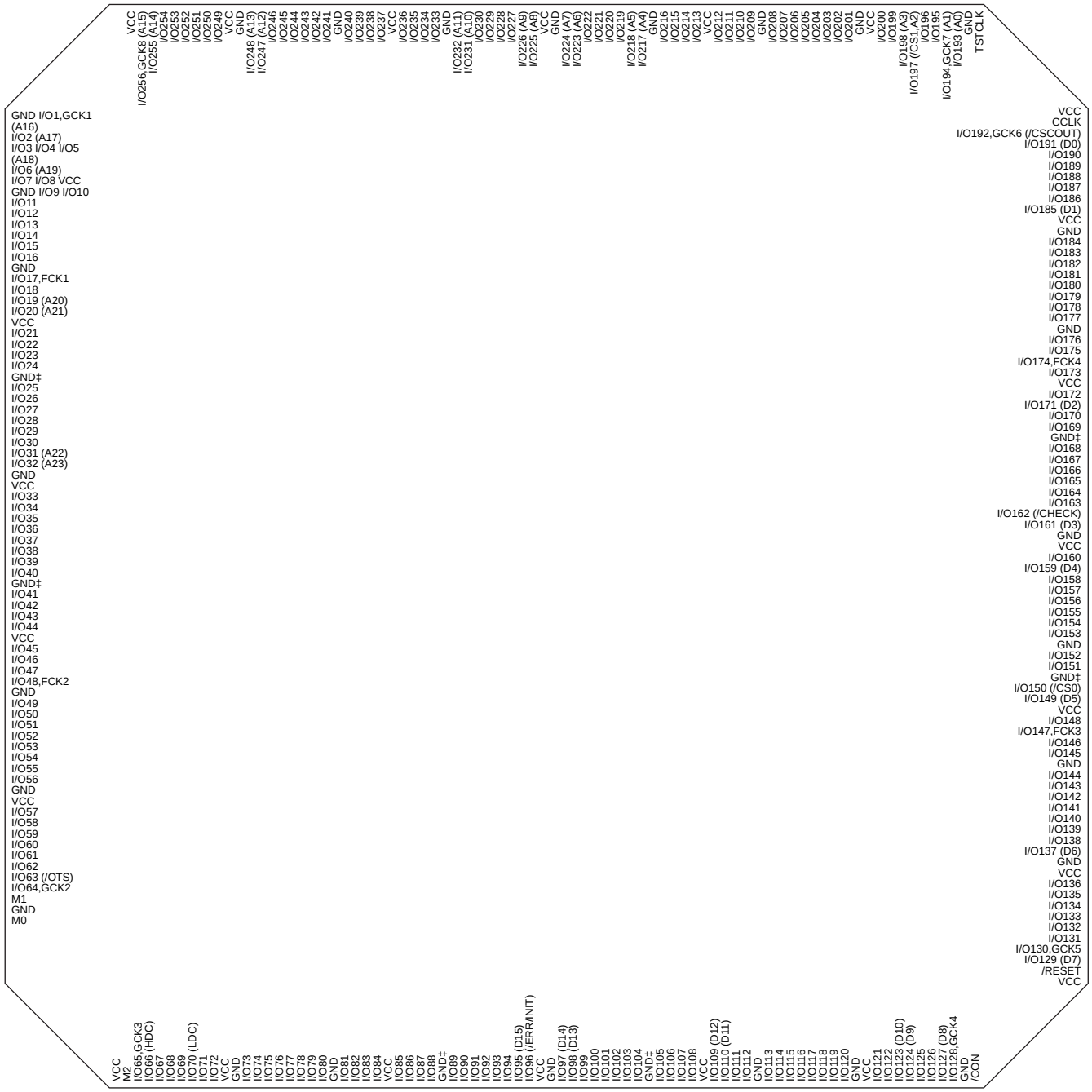
Notes: 1. Pads labelled GND or VCC are internally bonded to Ground or VCC planes within the package. They have no direct connection to any specific package pin.

