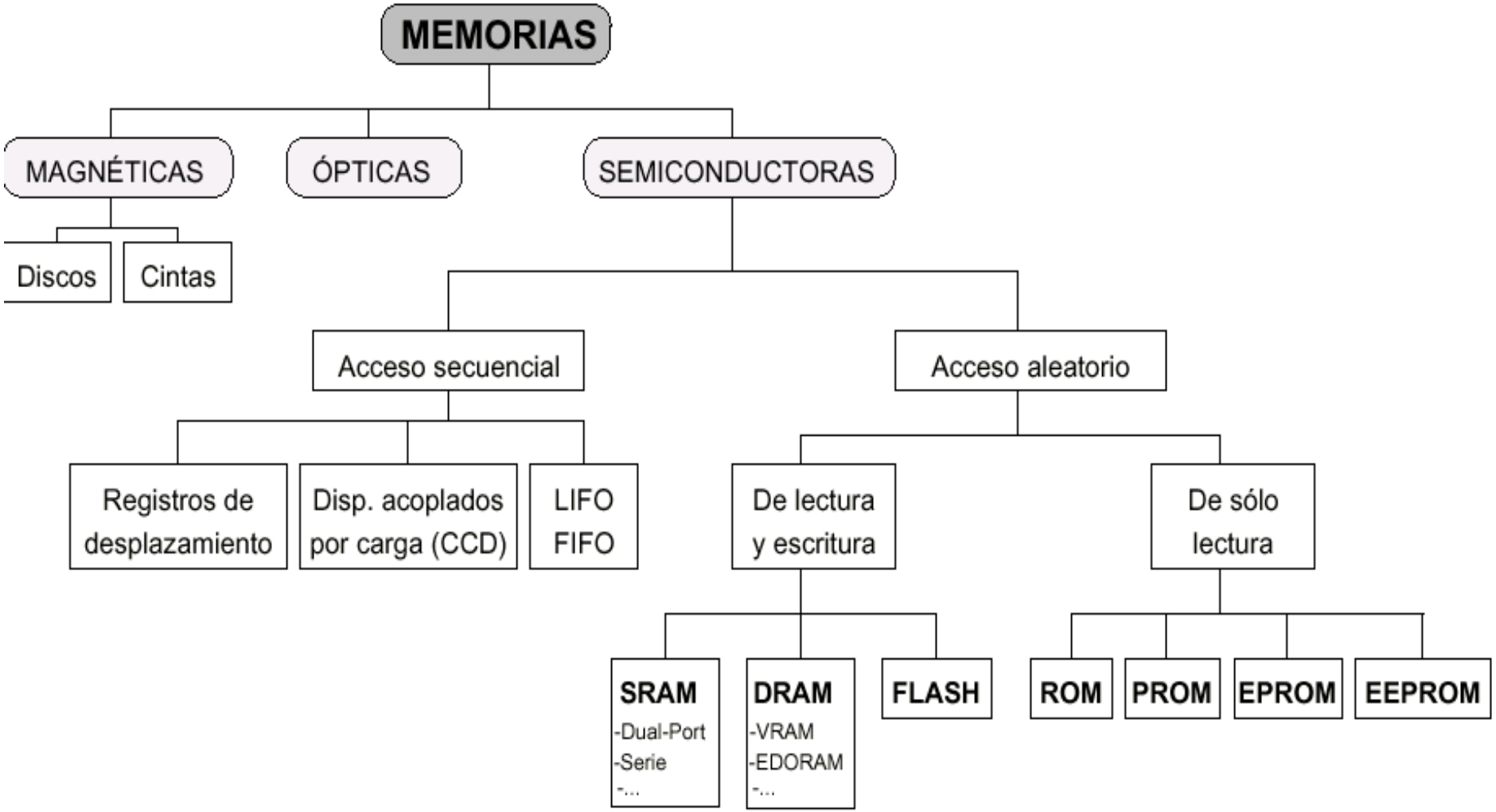
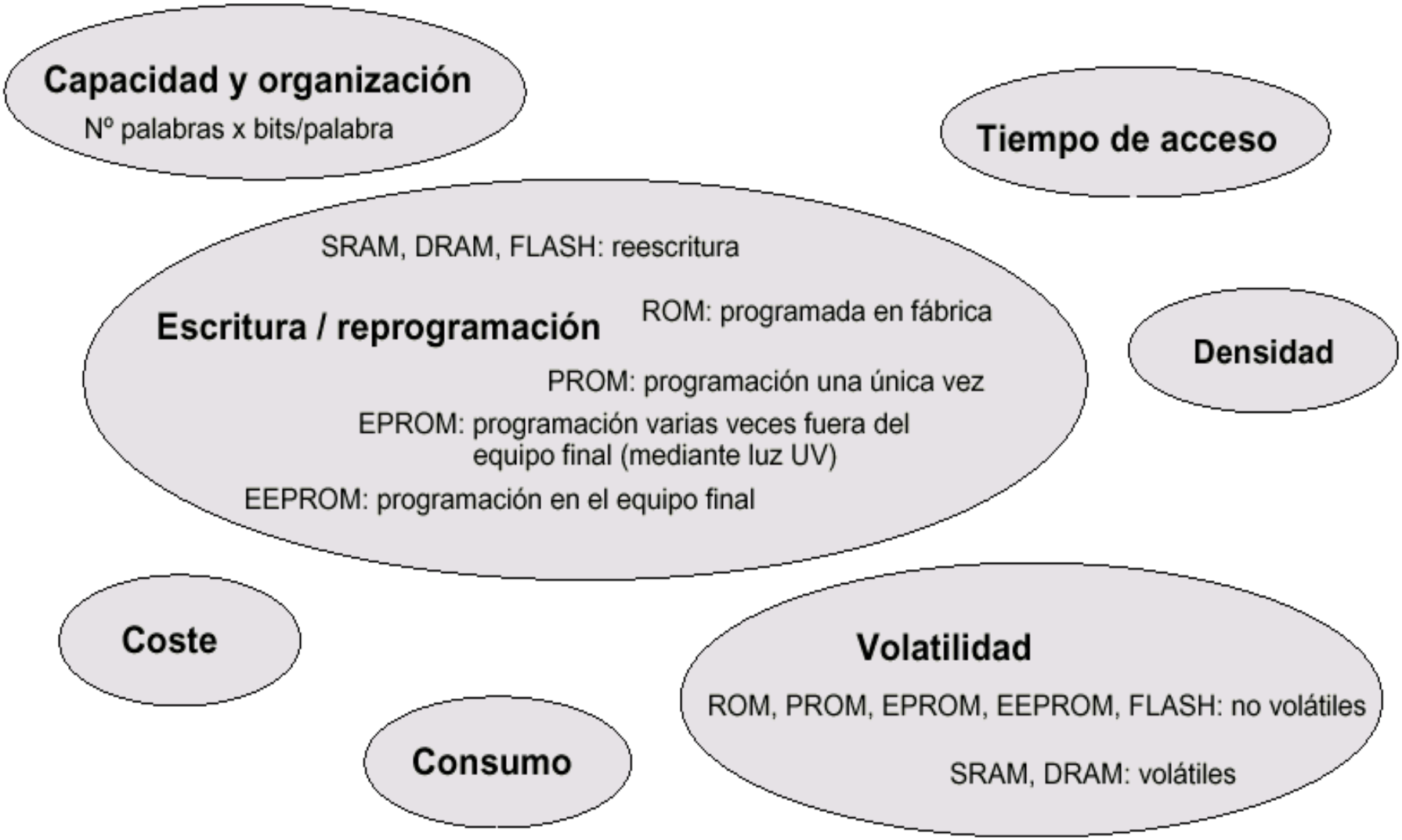
Clasificación de memorias

