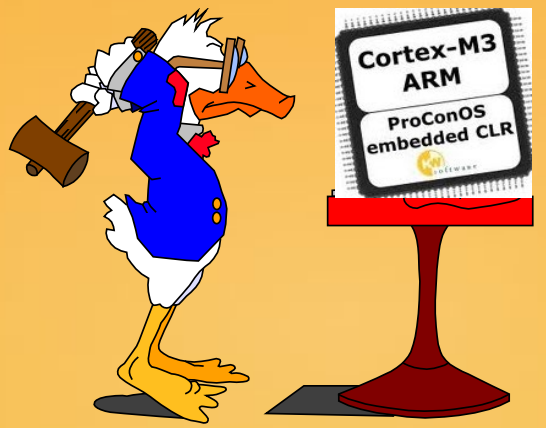
Informática II

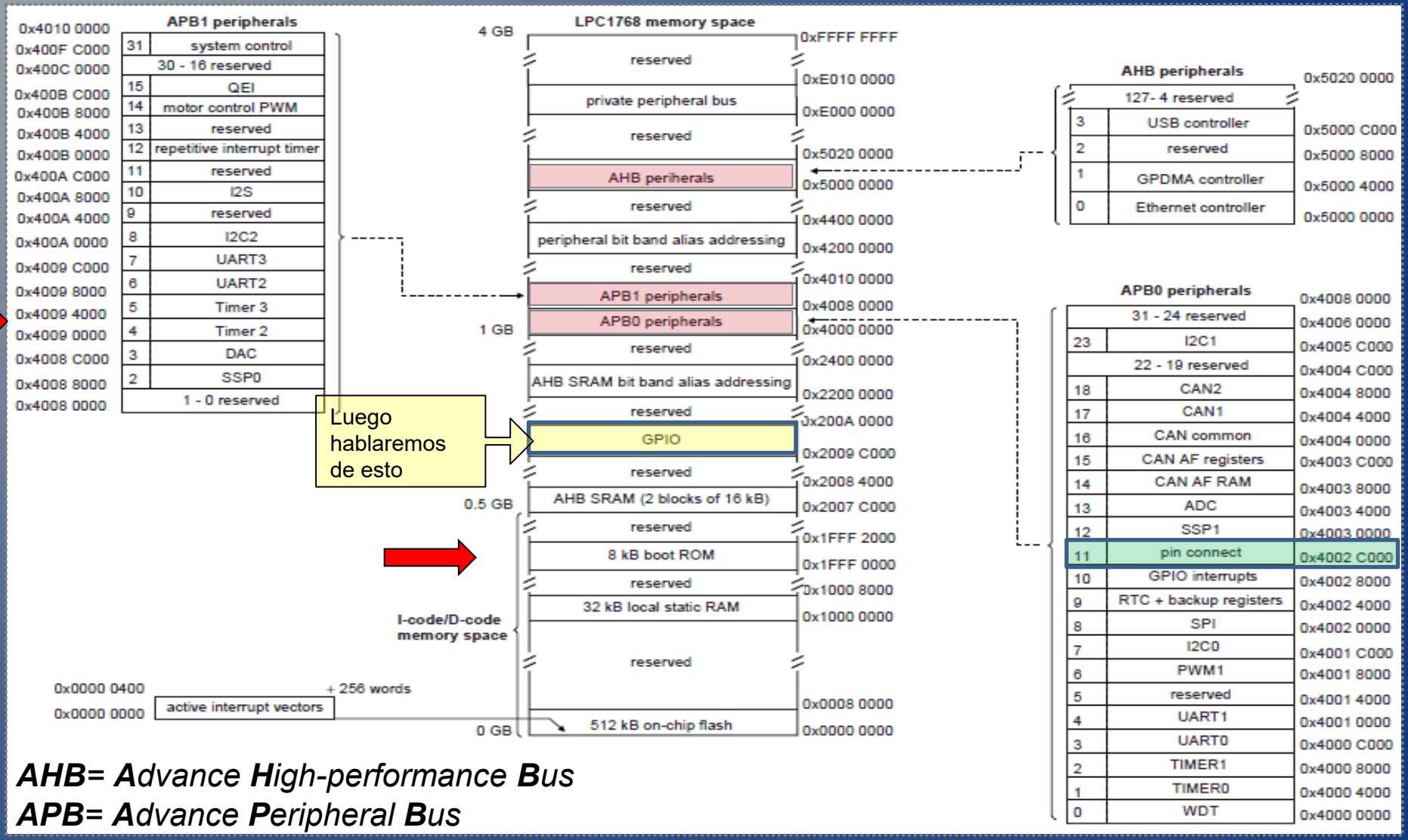
Cortex M3 LPC1769

General Purpuse Input Output



Basado en el material del Ing. Marcelo Trujillo y el Ing. Marcelo Giura