2. This applies to the AT40K05 only.

AT40K05	AT40K10	AT40K20	AT40K40	Top Side (Right to Left)										
128 I/O	192 I/O	256 I/O	384 I/O	PC84	RQ100	VQ100	TQ144	PQ160	PQ208	BG225	PQ240	PQ304	BG352	BG432
			GND											GND(1)
			I/O331											
			I/O332											
			I/O333											A15
			I/O334											C16
I/O111 (A6)	I/O167 (A6)	I/O223 (A6)	I/O335 (A6)	83	89	86	125	139	180	C8	209	41	A13	B16
I/O112 (A7)	I/O168 (A7)	I/O224 (A7)	I/O336 (A7)	84	90	87	126	140	181	B8	210	40	B14	A16
GND	GND	GND	GND	1	91	88	127	141	182	GND(1)	211	39	GND(1)	GND(1)
VCC	VCC	VCC	VCC	2	92	89	128	142	183	VCC(1)	212	38	VCC(1)	VCC(1)
I/O113 (A8)	I/O169 (A8)	I/O225 (A8)	I/O337 (A8)	3	93	90	129	143	184	E8	213	37	D14	D17
I/O114 (A9)	I/O170 (A9)	I/O226 (A9)	I/O338 (A9)	4	94	91	130	144	185	B7	214	36	C14	A17
			I/O339											C17
			I/O340											B17
			I/O341											
			I/O342											
			GND											GND(1)
I/O115	I/O171	I/O227	I/O343		95	92	131	145	186	A7	215	35	A15	C18
I/O116	I/O172	I/O228	I/O344		96	93	132	146	187	C7	216	34	B15	D18
	I/O173	I/O229	I/O345						188	D7	217	33	C15	B18
	I/O174	I/O230	I/O346						189	E7	218	32	D15	A19
I/O117 (A10)	I/O175 (A10)	I/O231 (A10)	I/O347 (A10)	5	97	94	133	147	190	A6	220	31	A16	B19
I/O118 (A11)	I/O176 (A11)	I/O232 (A11)	I/O348 (A11)	6	98	95	134	148	191	B6	221	30	B16	C19
			VCC										VCC(1)	VCC(1)
		GND	GND										GND(1)	GND(1)
		I/O233	I/O349									29	C16	D19
		I/O234	I/O350									28	B17	A20
			I/O351										D16	B20
			I/O352										A18	C20
			I/O353											B21
			I/O354											D20
			GND											GND(1)
		I/O235	I/O355									27	C17	C21
		I/O236	I/O356									26	B18	A22
	VCC	VCC	VCC							VCC(1)	222	25	VCC(1)	VCC(1)
	I/O177	I/O237	I/O357							C6	223	23	C18	B22
	I/O178	I/O238	I/O358							F7	224	22	D17	C22
I/O119	I/O179	I/O239	I/O359				135	149	192	A5	225	21	A20	B23
I/O120	I/O180	I/O240	I/O360				136	150	193	B5	226	20	B19	A24

Note: 1. Pads labelled GND or VCC are internally bonded to Ground or VCC planes within the package. They have no direct connection to any specific package pin.

Figure 15. AT40K20 Pad Ring



AT40K05 Ordering Information

Usable Gates	Speed Grade (ns)	Ordering Code	Package	Operation Range
5,000-10,000	2	AT40K05-2AJC AT40K05-2AQC AT40K05-2BQC AT40K05-2CQC AT40K05-2DQC	84J 100Q 144Q 160Q 208Q	5V Commercial (0°C to 70°C)
5,000-10,000	2	AT40K05-2AJI AT40K05-2AQI AT40K05-2BQI AT40K05-2CQI AT40K05-2DQI	84J 100Q 144Q 160Q 208Q	5V Industrial (-40°C to 85°C)

Usable Gates	Speed Grade (ns)	Ordering Code	Package	Operation Range
5,000-10,000	3	AT40K05LV-3AJC AT40K05LV-3AQC AT40K05LV-3BQC AT40K05LV-3CQC AT40K05LV-3DQC	84J 100Q 144Q 160Q 208Q	3.3V Commercial (0°C to 20°C)