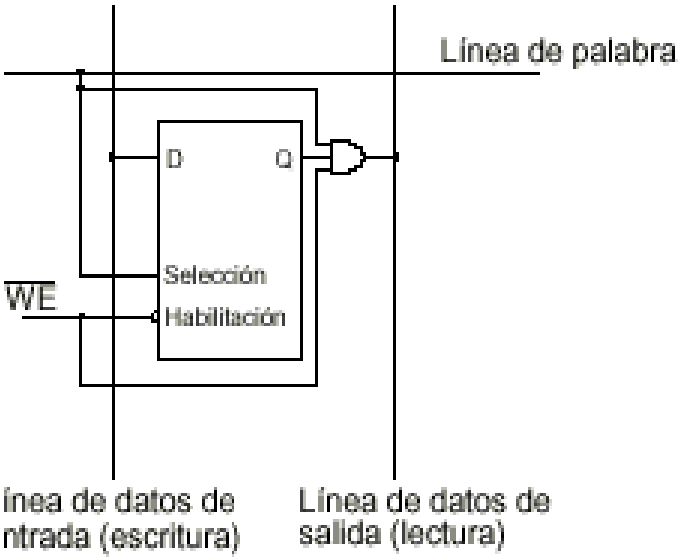


Características de las memorias semiconductoras de acceso aleatorio

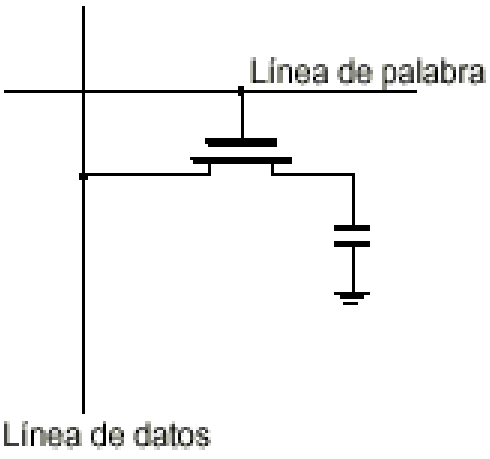


Celdas básicas de las memorias semiconductoras

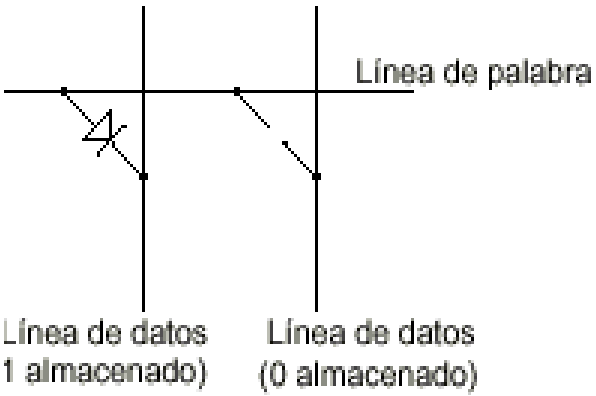
SRAM



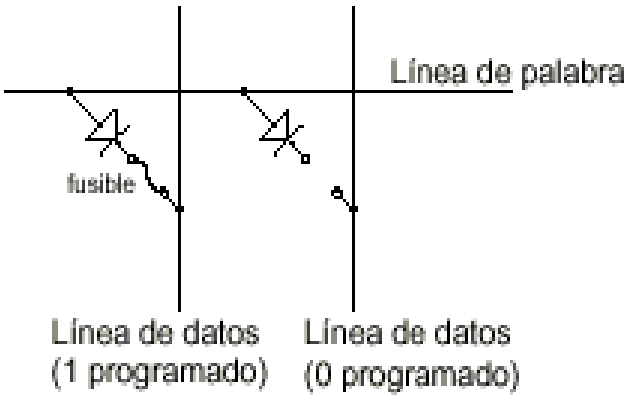
DRAM

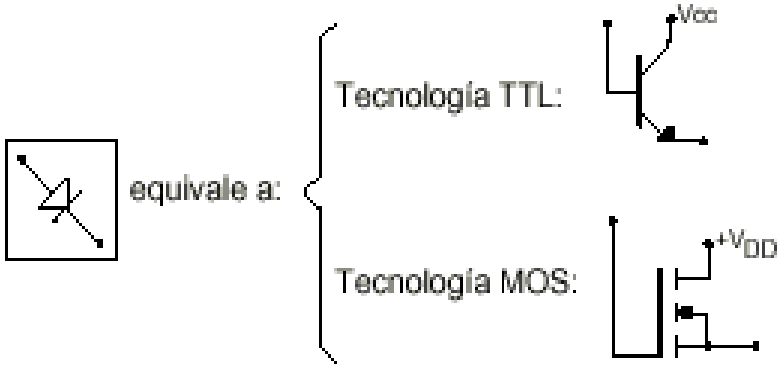


ROM

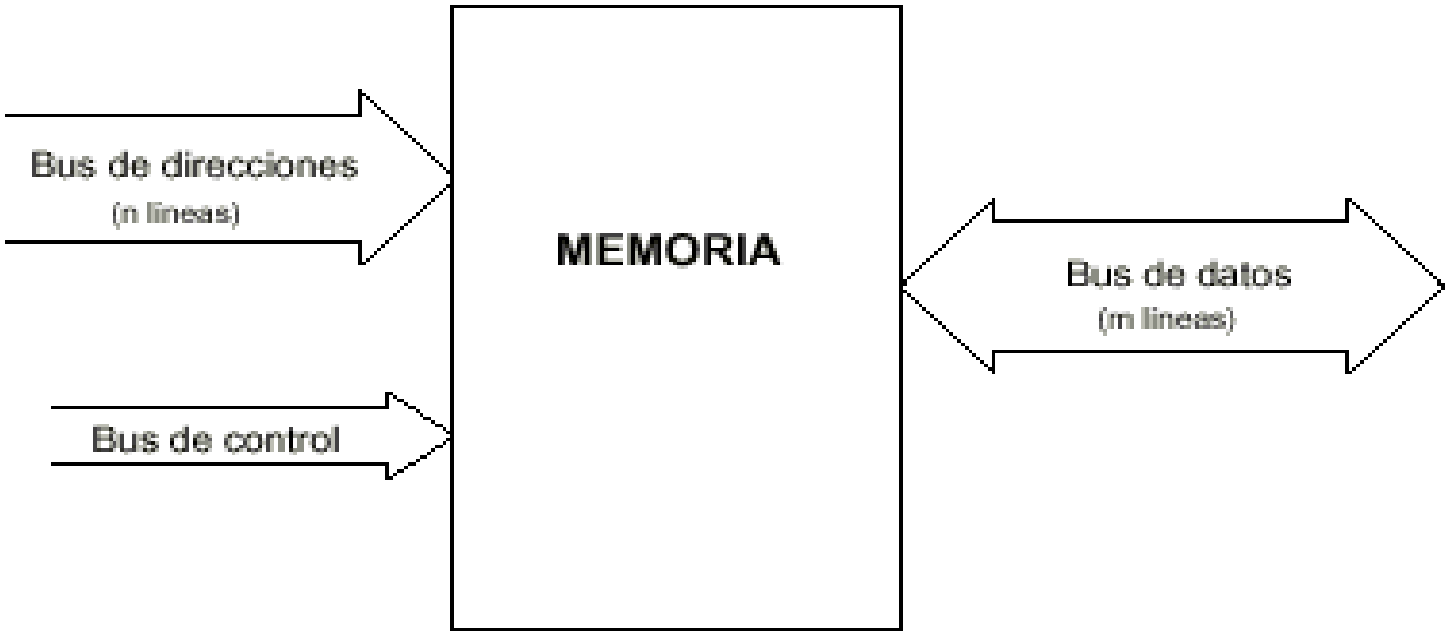


PROM





Organización y capacidad de una memoria

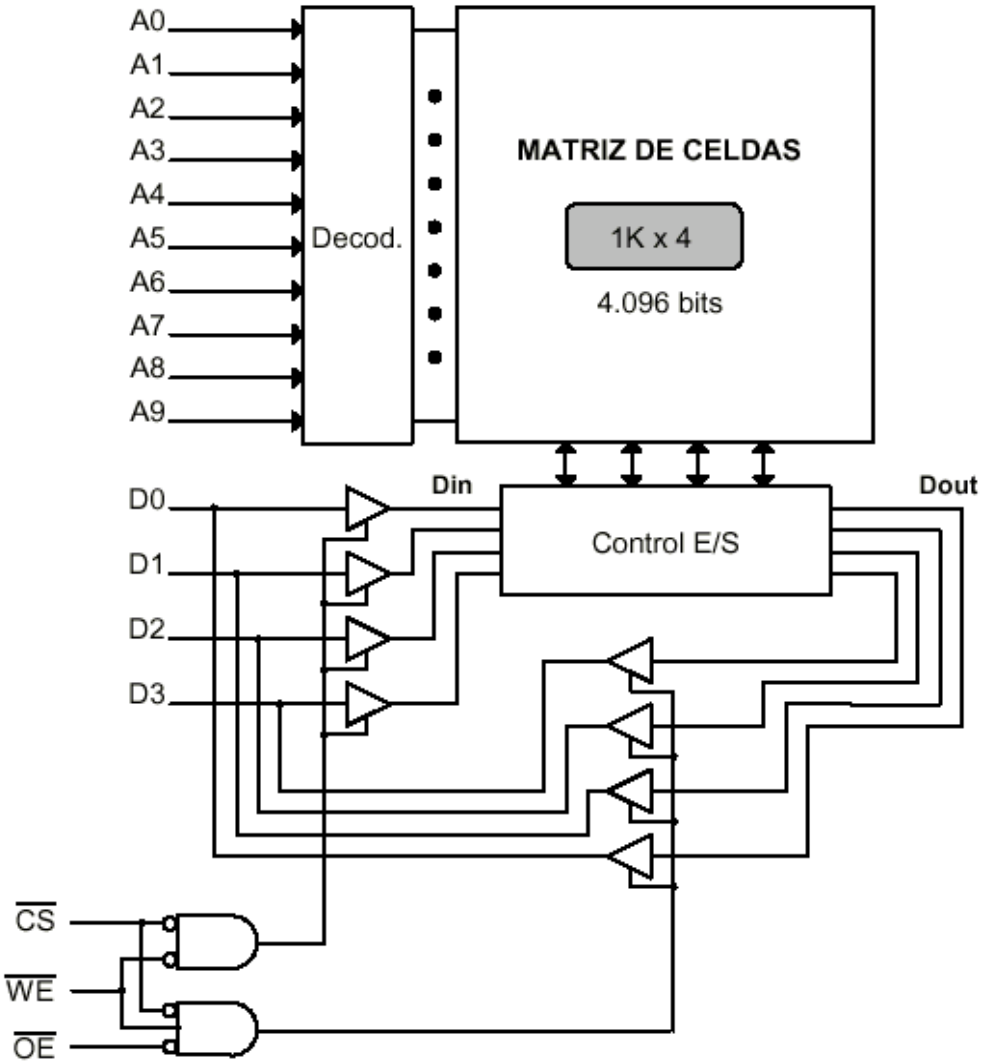


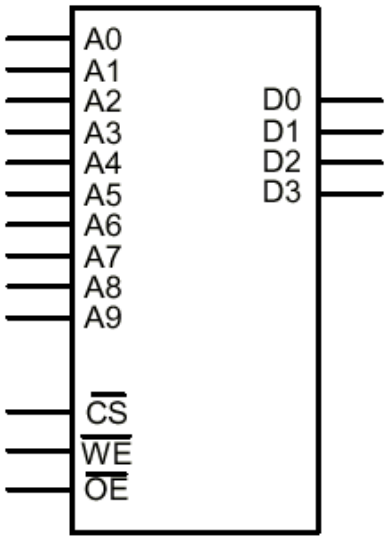
Nº de palabras: 2^n

Bits/palabra: m

→ Organización: 2^n x m bits

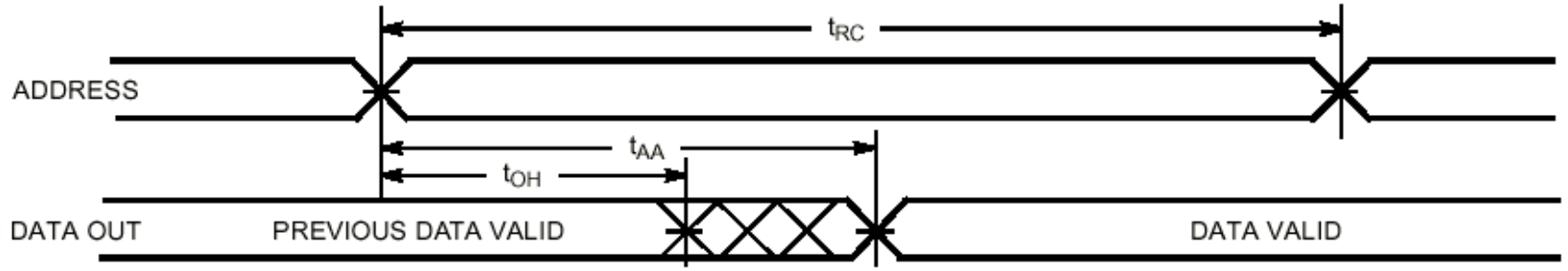
Estructura interna de una memoria RAM estática



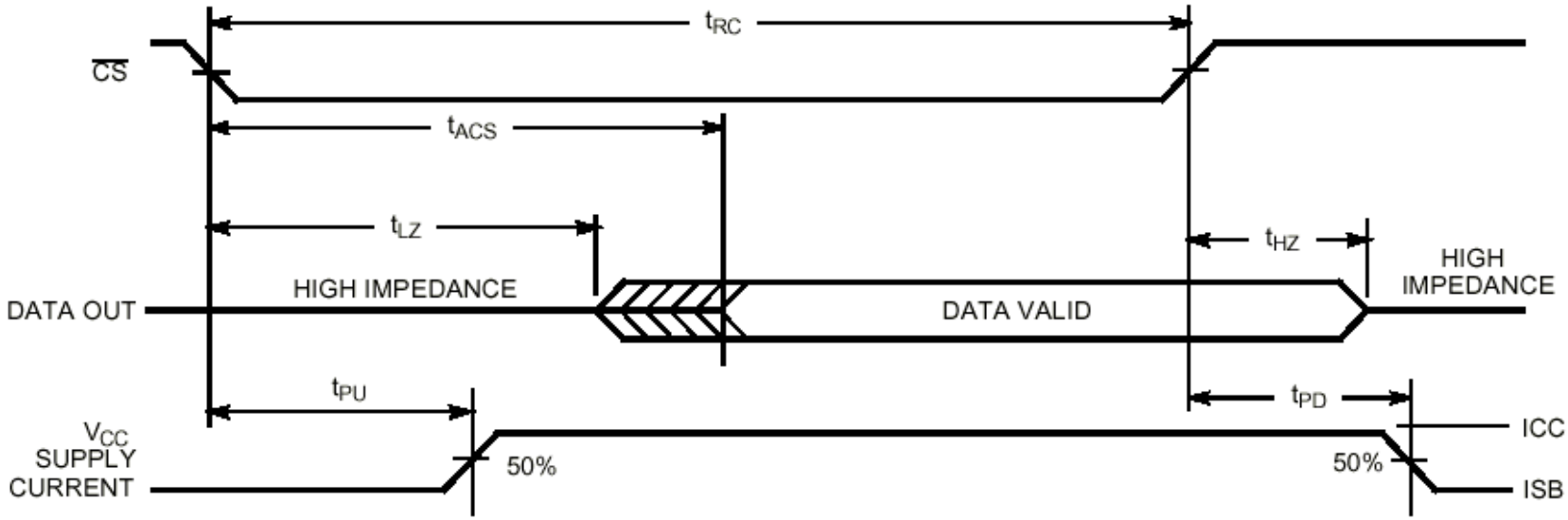


Ciclos de lectura (Memoria RAM estática CY7C148)

Read Cycle No. 1 [10,11]



Read Cycle No. 2 [10,12]

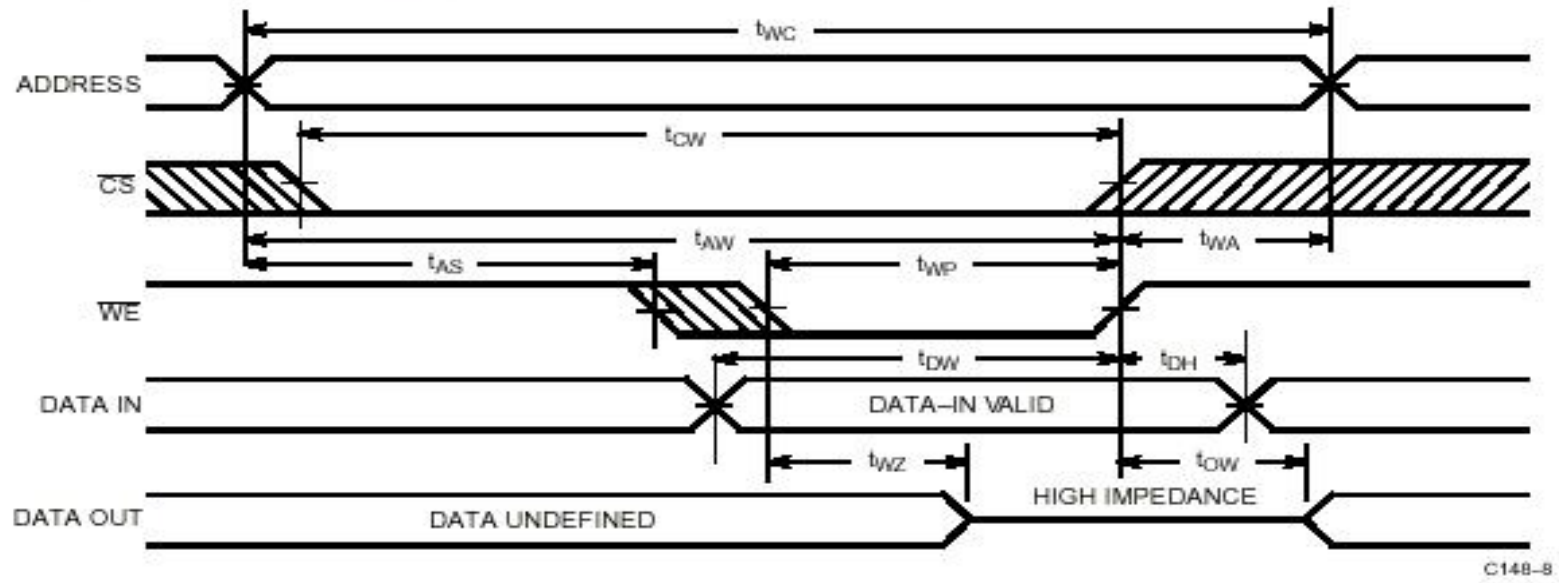


Notes:

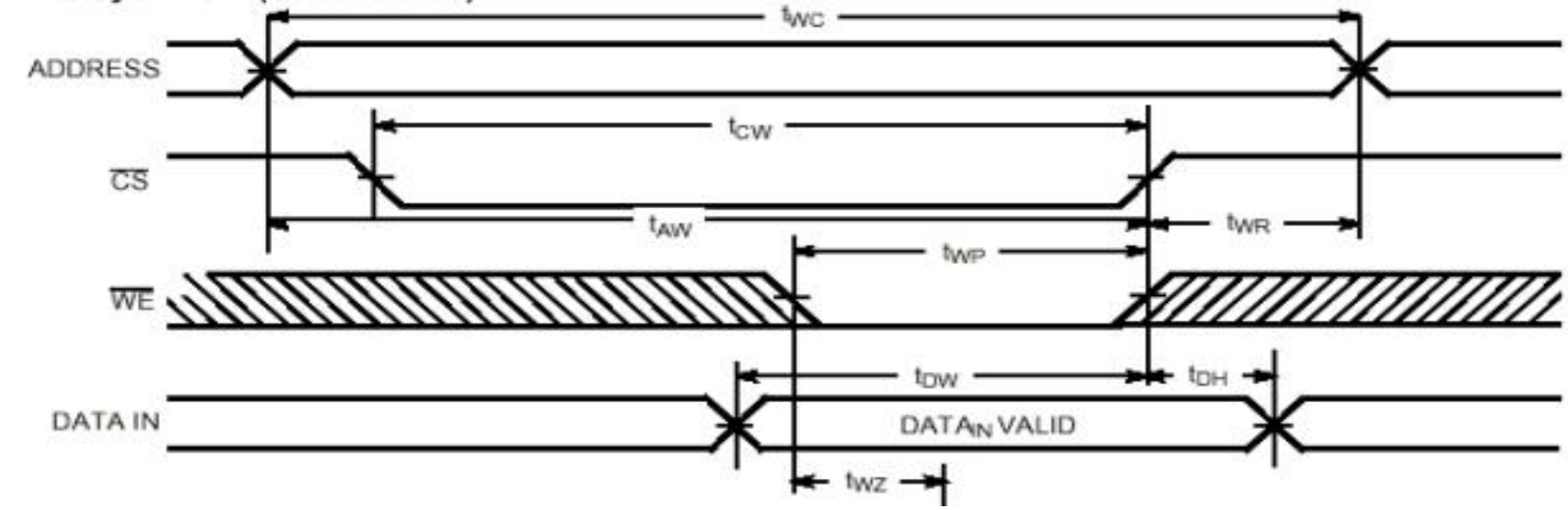
10. $\overline{WE}$ is HIGH for read cycle.
11. Device is continuously selected, $\overline{CS} = V_{IL}$.
12. Address valid prior to or coincident with $\overline{CS}$ transition LOW.

Ciclos de escritura (Memoria RAM estática CY7C148)

Write Cycle No. 1 ($\overline{WE}$ Controlled)



Write Cycle No. 2 ($\overline{CS}$ Controlled)[13]



Características temporales de la memoria

Switching Characteristics Over the Operating Range[2]

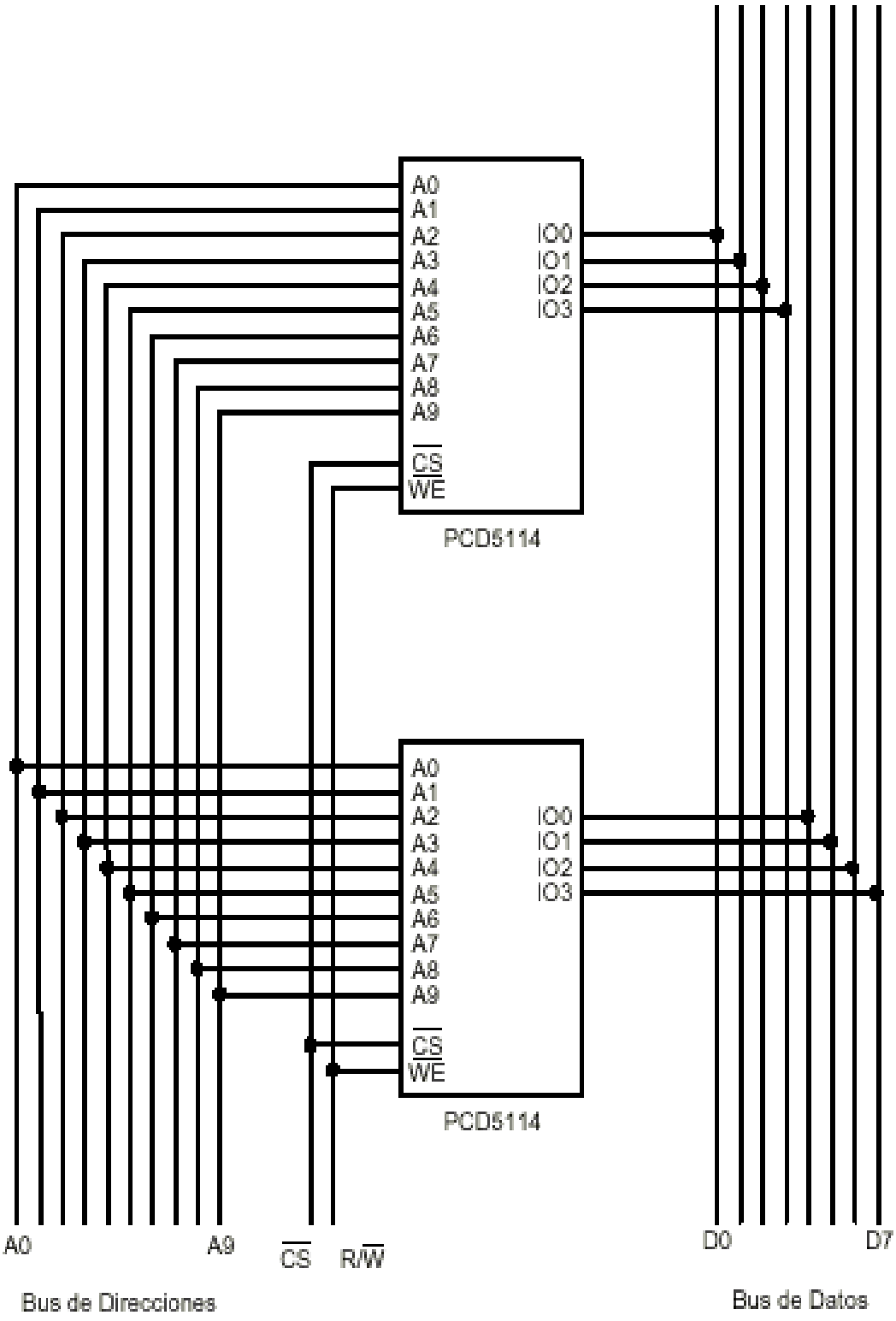
Parameter	Description		7C148–25 7C149–25		7C148–35 7C149–35		7C148–45 7C149–45		Unit
			Min.	Max.	Min.	Max.	Min.	Max.	
READ CYCLE									
t_{RC}	Address Valid to Address Do Not Care Time (Read Cycle Time)		25		35		45		ns
t_{AA}	Address Valid to Data Out Valid Delay (Address Access Time)			25		35		45	ns
t_{ACS1} t_{ACS2}	Chip Select LOW to Data Out Valid (7C148 only)			25[6]		35		45	ns
				30[7]		35		45	ns
t_{ACS}	Chip Select LOW to Data Out Valid (7C149 only)			15		15		20	ns
t_{LZ}[8]	Chip Select LOW to Data Out On	7C148	8		10		10		ns
		7C149	5		5		5		
t_{HZ}[8]	Chip Select HIGH to Data Out Off		0	15	0	20	0	20	ns
t_{OH}	Address Unknown to Data Out Unknown Time		0		0		5		ns
t_{PD}	Chip Select HIGH to Power-Down Delay	7C148		20		30		30	ns
t_{PU}	Chip Select LOW to Power-Up Delay	7C148	0		0		0		ns
WRITE CYCLE									
t_{WC}	Address Valid to Address Do Not Care (Write Cycle Time)		25		35		45		ns
t_{WP}[9]	Write Enable LOW to Write Enable HIGH		20		30		35		ns
t_{WR}	Address Hold from Write End		5		5		5		ns
t_{WZ}[8]	Write Enable to Output in High Z		0	8	0	8	0	8	ns
t_{DW}	Data in Valid to Write Enable HIGH		12		20		20		ns
t_{DH}	Data Hold Time		0		0		0		ns
t_{AS}	Address Valid to Write Enable LOW		0		0		0		ns
t_{CW}[9]	Chip Select LOW to Write Enable HIGH		20		30		40		ns
t_{OW}[8]	Write Enable HIGH to Output in Low Z		0		0		0		ns
t_{AW}	Address Valid to End of Write		20		30		35		ns