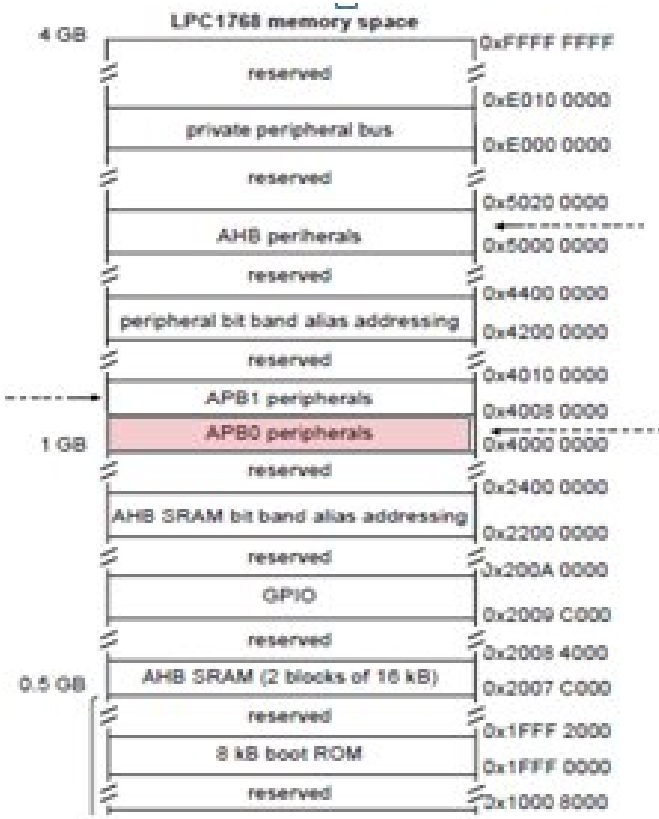
Mapa de memoria y periféricos - LPC1769



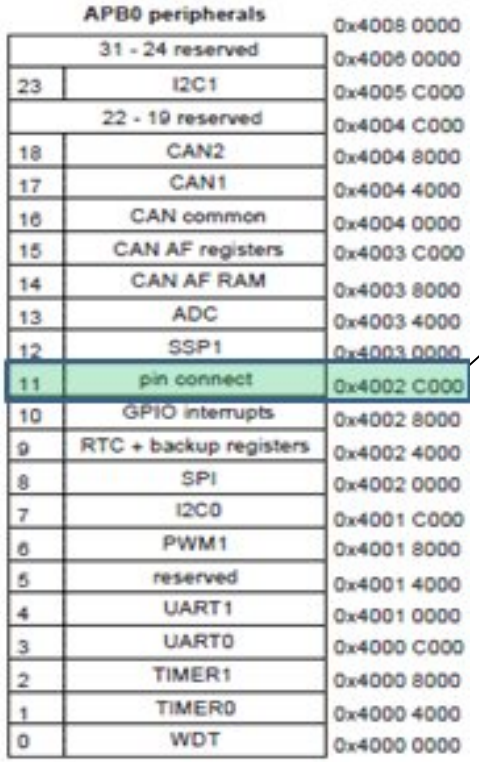
***AHB**= **A**dvance **H**igh-performance **B**us*