Package Type	
84J	84-lead, Plastic J-Leaded Chip Carrier (PLCC)
100Q	100-lead, Very Thin (1.0 mm) Plastic Gull Wing Quad Flat Package (VQFP)
100RQ	100-lead, Rectangular Plastic Plastic Gull Wing Quad Flat Package (RQPD)
144Q	144-lead, Thin (1.4 mm) Plastic Gull Wing Quad Flat Package (TQFP)
160Q	160-lead, Plastic Gull Wing Quad Flat Package (PQFP)
208Q	208-lead, Plastic Gull Wing Quad Flat Package (PQFP)
225G	225-lead, Ball Grid Array Package (BGA)
240Q	240-lead, Plastic Gull Wing Quad Flat Package (PQFP)
304Q	304-lead, Plastic Gull Wing Quad Flat Package (PQFP)
352G	352-ball, Ball Grid Array Package (BGA)
432G	432-ball, Ball Grid Array Package (BGA)

AT40K40 Ordering Information

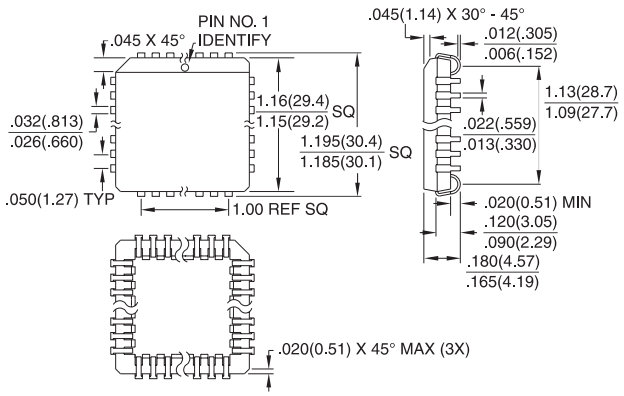
Usable Gates	Speed Grade (ns)	Ordering Code	Package	Operation Range
40,000-50,000	2	AT40K40-2BQC	144Q	5V Commercial
		AT40K40-2DQC	208Q	(0°C to 70°C)
		AT40K40-2EQC	240Q	
		AT40K40-2FQC	304Q	
		AT40K40-2BGC	352G	
		AT40K40-2CGC	432G	
40,000-50,000	2	AT40K40-2BQI	144Q	5V Industrial
		AT40K40-2DQI	208Q	(-40°C to 85°C)
		AT40K40-2EQI	240Q	
		AT40K40-2FQI	304Q	
		AT40K40-2BGI	352G	
		AT40K40-2CGI	432G	

Usable Gates	Speed Grade (ns)	Ordering Code	Package	Operation Range
40,000-50,000	3	AT40K40LV-3BQC	144Q	3.3V Commercial
		AT40K40LV-3DQC	208Q	(0°C to 20°C)
		AT40K40LV-3EQC	240Q	
		AT40K40LV-3FQC	304Q	
		AT40K40LV-3BGC	352G	
		AT40K40LV-3CGC	432G	

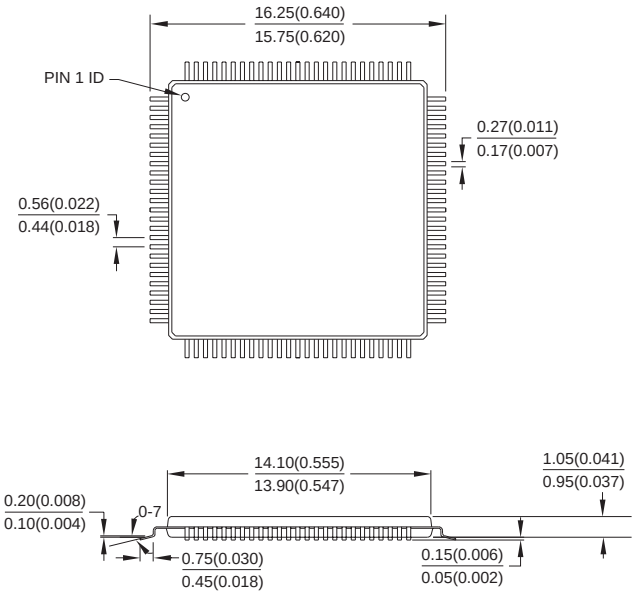
Package Type	
144Q	144-lead, Thin (1.4 mm) Plastic Gull Wing Quad Flat Package (TQFP)
160Q	160-lead, Plastic Gull Wing Quad Flat Package (PQFP)
208Q	208-lead, Plastic Gull Wing Quad Flat Package (PQFP)
225G	225-lead, Ball Grid Array Package (BGA)
240Q	240-lead, Plastic Gull Wing Quad Flat Package (PQFP)
304Q	304-lead, Plastic Gull Wing Quad Flat Package (PQFP)
352G	352-ball, Ball Grid Array Package (BGA)
432G	432-ball, Ball Grid Array Package (BGA)