Notes:

6. Chip deselected greater than 25 ns prior to selection.
7. Chip deselected less than 25 ns prior to selection.
8. At any given temperature and voltage condition, t_{HZ} is less than t_{LZ} for all devices. Transition is measured ±500 mV from steady-state voltage with specified loading in part (b) of AC Test Loads.
9. The internal write time of the memory is defined by the overlap of $\overline{CS}$ LOW and $\overline{WE}$ LOW. Both signals must be LOW to initiate a write and either signal can terminate a write by going high. The data input set-up and hold timing should be referenced to the rising edge of the signal that terminates the write.

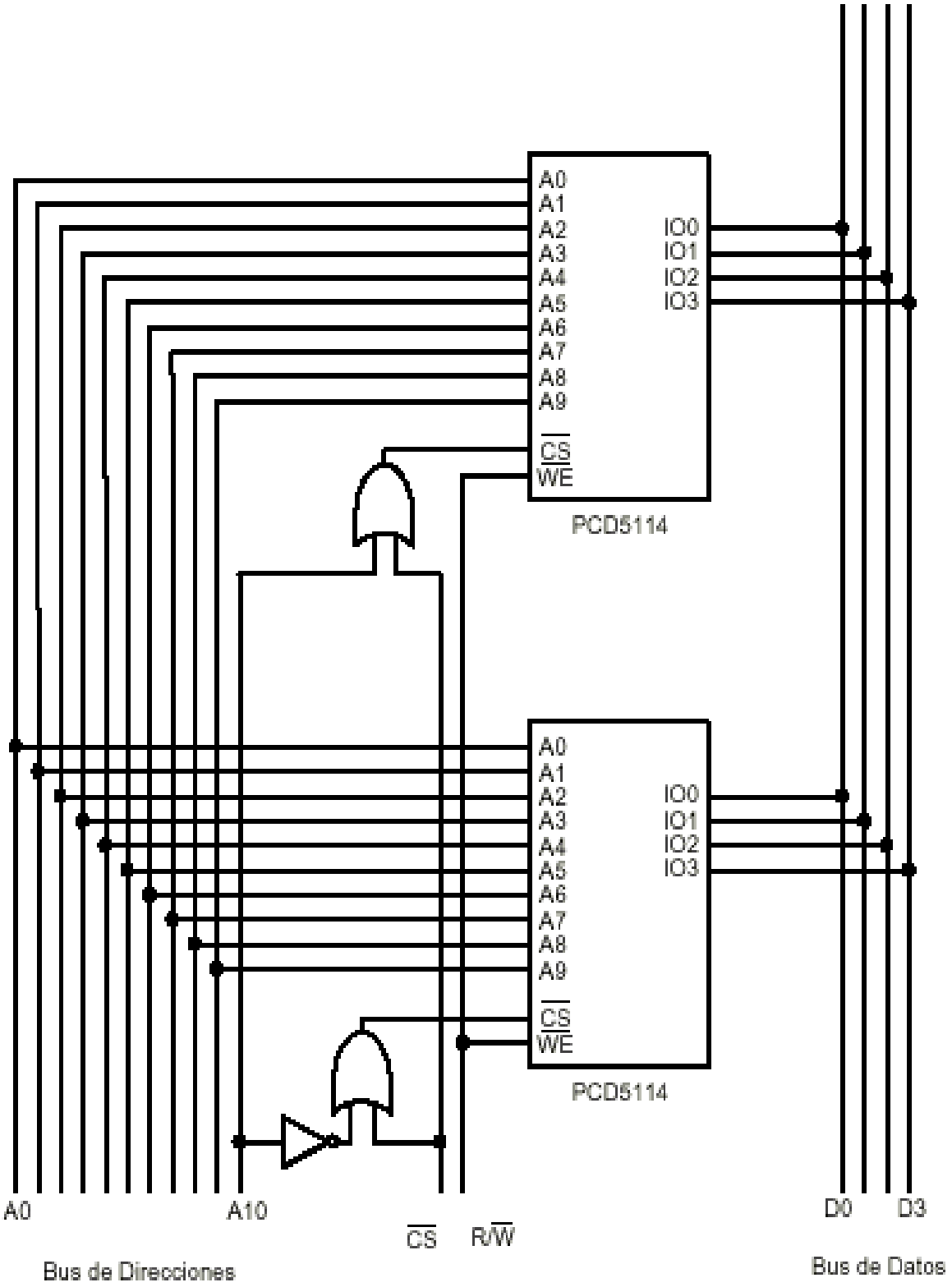
Ampl. de la longitud de palabra de una memoria

2 chips PCD5114 (1k x 4) ⟶ Memoria 1k x 8



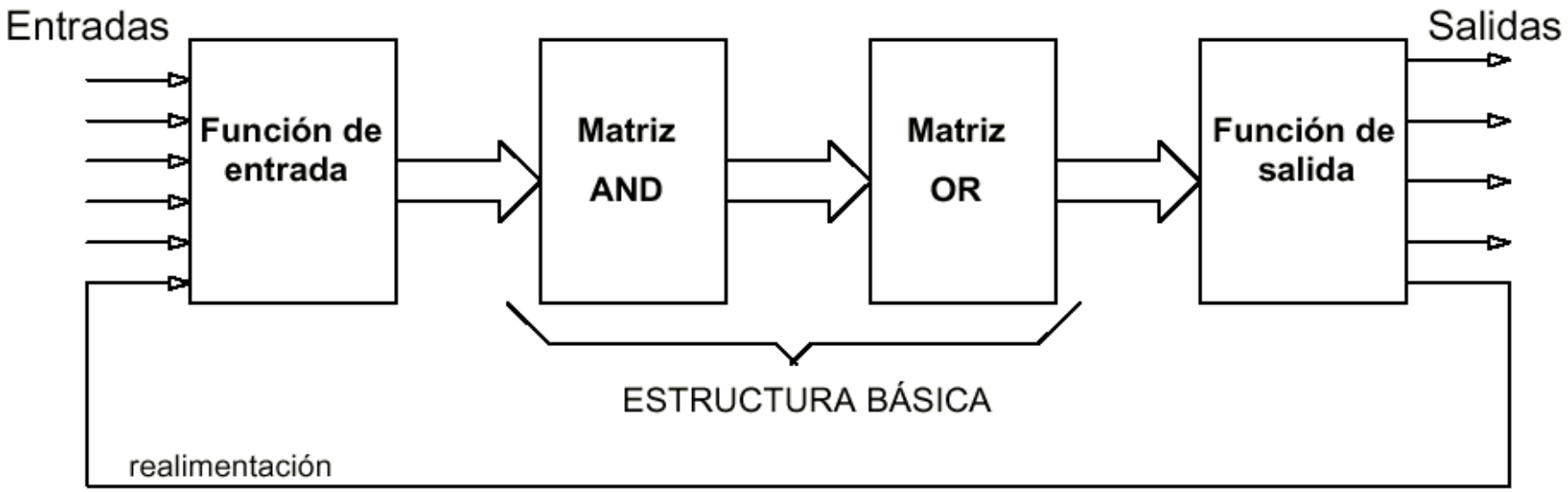
Ampl. del número de palabras de una memoria

2 chips PCD5114 (1k x 4) ⟶ Memoria 2k x 4



Dispositivos de Lógica Programable (PLDs)

Estructura general de un PLD



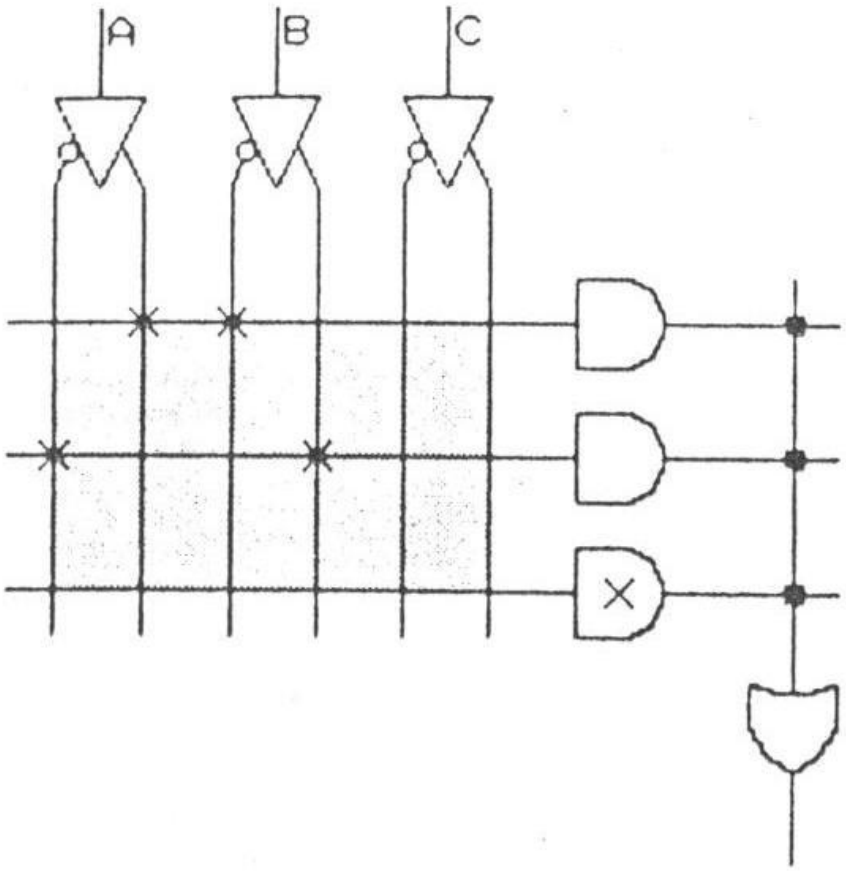
Tipos:

- PROM
- PAL – GAL (SPLD)
- CPLD
- FPGA-PLA

Aplicaciones típicas

- SPLDs
  - Decodificación
  - Autómatas
  - Integración de sistema SSI
- CPLDs
  - Subsistemas de E/S, lógica de alta velocidad, periféricos, etc.
  - Decodificación más compleja
  - Integración de varios SPLDs
- FPGAs
  - Subsitemas digitales complejos (compresión de datos, encriptación, protocolos de comunicaciones, DSP)
  - Circuitos con gran uso de registros
  - Realización de prototipos para ASICs