***APB**= **A**dvance **P**eripheral **B**us*

Mapa de memoria y periféricos LPC1769



Nos permite configurar todos los parámetros de cada PIN del micro



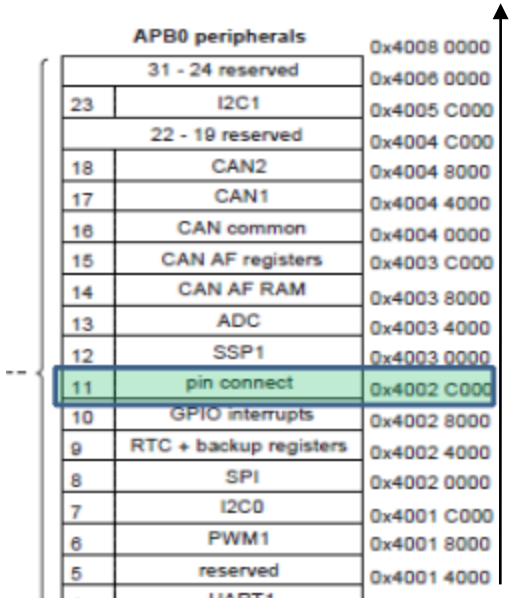
¿Qué podemos configurar en cada pin?

Registros de Configuración de cada Pin

Posiciones correlativas

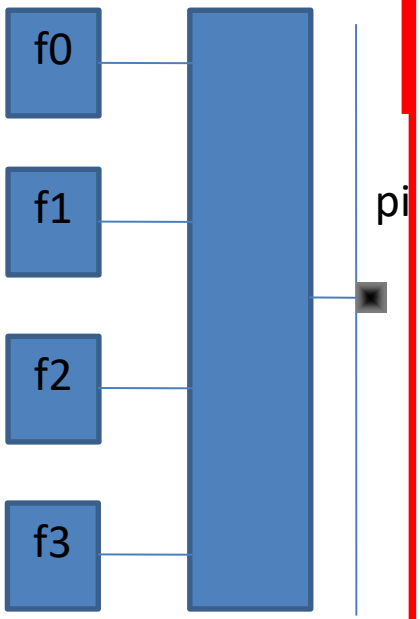
Name	Description	Access	Reset Value[1]	Address
PINSEL0	Pin function select register 0.	R/W	0	0x4002 C000
PINSEL1	Pin function select register 1.	R/W	0	0x4002 C004
PINSEL2	Pin function select register 2.	R/W	0	0x4002 C008
PINSEL3	Pin function select register 3.	R/W	0	0x4002 C00C
PINSEL4	Pin function select register 4	R/W	0	0x4002 C010
PINSEL7	Pin function select register 7	R/W	0	0x4002 C01C
PINSEL8	Pin function select register 8	R/W	0	0x4002 C020
PINSEL9	Pin function select register 9	R/W	0	0x4002 C024
PINSEL10	Pin function select register 10	R/W	0	0x4002 C028
PINMODE0	Pin mode select register 0	R/W	0	0x4002 C040
PINMODE1	Pin mode select register 1	R/W	0	0x4002 C044
PINMODE2	Pin mode select register 2	R/W	0	0x4002 C048
PINMODE3	Pin mode select register 3.	R/W	0	0x4002 C04C
PINMODE4	Pin mode select register 4	R/W	0	0x4002 C050
PINMODE5	Pin mode select register 5	R/W	0	0x4002 C054
PINMODE6	Pin mode select register 6	R/W	0	0x4002 C058
PINMODE7	Pin mode select register 7	R/W	0	0x4002 C05C
PINMODE9	Pin mode select register 9	R/W	0	0x4002 C064
PINMODE_OD0	Open drain mode control register 0	R/W	0	0x4002 C068
PINMODE_OD1	Open drain mode control register 1	R/W	0	0x4002 C06C
PINMODE_OD2	Open drain mode control register 2	R/W	0	0x4002 C070
PINMODE_OD3	Open drain mode control register 3	R/W	0	0x4002 C074
PINMODE_OD4	Open drain mode control register 4	R/W	0	0x4002 C078
I2CPADCFG	I²C Pin Configuration register	R/W	0	0x4002 C07C