Packaging Information

84J, 84-lead, Plastic J-Leaded Chip Carrier (PLCC)
Dimensions in Inches and (Millimeters)
JEDEC STANDARD MS-018 AF

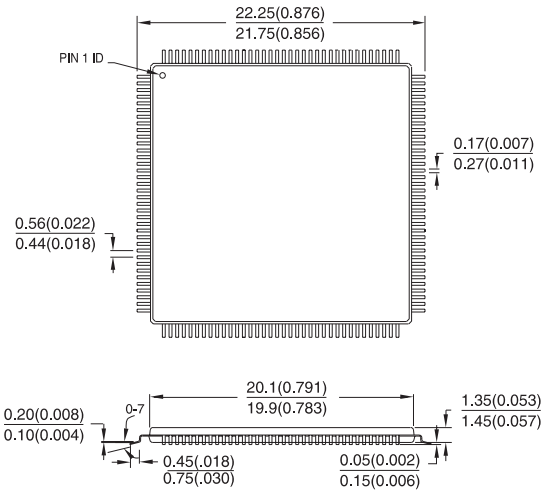


100Q, 100-lead, Plastic Gull Wing Quad Flat Package (VQFP)
Dimensions in Millimeters and (Inches)*



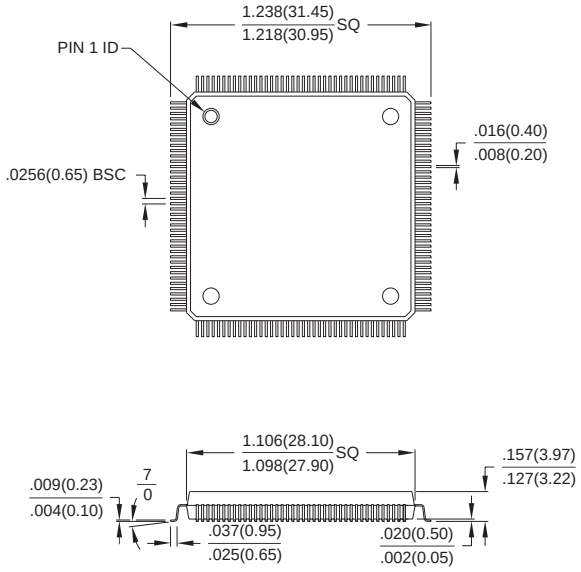
*Controlling dimension: millimeters

144Q, 144-lead, Plastic Gull Wing Quad Flat Package (TQFP)
Dimensions in Millimeters and (Inches)*



*Controlling dimension: millimeters

160Q, 160-lead, Plastic Gull Wing Quad Flat Package (PQFP)
Dimensions in (Millimeters) and Inches



Thermal Coefficient Table

Package Style	Lead Count	Theta J-A 0 LFPM	Theta J-A 225 LFPM	Theta J-A 500 LPFM	Theta J-C
PQFP	144	33	27	23	8.5
PQFP	160	30	24	20	7
PQFP	208	32	28	24	10
PQFP	240	27	No Data	No Data	
PQFP	304	19	No Data	No Data	
TQFP	100	47	39	33	22
RQFP	100	3			
PLCC	84	37	30	25	12
BGA	225	26	No Data	No Data	
BGA	352				
BGA	432				