Realización de una función lógica con un PLD

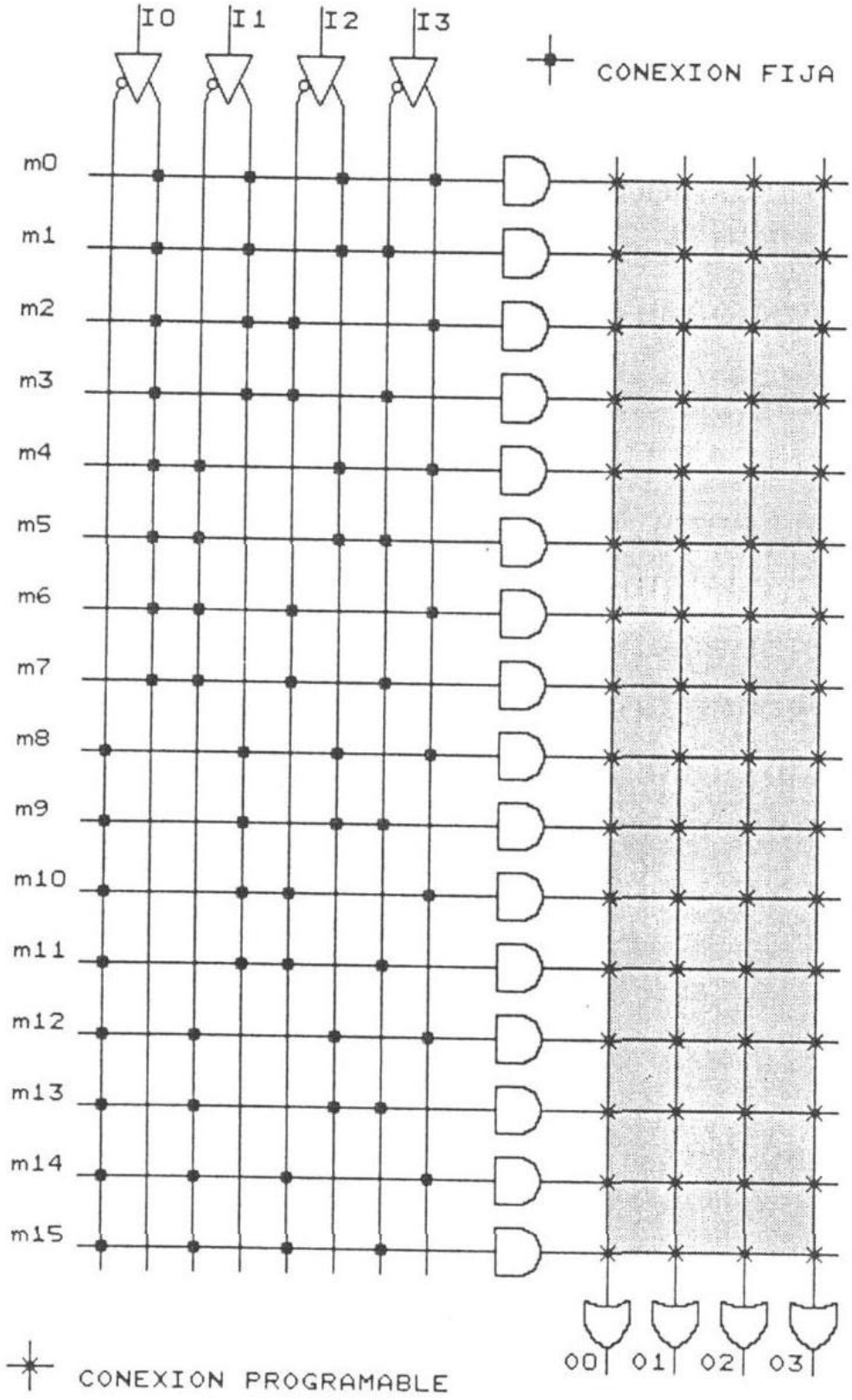


CONEXION FIJA

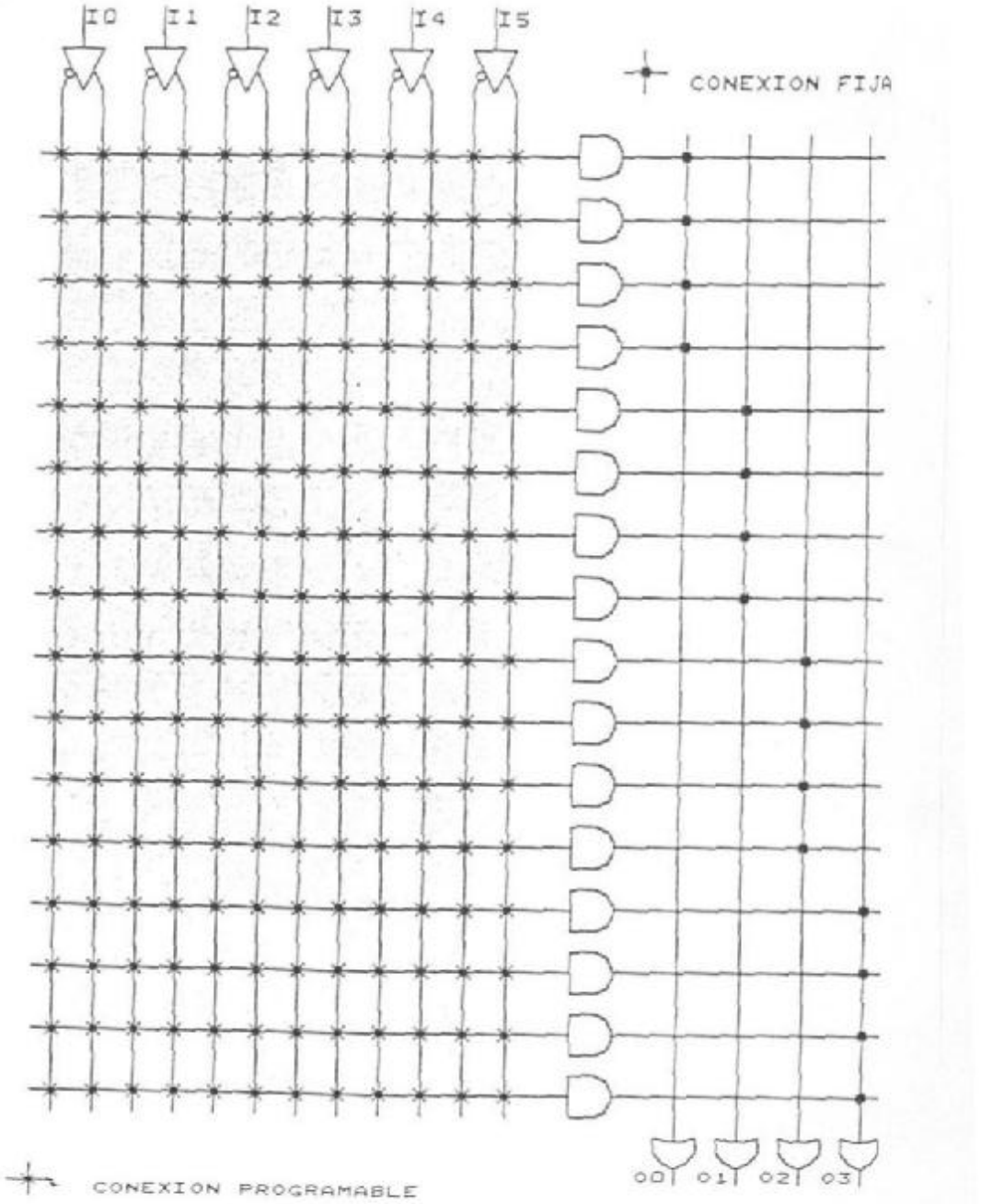
CONEXION PROGRAMABLE

F = A & B' * A' & B

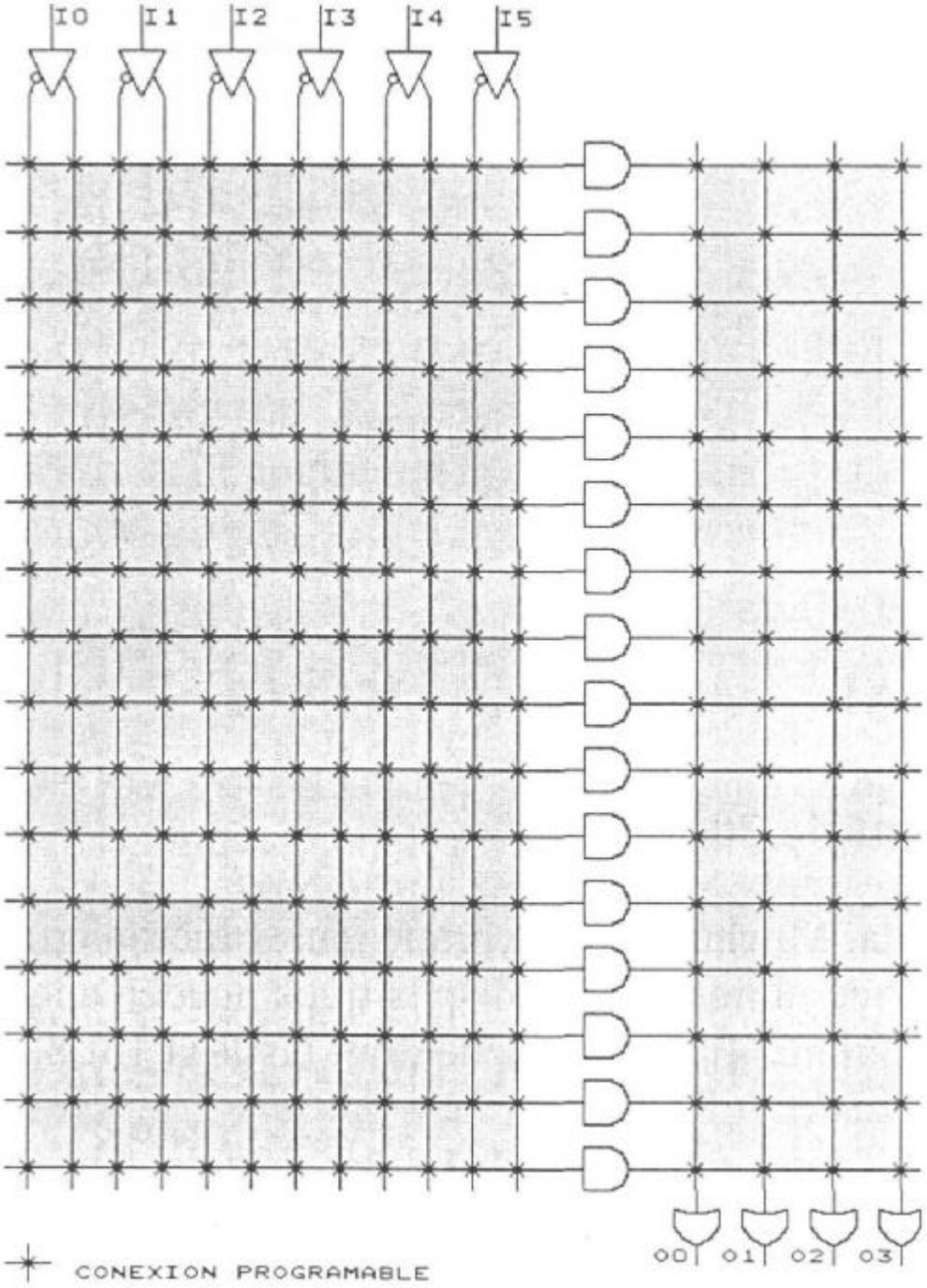
PROM


I0
I1
I2
I3
CONEXION FIJA
m0
m1
m2
m3
m4
m5
m6
m7
m8
m9
m10
m11
m12
m13
m14
m15
O0
O1
O2
O3
CONEXION PROGRAMABLE