[1] Reset Value reflects the data stored in used bits only. It does not include reserved bits content.



¿Qué podemos configurar en cada pin?

¿Qué podemos configurar en cada pin y con qué?



Name	Description	Access	Reset Value[1]	Address
PINSEL0	Pin function select register 0.	R/W	0	0x4002 C000
PINSEL1	Pin function select register 1.	R/W	0	0x4002 C004
PINSEL2	Pin function select register 2.	R/W	0	0x4002 C008
PINSEL3	Pin function select register 3.	R/W	0	0x4002 C00C
PINSEL4	Pin function select register 4	R/W	0	0x4002 C010
PINSEL7	Pin function select register 7	R/W	0	0x4002 C01C
PINSEL8	Pin function select register 8	R/W	0	0x4002 C020
PINSEL9	Pin function select register 9	R/W	0	0x4002 C024
PINSEL10	Pin function select register 10	R/W	0	0x4002 C028
PINMODE0	Pin mode select register 0	R/W	0	0x4002 C040
PINMODE1	Pin mode select register 1	R/W	0	0x4002 C044
PINMODE2	Pin mode select register 2	R/W	0	0x4002 C048
PINMODE3	Pin mode select register 3.	R/W	0	0x4002 C04C
PINMODE4	Pin mode select register 4	R/W	0	0x4002 C050
PINMODE5	Pin mode select register 5	R/W	0	0x4002 C054
PINMODE6	Pin mode select register 6	R/W	0	0x4002 C058
PINMODE7	Pin mode select register 7	R/W	0	0x4002 C05C
PINMODE9	Pin mode select register 9	R/W	0	0x4002 C064
PINMODE_OD0	Open drain mode control register 0	R/W	0	0x4002 C068
PINMODE_OD1	Open drain mode control register 1	R/W	0	0x4002 C06C
PINMODE_OD2	Open drain mode control register 2	R/W	0	0x4002 C070
PINMODE_OD3	Open drain mode control register 3	R/W	0	0x4002 C074
PINMODE_OD4	Open drain mode control register 4	R/W	0	0x4002 C078
I2CPADCFG	I^2C Pin Configuration register	R/W	0	0x4002 C07C

[1] Reset Value reflects the data stored in used bits only. It does not include reserved bits content.

PINSEL0 - 0x4002C

PINSEL0 to PINSEL9 Values	Function
00	Primary (default) function, typically GPIO p
01	First alternate function
10	Second alternate function
11	Third alternate function

Pin Function Select Register 0 (*PINSEL0 - 0x4002C000*)

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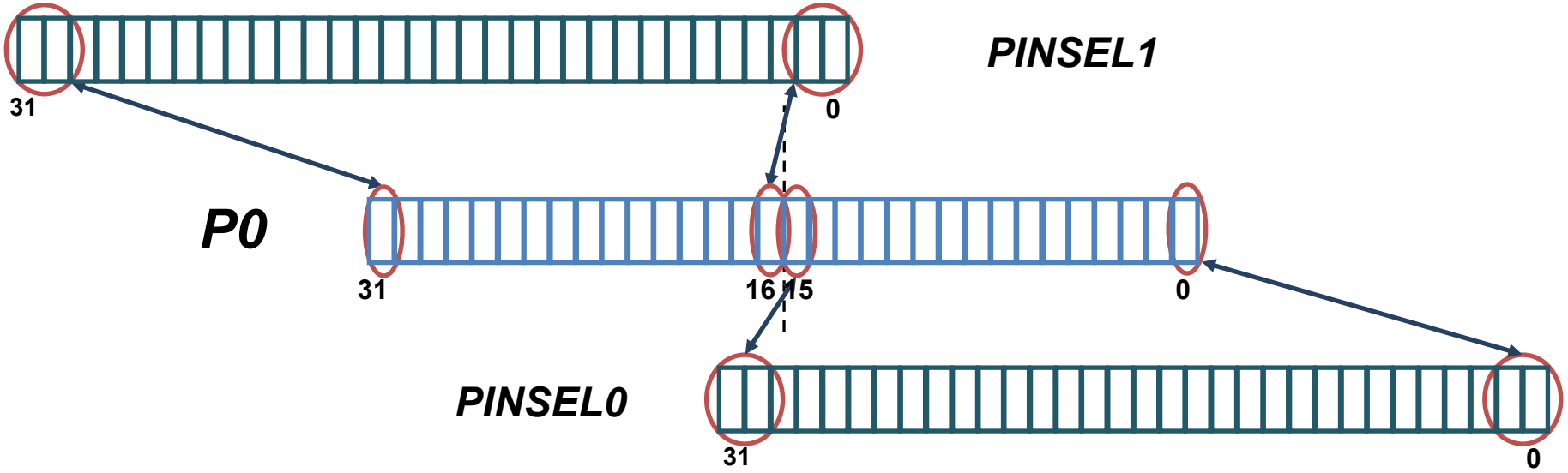
Register	Controls	
PINSEL0	P0[15:0]	
PINSEL1	P0 [31:16]	
PINSEL2	P1 [15:0] (Ethernet)	
PINSEL3	P1 [31:16]	
PINSEL4	P2 [15:0]	
PINSEL5	P2 [31:16]	not used
PINSEL6	P3 [15:0]	not used
PINSEL7	P3 [31:16]	
PINSEL8	P4 [15:0]	not used
PINSEL9	P4 [31:16]	

PINSEL0 to PINSEL9 Values	Function	Value after Reset
00	Primary (default) function, typically GPIO port	00
01	First alternate function	
10	Second alternate function	
11	Third alternate function	



Pin Function Select Register 0 (*PINSEL0 - 0x4002C000*)

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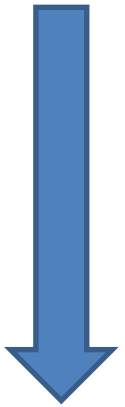
Name	Description	Access	Reset Value	Address	
PINSEL0	Pin function select register 0.	R/W	0	0x4002 C000	
PINSEL1	Pin function select register 1.	R/W	0	0x4002 C004	***Configura P0***
PINSEL2	Pin function select register 2.	R/W	0	0x4002 C008	
PINSEL3	Pin function select register 3.	R/W	0	0x4002 C00C	***Configura P1***
PINSEL4	Pin function select register 4	R/W	0	0x4002 C010	
PINSEL5	Pin function select register	R/W	0	0x4002 C014	***Configura P2***
PINSEL6	Pin function select register	R/W	0	0x4002 C018	
PINSEL7	Pin function select register 7	R/W	0	0x4002 C01C	***Configura P3***
PINSEL8	Pin function select register 8	R/W	0	0x4002 C020	
PINSEL9	Pin function select register 9	R/W	0	0x4002 C024	***Configura P4***

Posiciones correlativas



Register	Controls	
PINSEL0	P0[15:0]	
PINSEL1	P0 [31:16]	
PINSEL2	P1 [15:0] (Ethernet)	
PINSEL3	P1 [31:16]	
PINSEL4	P2 [15:0]	
PINSEL5	P2 [31:16]	not used
PINSEL6	P3 [15:0]	not used
PINSEL7	P3 [31:16]	
PINSEL8	P4 [15:0]	not used
PINSEL9	P4 [31:16]	