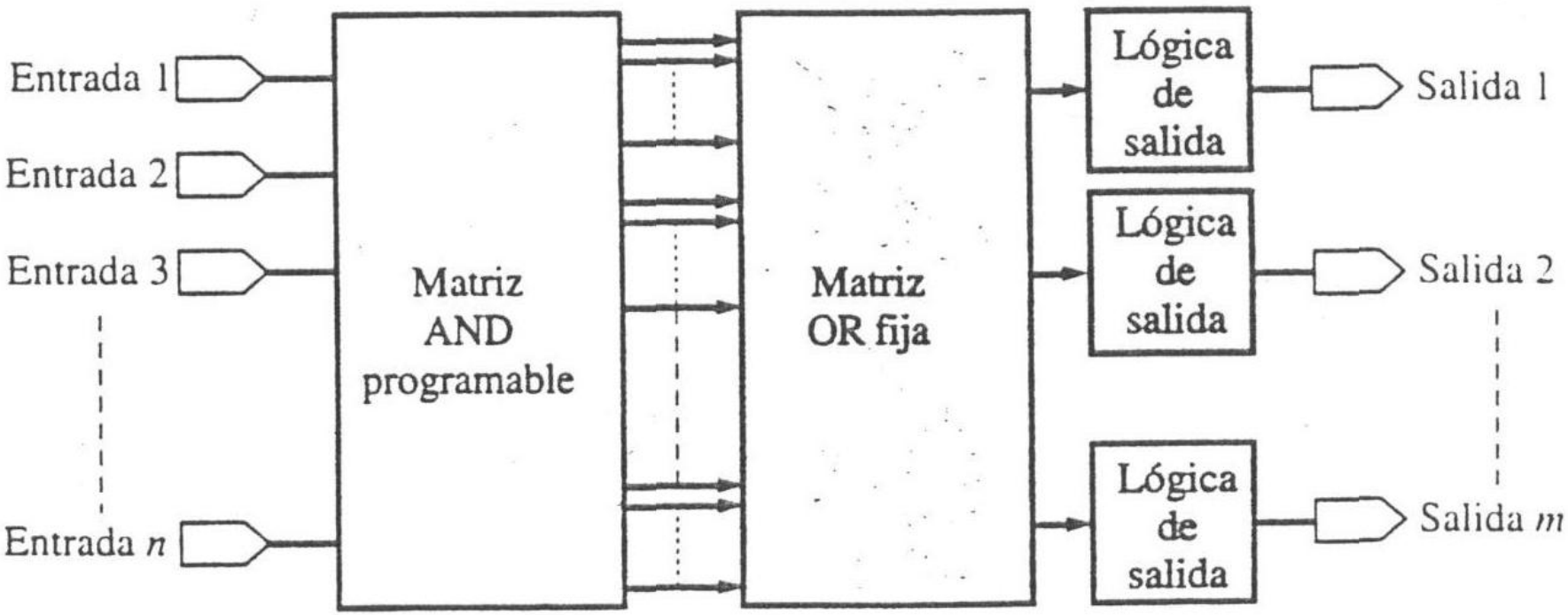
PAL

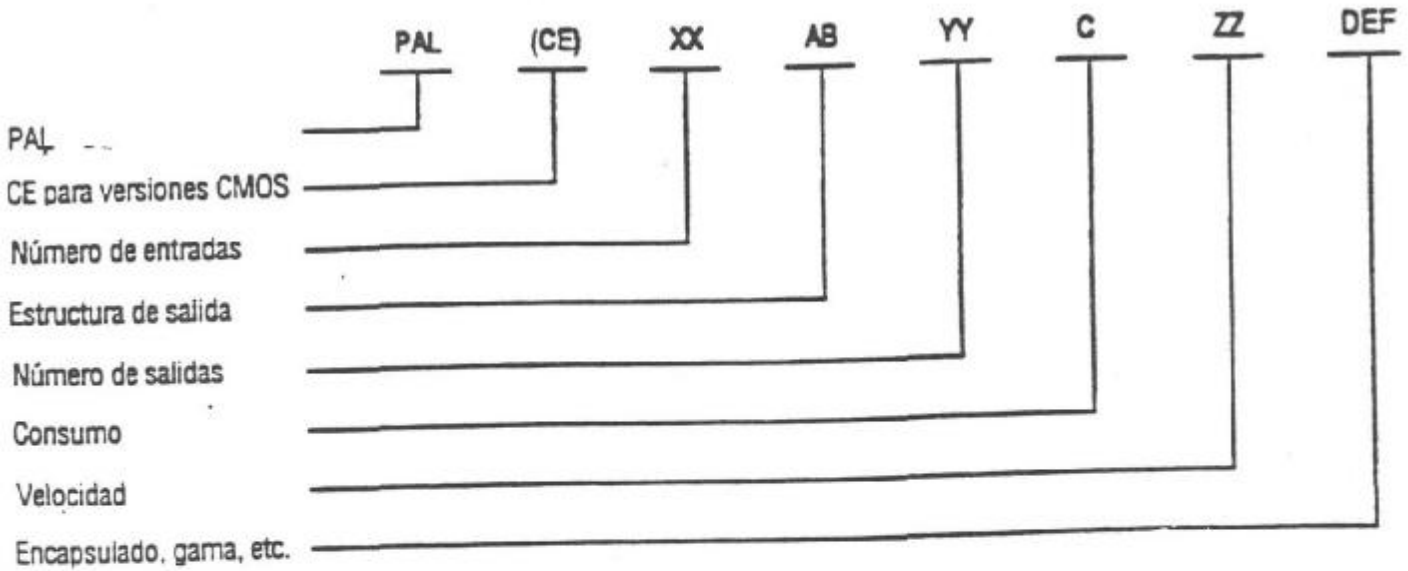

I0
I1
I2
I3
I4
I5
CONEXION FIJA
CONEXION PROGRAMABLE
O0
O1
O2
O3

FPLA



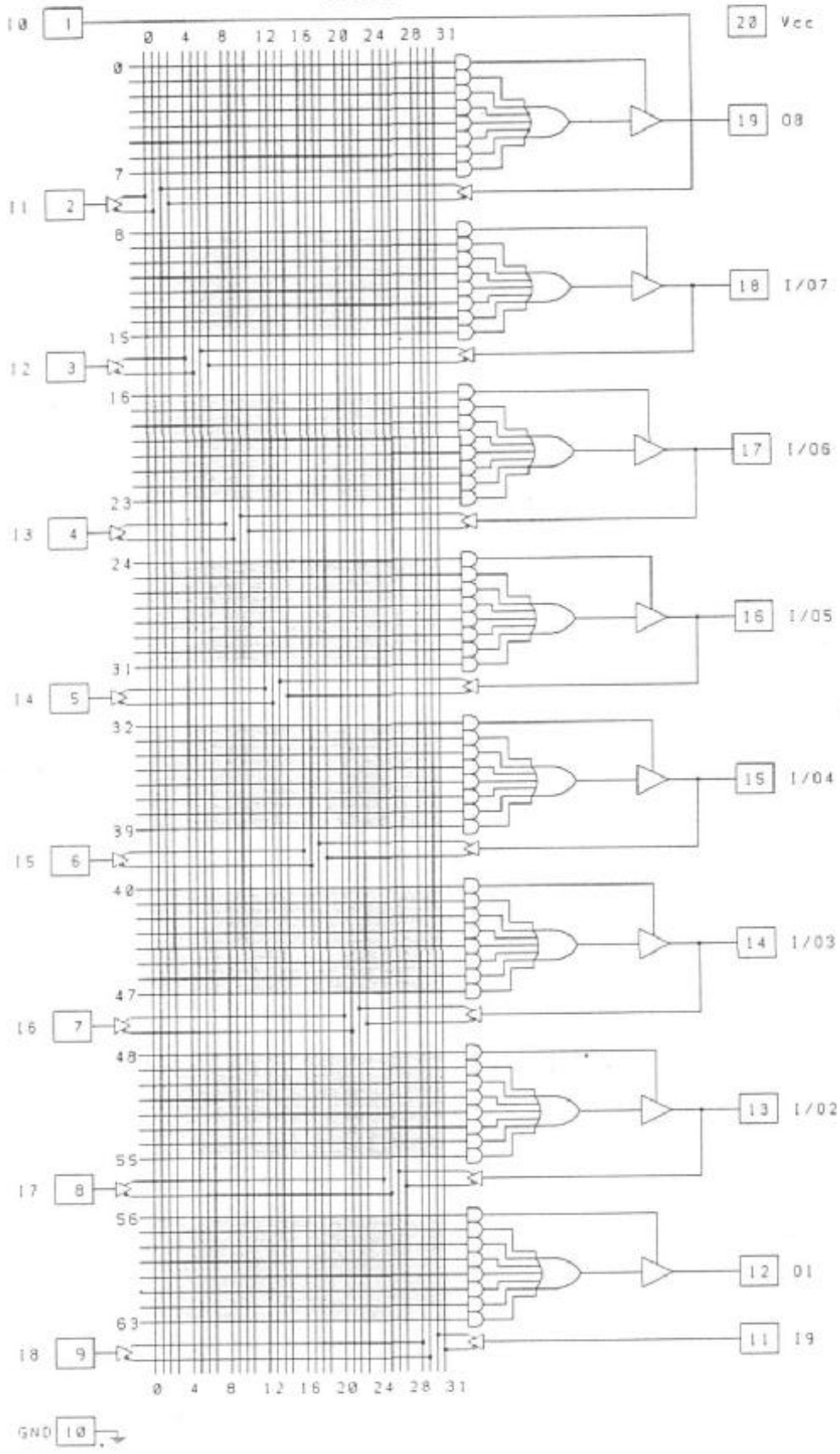
Estructura de una una PAL



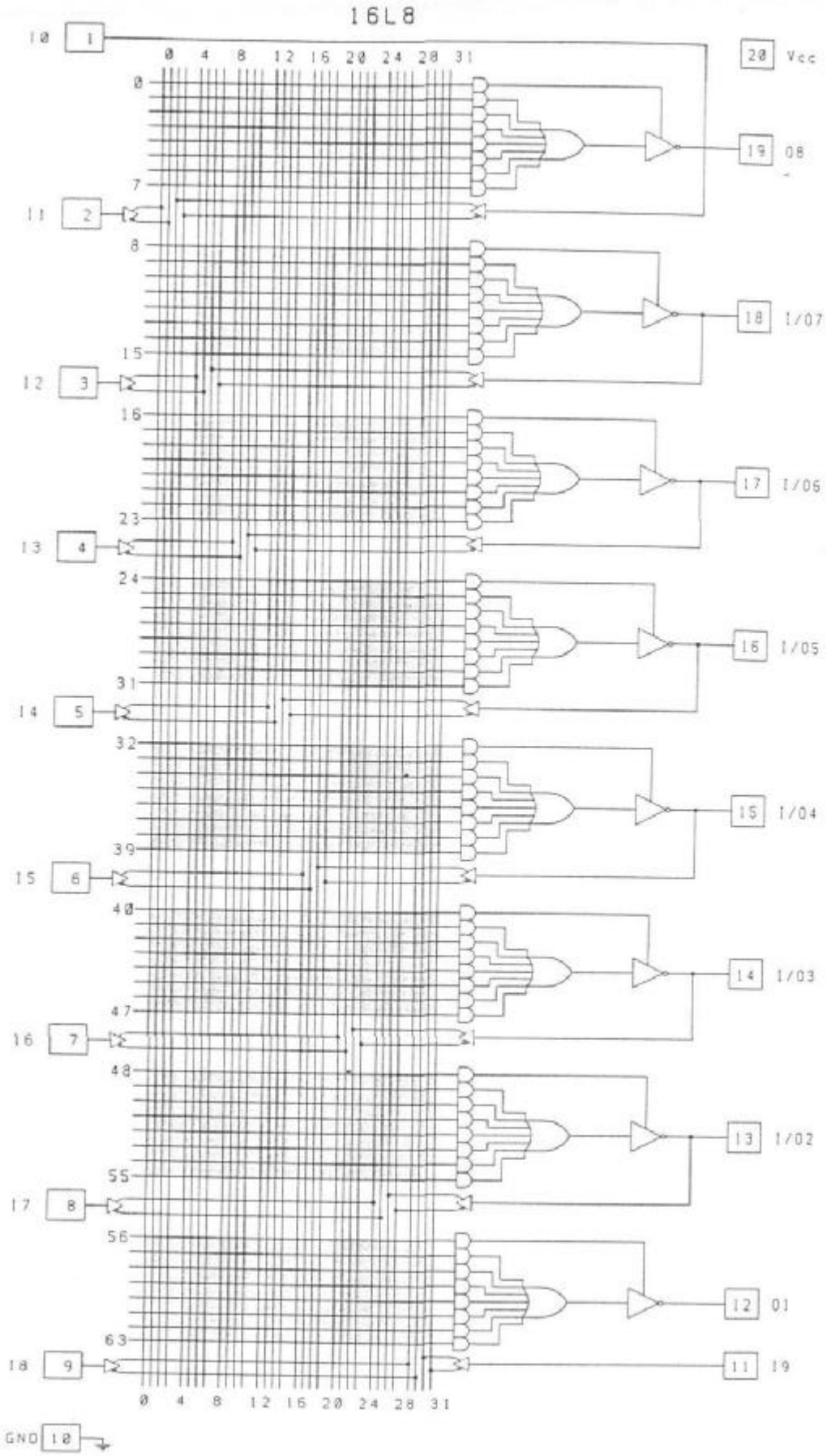


Letra(s) código(s)	Estructura de salida
L	Combinatoria activo bajo
H	Combinatoria activo alto
R	Registro
RA	Registro asíncrono
X	Registro de O exclusivo
V	Versátil

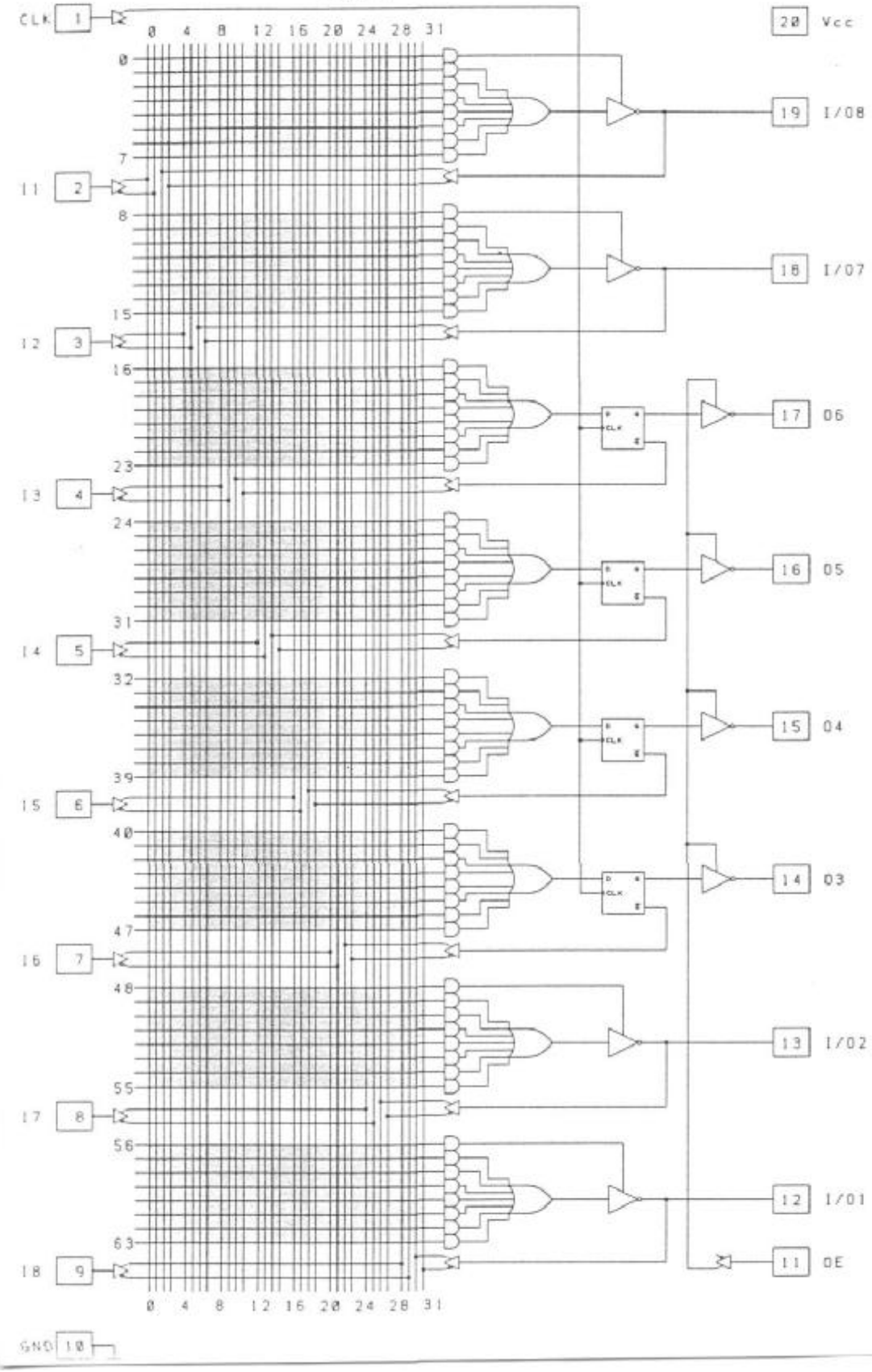
16H8


I0 1
0 4 8 12 16 20 24 28 31
0
7
I1 2
8
15
I2 3
16
23
I3 4
24
31
I4 5
32
39
I5 6
40
47
I6 7
48
55
I7 8
56
63
I8 9
0 4 8 12 16 20 24 28 31
GND 10
20 Vcc
19 O8
18 I/O7
17 I/O6
16 I/O5
15 I/O4
14 I/O3
13 I/O2
12 O1
11 I9

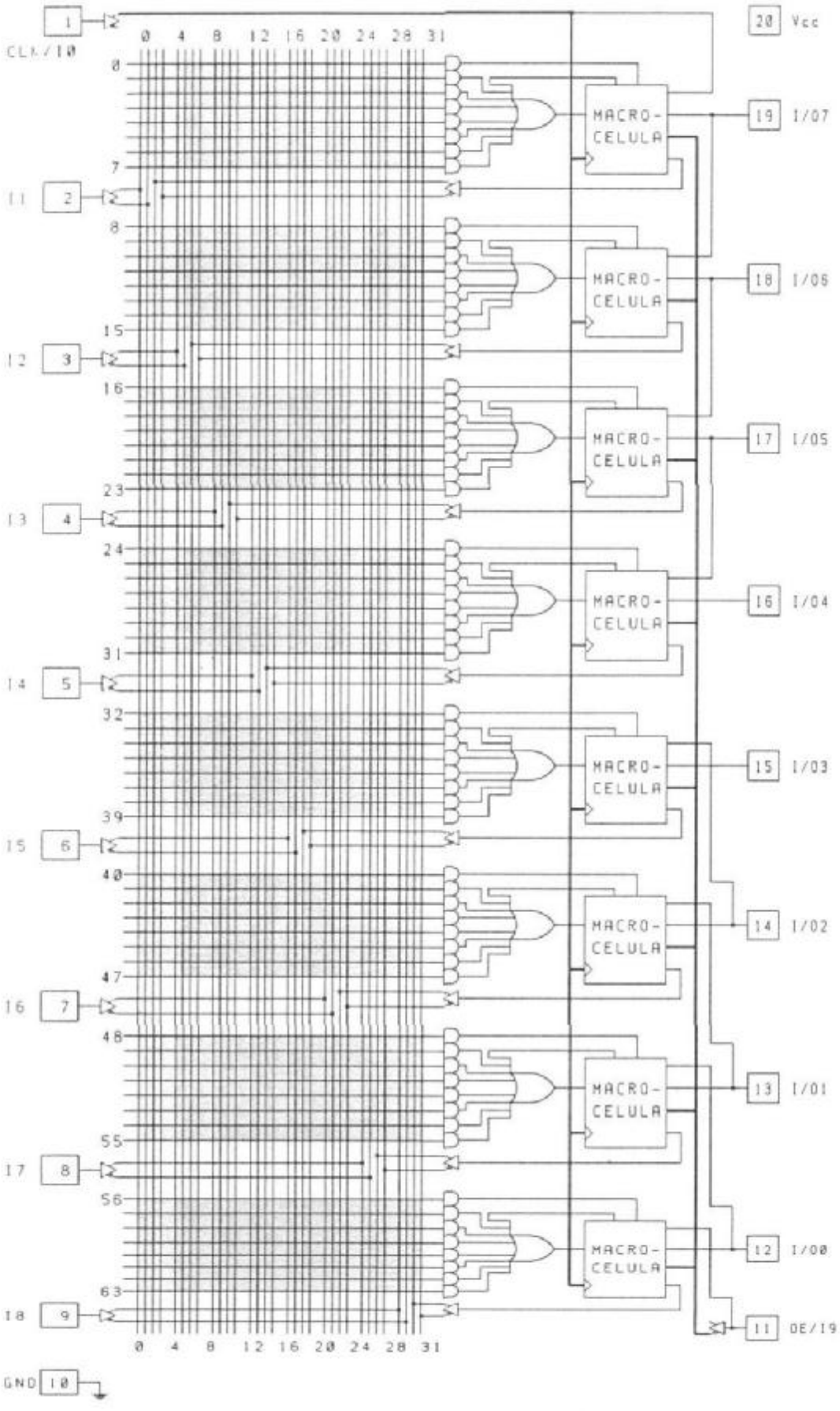
16L8


I0 1
0 4 8 12 16 20 24 28 31
20 Vcc
0
19 O8
7
I1 2
8
18 I/O7
15
I2 3
16
17 I/O6
23
I3 4
24
16 I/O5
31
I4 5
32
15 I/O4
39
I5 6
40
14 I/O3
47
I6 7
48
13 I/O2
55
I7 8
56
12 O1
63
I8 9
11 I9
0 4 8 12 16 20 24 28 31
GND 10

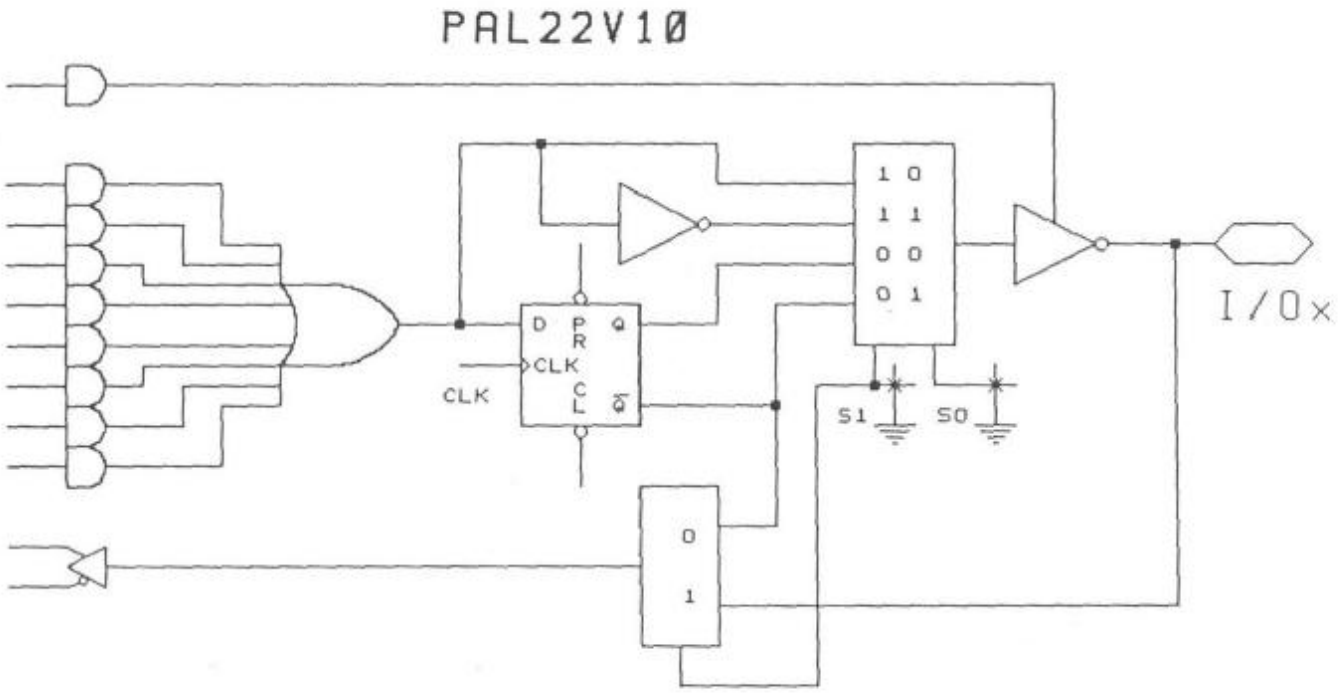
16R4


CLK 1
I1 2
I2 3
I3 4
I4 5
I5 6
I6 7
I7 8
I8 9
GND 10
20 Vcc
19 I/08
18 I/07
17 O6
16 O5
15 O4
14 O3
13 I/02
12 I/01
11 OE
0 4 8 12 16 20 24 28 31
0
7
8
15
16
23
24
31
32
39
40
47
48
55
56
63

16V8


1
CLK/I0
0 4 8 12 16 20 24 28 31
0
7
11
2
8
15
12
3
16
23
13
4
24
31
14
5
32
39
15
6
40
47
16
7
48
55
17
8
56
63
18
9
0 4 8 12 16 20 24 28 31
GND
10
20
Vcc
MACRO-CELULA
19
I/07
MACRO-CELULA
18
I/06
MACRO-CELULA
17
I/05
MACRO-CELULA
16
I/04
MACRO-CELULA
15
I/03
MACRO-CELULA
14
I/02
MACRO-CELULA
13
I/01
MACRO-CELULA
12
I/00
11
OE/I9

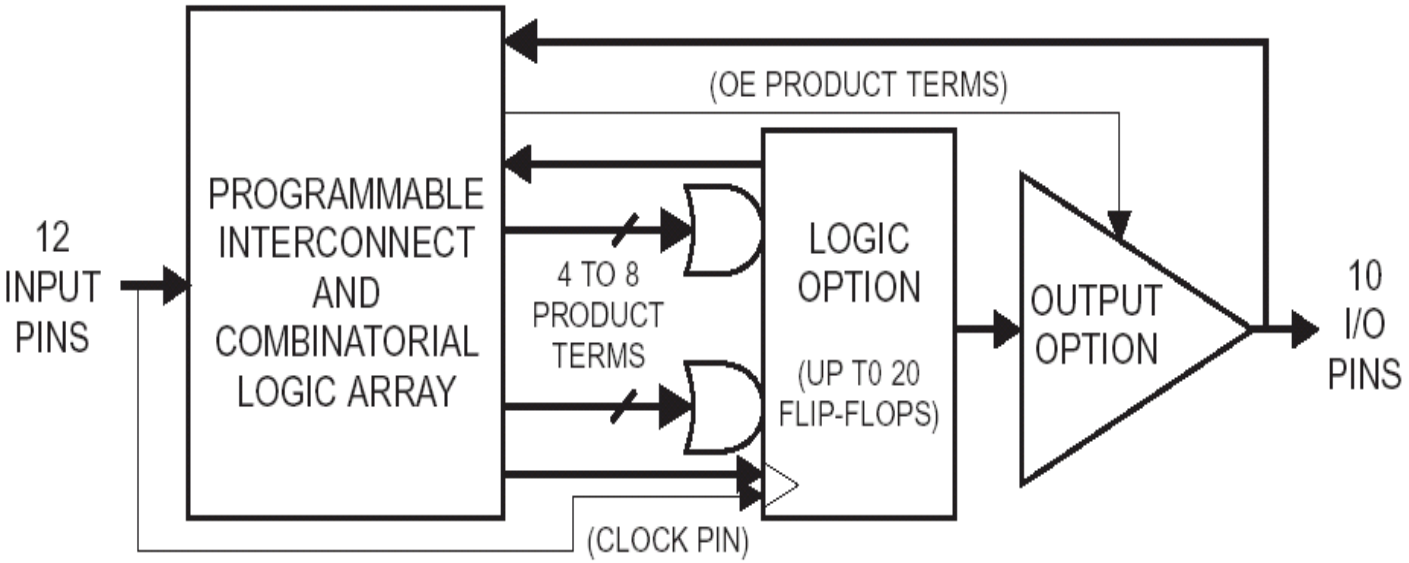
Estructura de la macrocélula en una PAL22V10

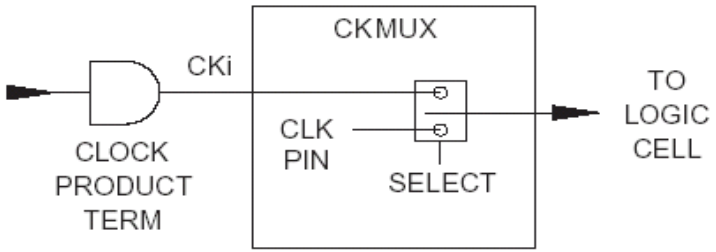


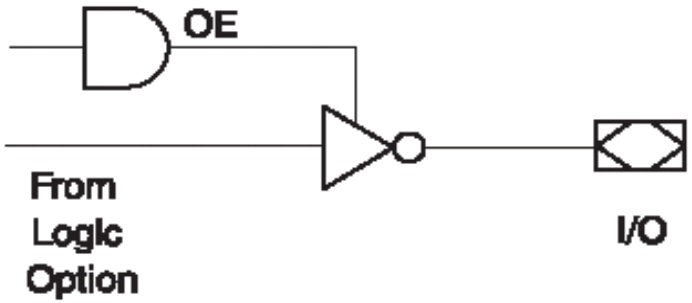
ATMEL ATF750

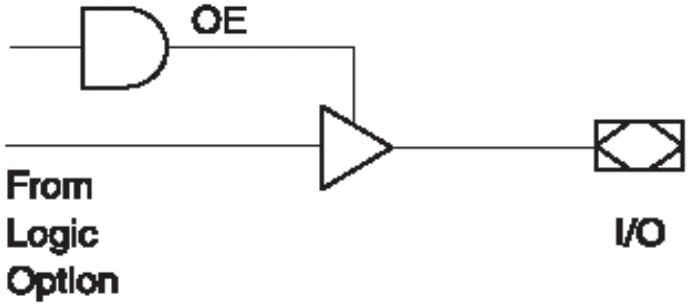
- Características
  - Superconjunto de 22V10 -> compatible pin a pin.
  - 42 entradas del array
  - 20 términos de sumas
  - Retardo máximo entrada-salida 7,5ns.
  - 20 flip-flops
    - Los 20 se realimentan directamente al array
    - 10 son accesibles como salidas
    - Configurables como D o T
    - Reloj individual seleccionable como CLK del sistema o un producto.
    - RESET asíncrono individual como producto
    - PRESET síncrono común a todos
  - Configuración de E/S
    - Los 22 pines pueden usarse como salidas
    - 10 pueden ser entradas, salidas o bidireccionales
    - Salida OE independiente para cada pin
    - Hasta 171 productos disponibles en total

Configuración de las E/S

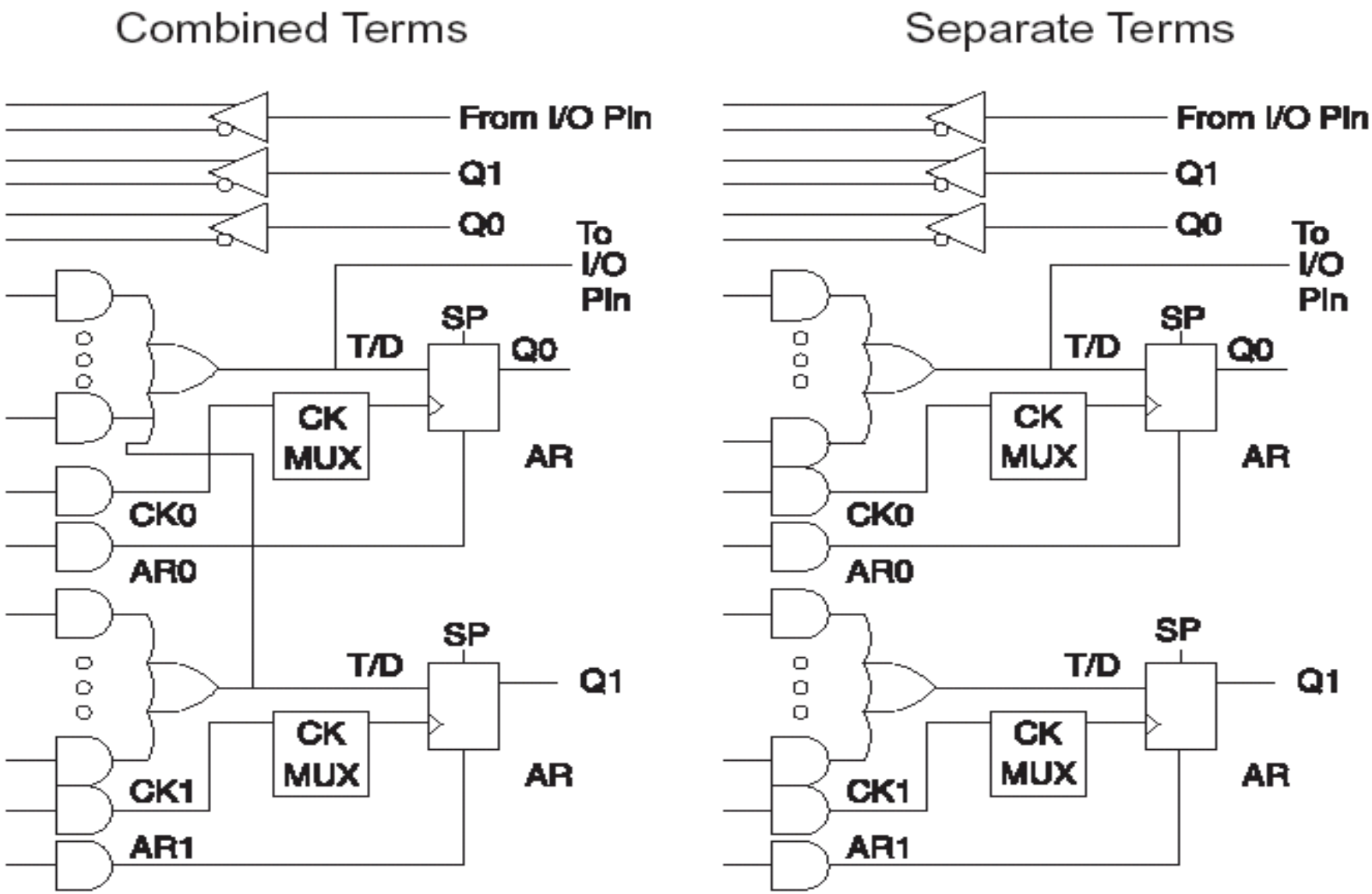




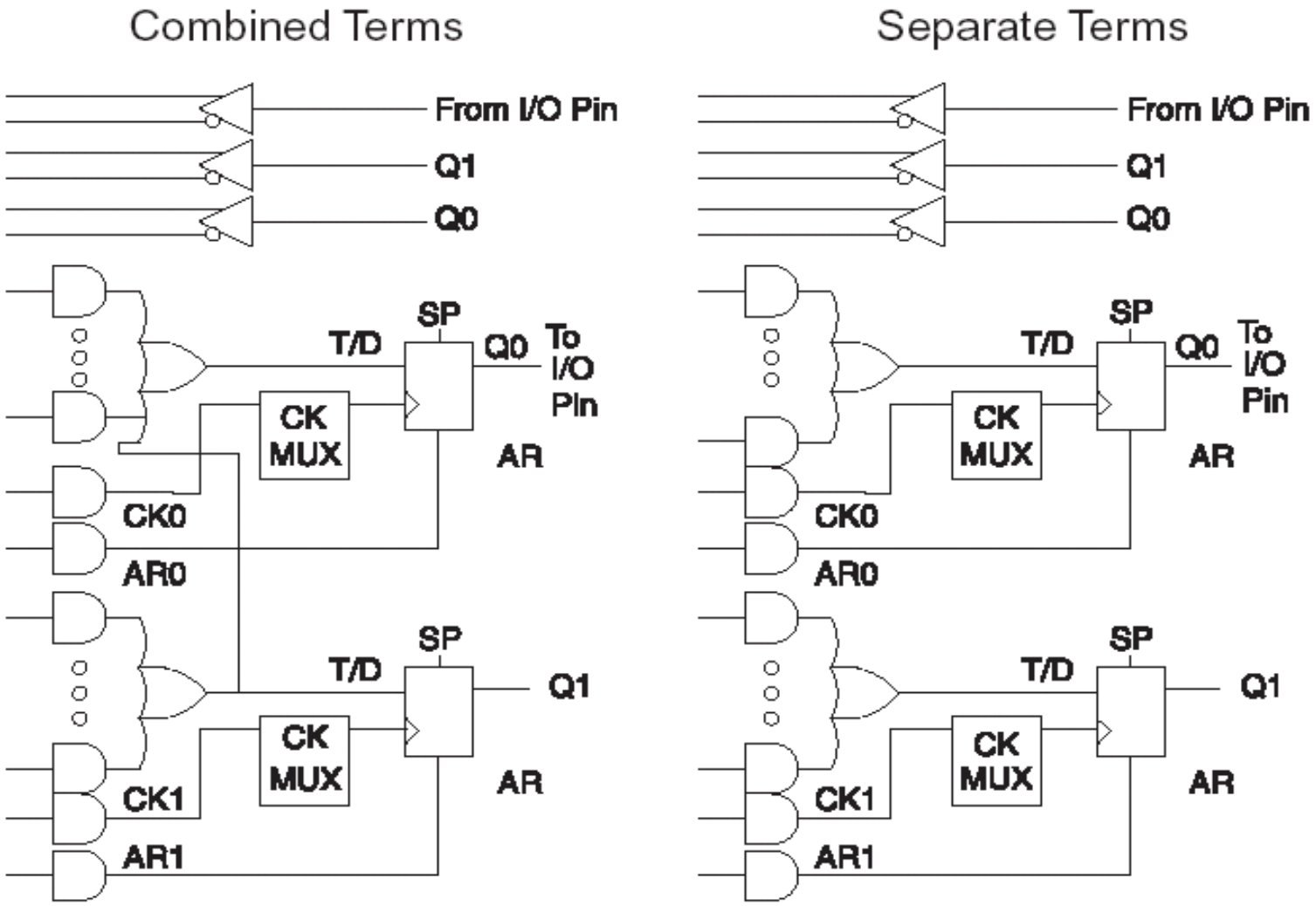




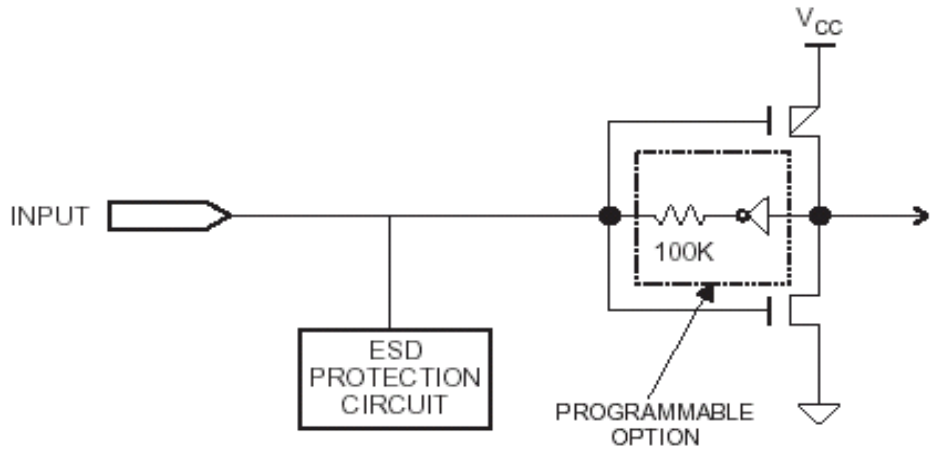
Configuración de la salida (LOGIC OPTIONS) para salida combinacional