Pin Function Select Register 0 (*PINSEL0 - 0x4002C000*)

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Ejemplo PINSEL0

PINSEL0	Pin name	Function when 00	Function when 01	Function when 10	Function when 11	Reset value
1:0	P0.0	GPIO Port 0.0	RD1	TXD3	SDA1	00
3:2	P0.1	GPIO Port 0.1	TD1	RXD3	SCL1	00
5:4	P0.2	GPIO Port 0.2	TXD0	AD0.7	Reserved	00
7:6	P0.3	GPIO Port 0.3	RXD0	AD0.6	Reserved	00
9:8	P0.4[1]	GPIO Port 0.4	I2SRX_CLK	RD2	CAP2.0	00
11:10	P0.5[1]	GPIO Port 0.5	I2SRX_WS	TD2	CAP2.1	00
13:12	P0.6	GPIO Port 0.6	I2SRX_SDA	SSEL1	MAT2.0	00
15:14	P0.7	GPIO Port 0.7	I2STX_CLK	SCK1	MAT2.1	00
17:16	P0.8	GPIO Port 0.8	I2STX_WS	MISO1	MAT2.2	00
19:18	P0.9	GPIO Port 0.9	I2STX_SDA	MOSI1	MAT2.3	00
21:20	P0.10	GPIO Port 0.10	TXD2	SDA2	MAT3.0	00
23:22	P0.11	GPIO Port 0.11	RXD2	SCL2	MAT3.1	00
29:24	-	Reserved	Reserved	Reserved	Reserved	0
31:30	P0.15	GPIO Port 0.15	TXD1	SCK0	SCK	00

Register	Controls	
PINSEL0	P0[15:0]	
PINSEL1	P0 [31:16]	
PINSEL2	P1 [15:0] (Ethernet)	
PINSEL3	P1 [31:16]	
PINSEL4	P2 [15:0]	
PINSEL5	P2 [31:16]	not used
PINSEL6	P3 [15:0]	not used
PINSEL7	P3 [31:16]	
PINSEL8	P4 [15:0]	not used
PINSEL9	P4 [31:16]	

PINSEL0 to PINSEL9 Values	Function	Value after Reset
00	Primary (default) function, typically GPIO port	00
01	First alternate function	
10	Second alternate function	
11	Third alternate function	

Ejemplo P0.26

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Ejemplo configuración P0.26 (PINSEL1 - 0x4002C004)

PINSEL1	Pin name	Function when 00	Function when 01	Function when 10	Function when 11	Reset value
1:0	P0.16	GPIO Port 0.16	RXD1	SSEL0	SSEL	00
3:2	P0.17	GPIO Port 0.17	CTS1	MISO0	MISO	00
5:4	P0.18	GPIO Port 0.18	DCD1	MOSI0	MOSI	00
7:6	P0.19[1]	GPIO Port 0.19	DSR1	Reserved	SDA1	00
9:8	P0.20[1]	GPIO Port 0.20	DTR1	Reserved	SCL1	00
11:10	P0.21[1]	GPIO Port 0.21	RI1	Reserved	RD1	00
13:12	P0.22	GPIO Port 0.22	RTS1	Reserved	TD1	00
15:14	P0.23[1]	GPIO Port 0.23	AD0.0	I2SRX_CLK	CAP3.0	00
17:16	P0.24[1]	GPIO Port 0.24	AD0.1	I2SRX_WS	CAP3.1	00
19:18	P0.25	GPIO Port 0.25	AD0.2	I2SRX_SDA	TXD3	00
21:20	P0.26	GPIO Port 0.26	AD0.3	AOUT	RXD3	00
23:22	P0.27[1][2]	GPIO Port 0.27	SDA0	USB_SDA	Reserved	00
25:24	P0.28[1][2]	GPIO Port 0.28	SCL0	USB_SCL	Reserved	00
27:26	P0.29	GPIO Port 0.29	USB_D+	Reserved	Reserved	00
29:28	P0.30	GPIO Port 0.30	USB_D–	Reserved	Reserved	00
31:30	-	Reserved	Reserved	Reserved	Reserved	00