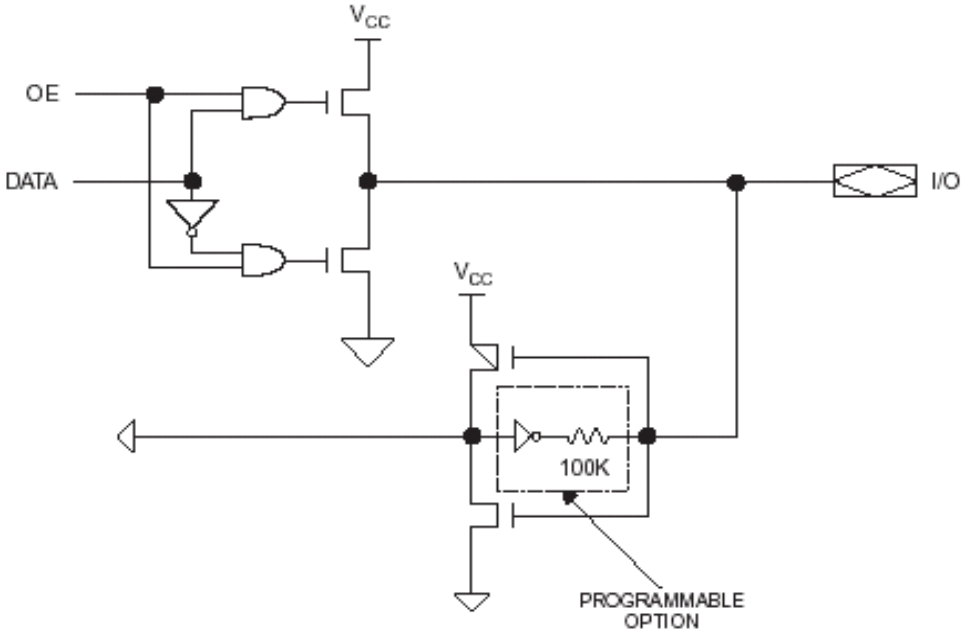
Configuración de la salida (LOGIC OPTIONS) para salida registrada



Configuración Entrada/Salida

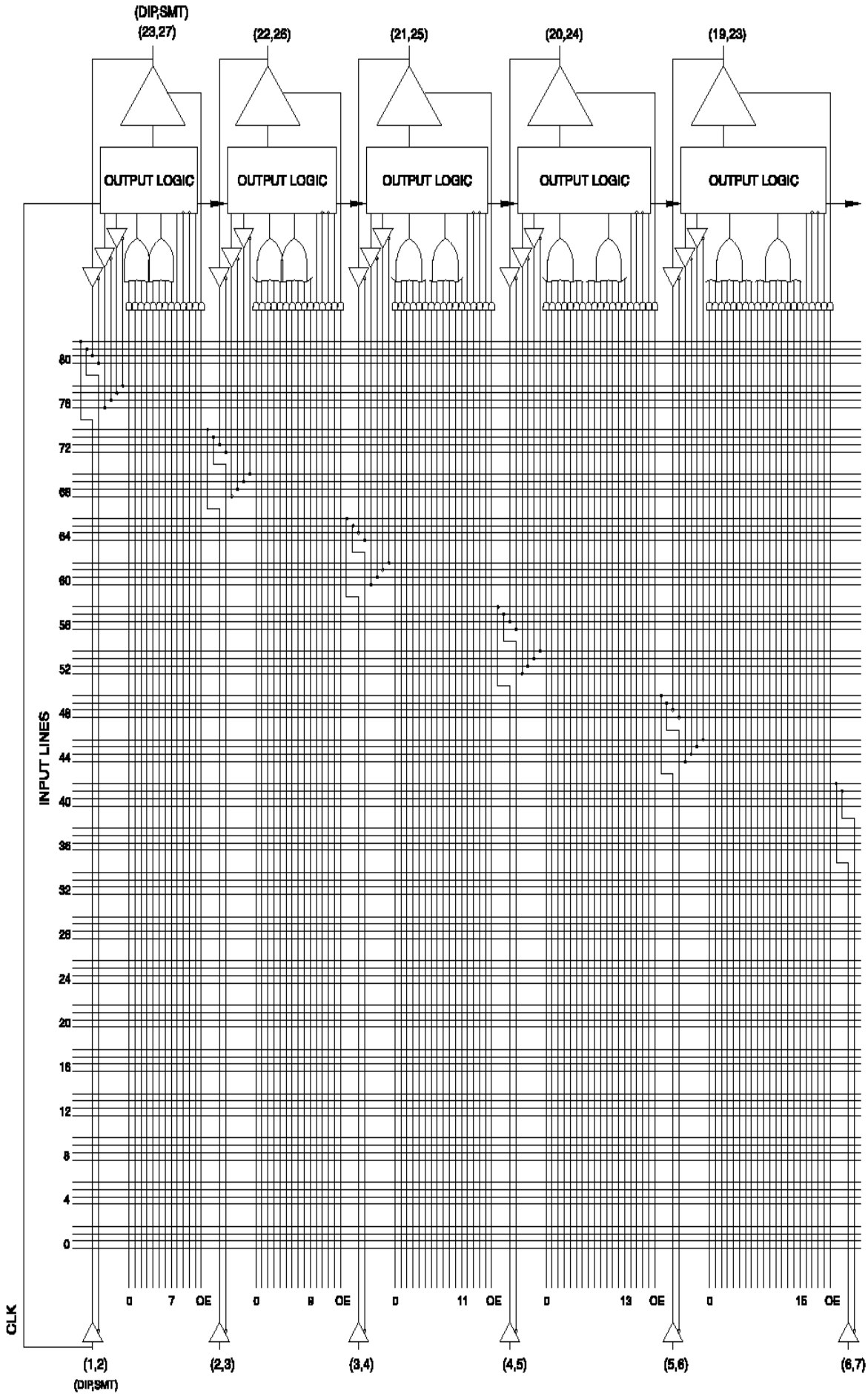


- ENTRADA
  - "Programable option" para evitar ruidos en entradas "al aire"



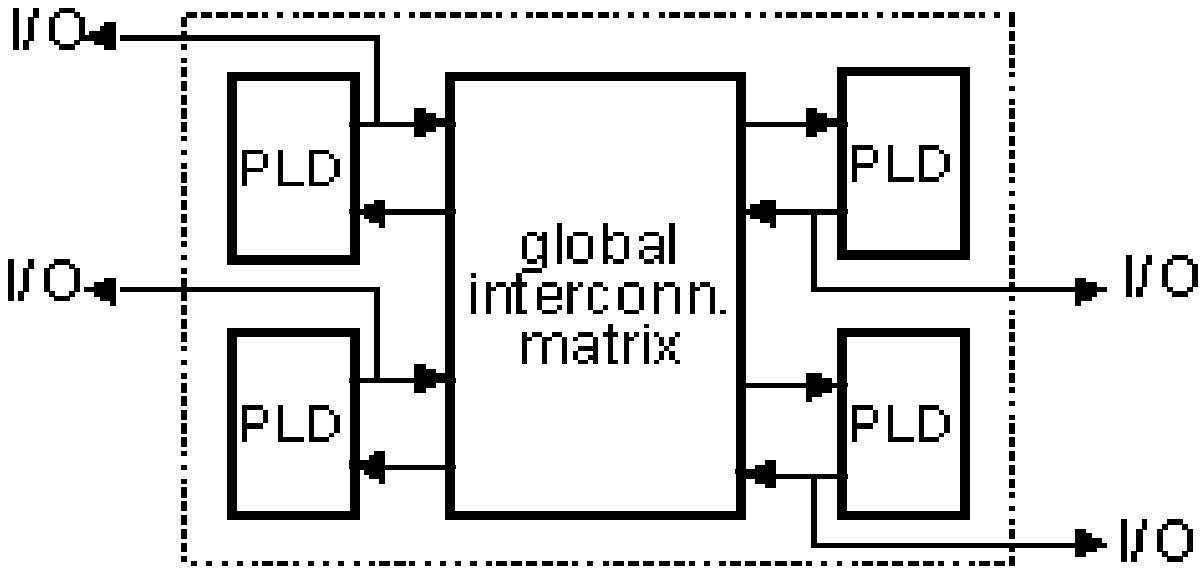
- SALIDA (I/O)
  - Bidireccional
  - Señal OE discrimina E/S

Functional Logic Diagram ATF750C, Upper Half



CPLDs

- SPLDs limitados típicamente a 10-20 ecuaciones lógicas.
- CPLDs

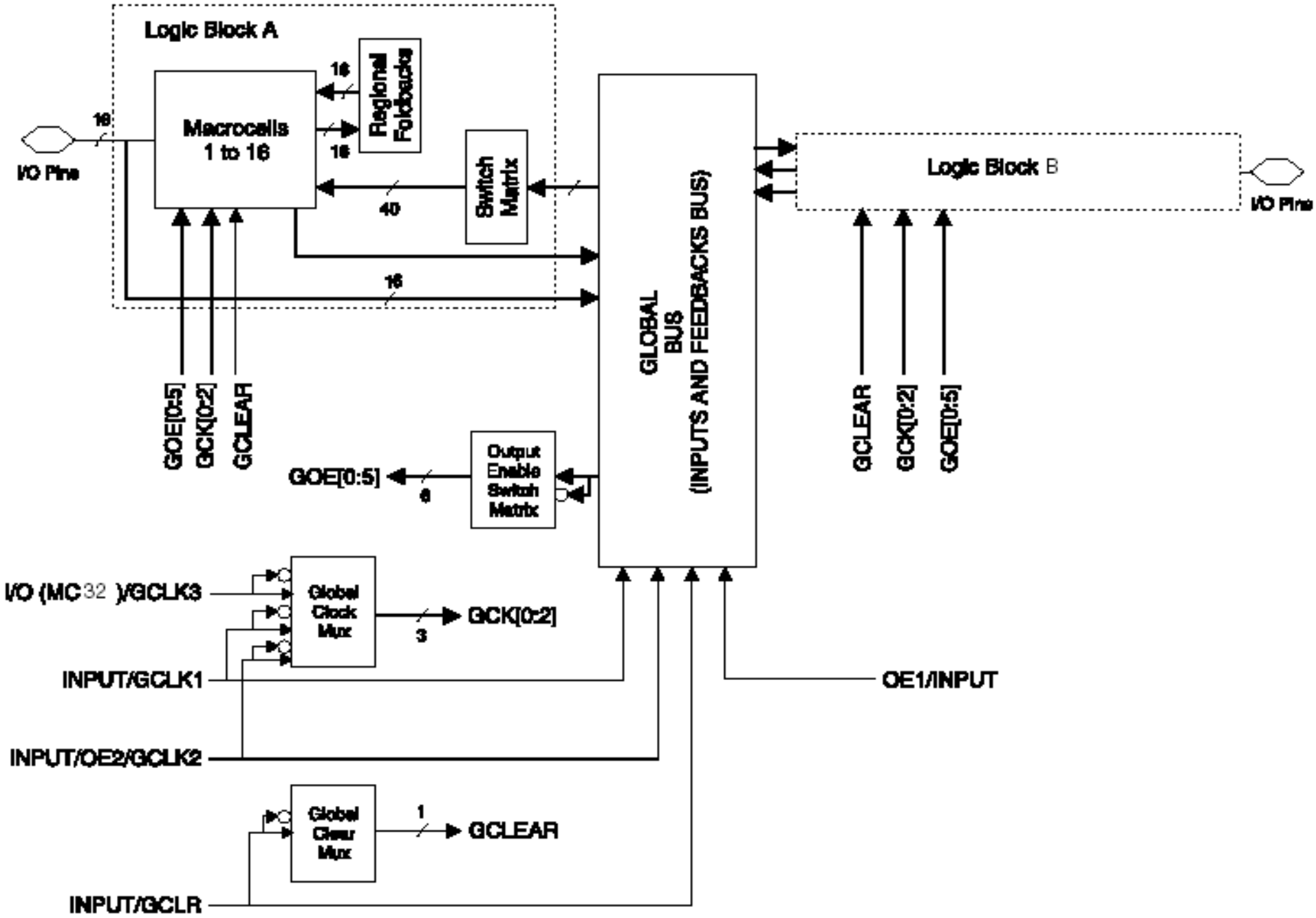


  - Bloques de PLD
  - Matriz de interconexiones entre ellas
  - Dos niveles de programación -> mucha más flexibilidad

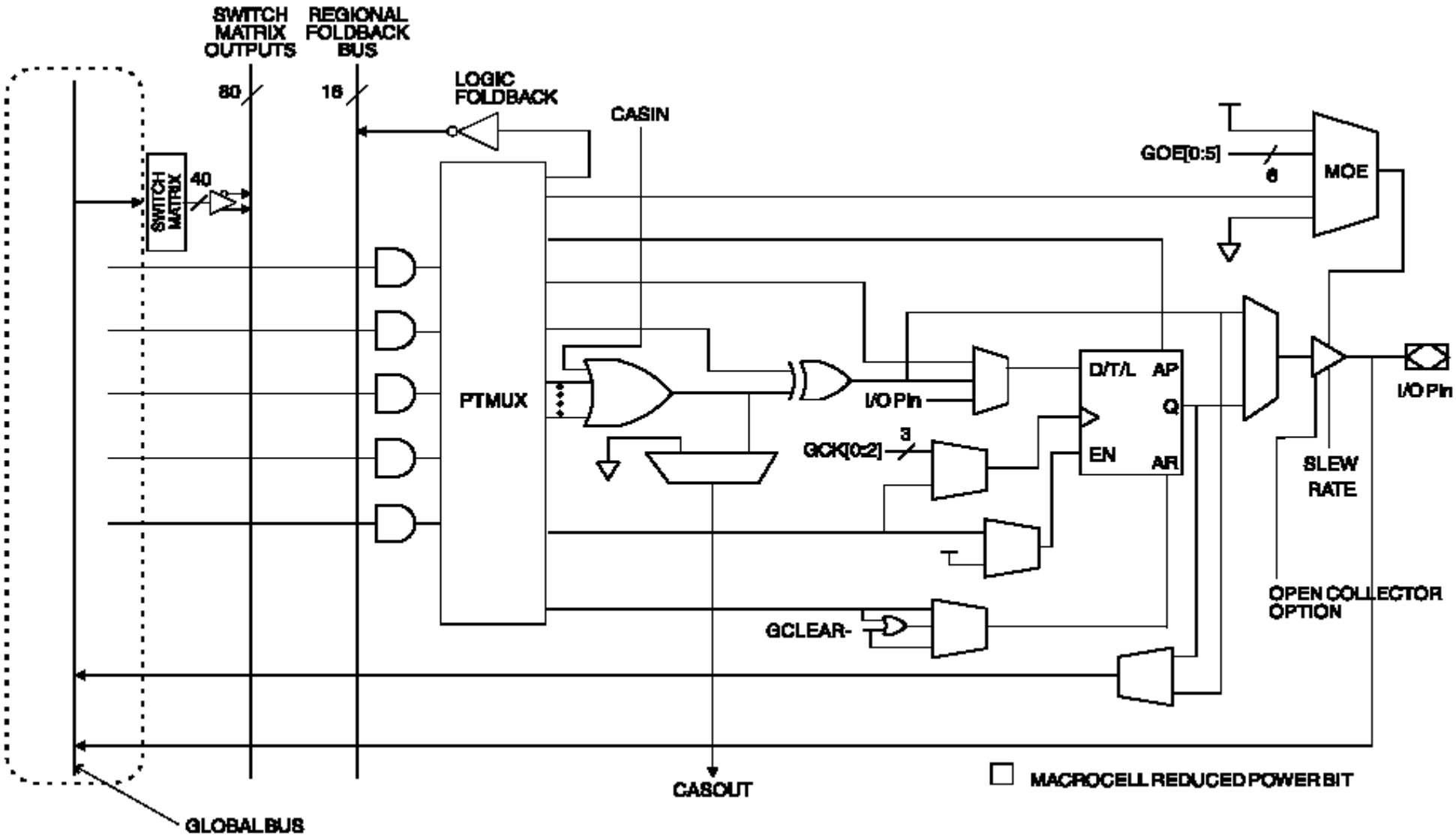
ATF1502

- Características
  - 44 pines
  - Retardo entrada-salida máximo 7,5ns
  - 32 macrocélulas
    - 5 productos por macrocélula, ampliables hasta 40.
    - Configurable como registro D o T
    - Señales de control del registro globales o individuales
    - ENABLE global o individual de cada salida
    - Programables como entradas, salidas o E/S (como ATF750), y colector abierto.
  - Programación ISP
  - Tres pines de CLK globales disponibles
  - Opción de RESET en encendido
  - EEPROM