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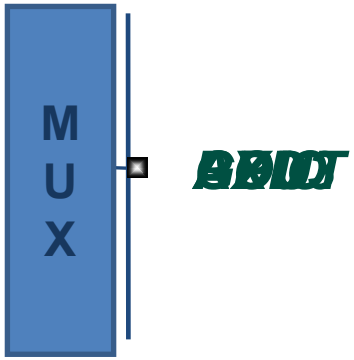
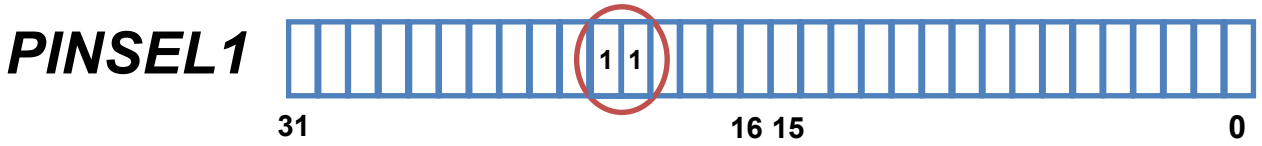
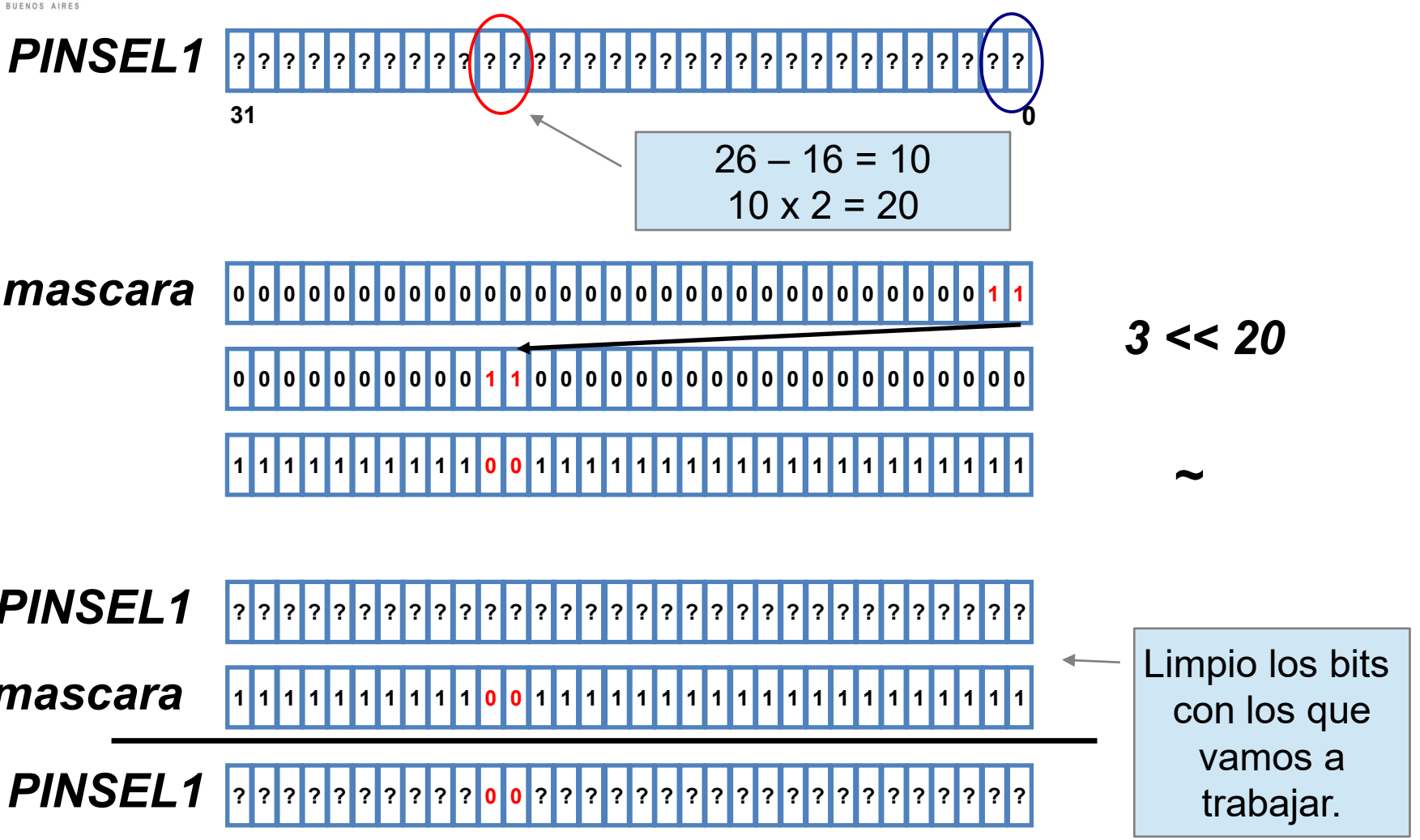
Ejemplo configuración P0.26 (PINSEL1 - 0x4002C004)