Arquitectura

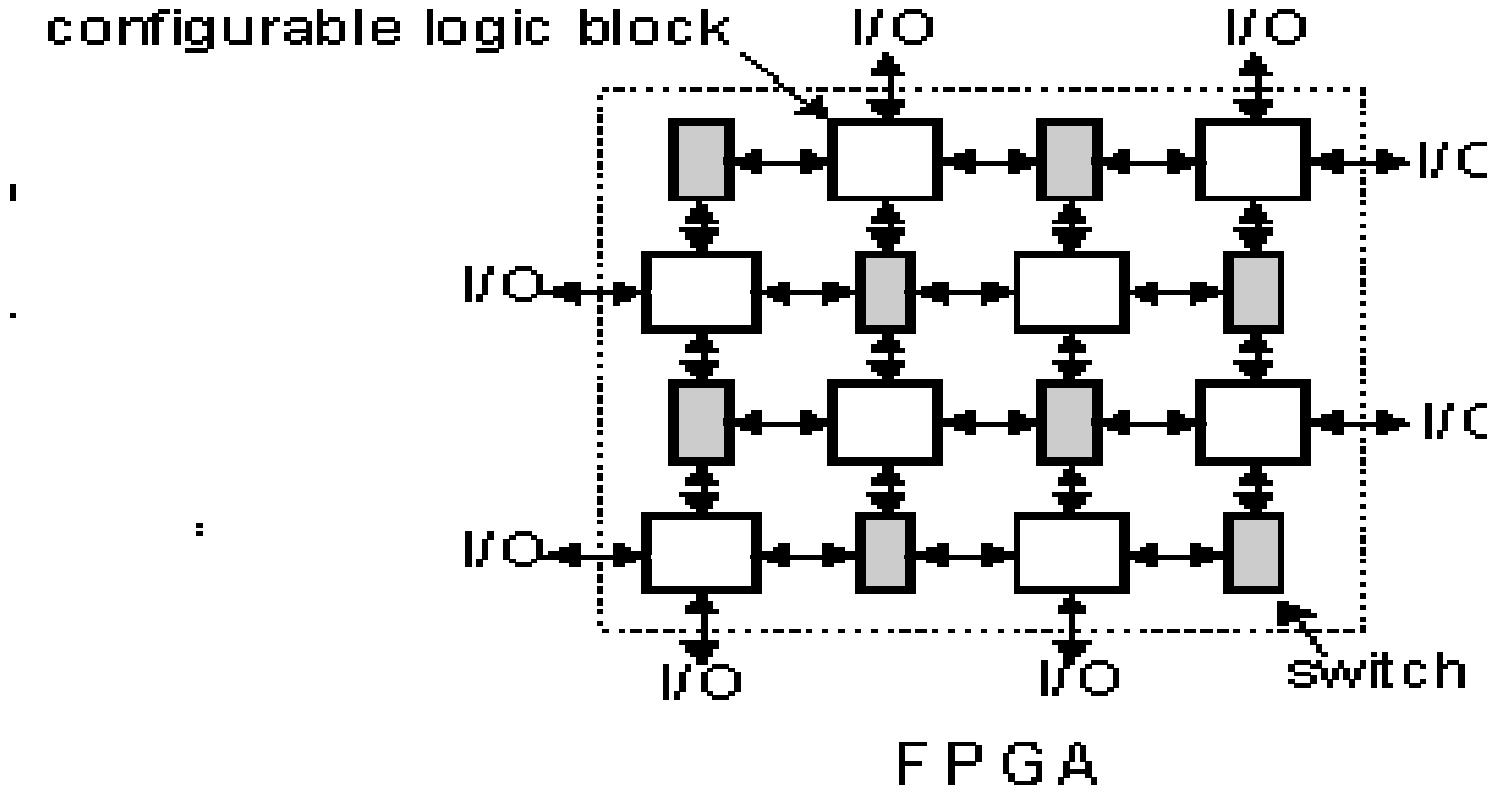


Estructura de la macrocélula



FPGAs

- Mucha mayor complejidad y flexibilidad
- Estructura



FPGA

  - Bloques lógicos configurables (CLB) -> cada uno realiza una función lógica
  - Array de conexiones programables mediante switches distribuidos por todo el FPGA -> con las conexiones se realizan funciones complejas.

AT40Kxx

- Características
  - Compatible XC4000 de Xilinx
  - 8 relojes externos con distribución “low skew”
  - Reconfiguración total/parcial en el sistema
  - Versiones 5V y 3,3V
  - 128-384 E/S compatibles PCI
  - Entre 2K y 18Bbits SRAM de 10ns
  - 5.000 a 50.000 puertas lógicas
  - 256 a 2304 registros
  - 84-352 pines

Diagrama de bloques

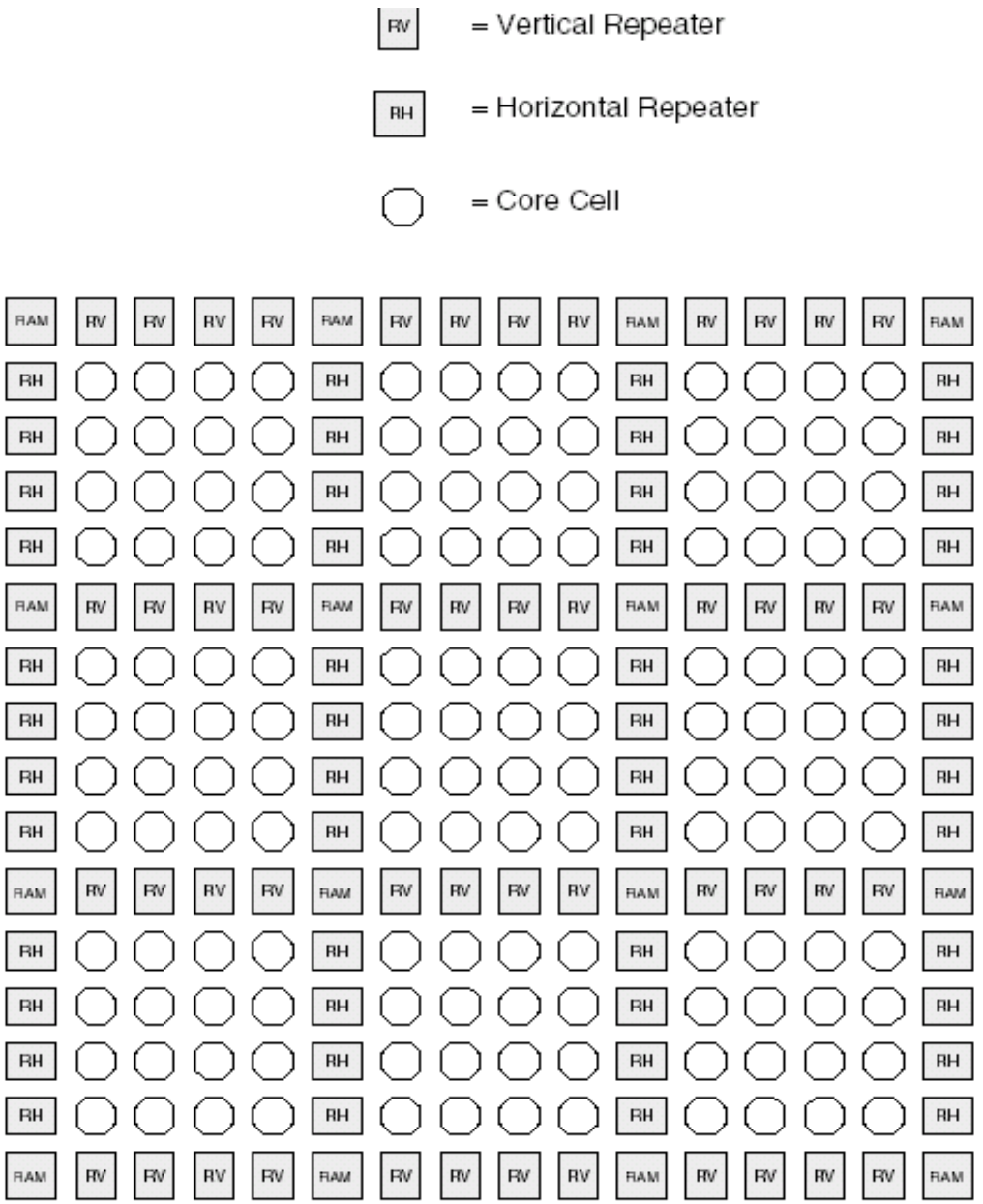
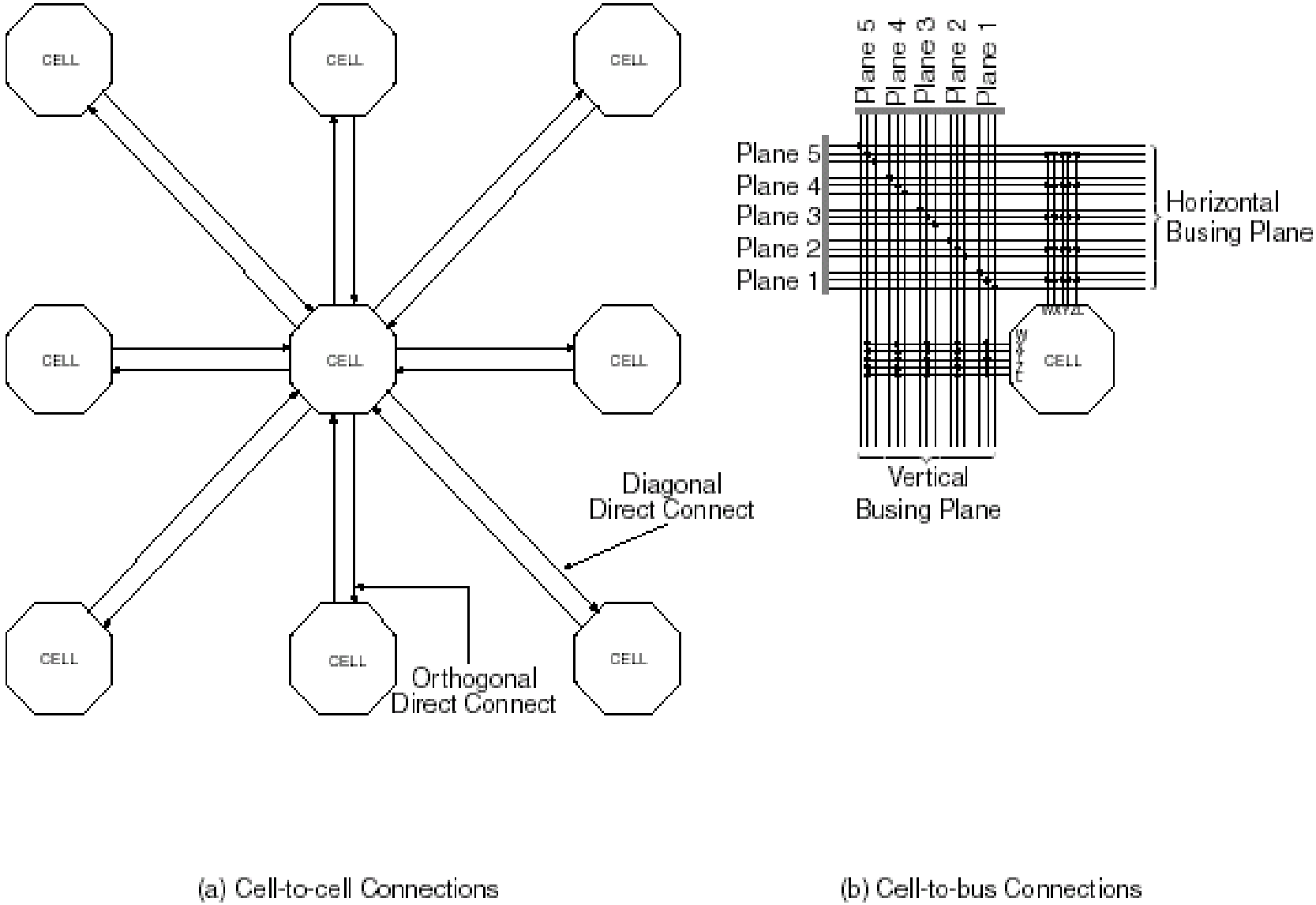


Figure 4. Cell Connections



(a) Cell-to-cell Connections

(b) Cell-to-bus Connections

Figure 5. The Cell

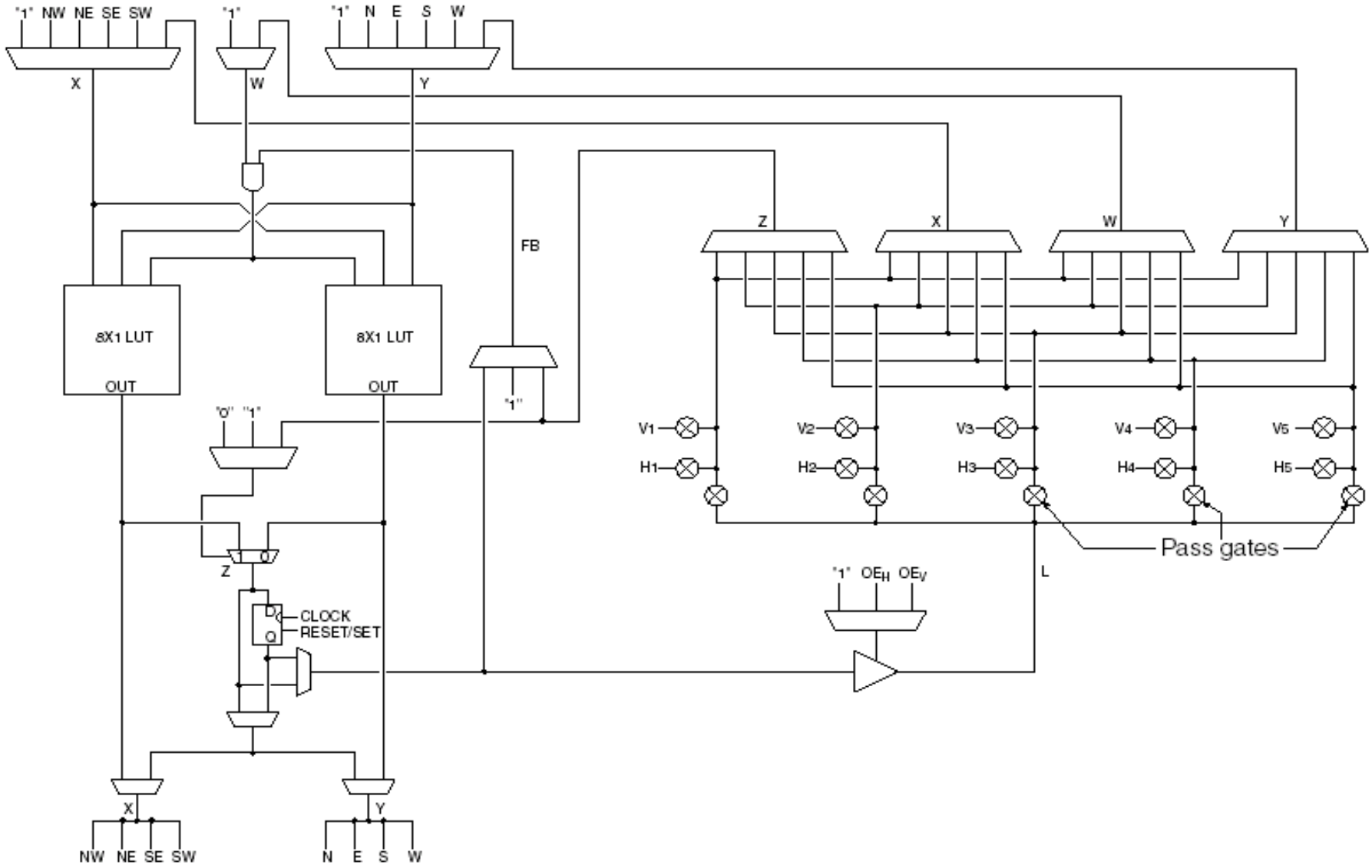


Figure 8. RAM Logic