PINSEL	Function	
00	GPIO pin.	P0[26]
01	A/D converter 0, input 3.	AD0[3]
10	D/A converter output.	AOUT
11	Receiver input for UART3.	RXD3





Ejemplo configuración P0.26 – Función 2 (PINSEL1)



PINSEL1 ----> 0x4002C004

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Ejemplo configuración P0.26 – Función 2 (PINSEL1)

PINSEL1

31																												0
?	?	?	?	?	?	?	?	?	?	0	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

máscara función 2

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2 << 20

PINSEL1

?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

máscara funcion 2

PINSEL1

?	?	?	?	?	?	?	?	?	?	1	0	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

PINSEL1 ----> 0x4002C004

dualidad P-V

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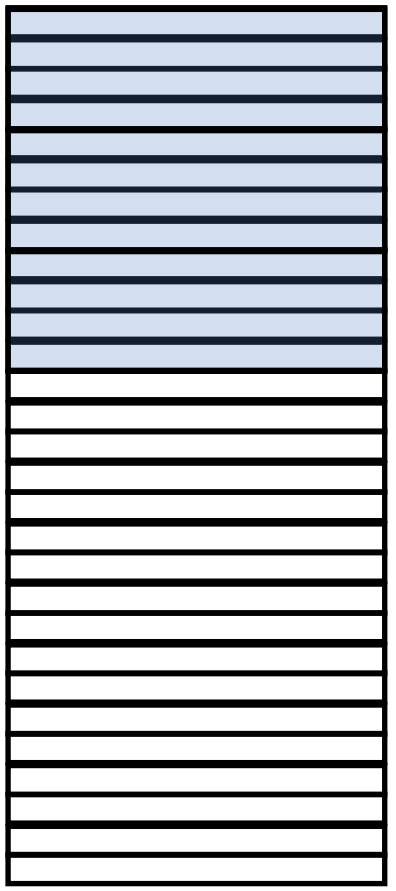
Dualidad Puntero-Vector

Recordando...

Ejemplo: Tomemos la dirección 4002C000h



Si quiero apuntar a ints

((unsigned int *)0x4002C000)[0]

Mas cómodo seria..

```
#define   dato   ((unsigned int *)0x4002C000)
dato[0]
dato[1]
dato[2]
```

Tipos y defines
Acercándonos al C

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Preparándonos para programar...

- **Declaración de tipos**

```
typedef    unsigned int          uint32_t
typedef    short unsigned int    uint16_t
typedef    unsigned char         uint8_t
```

```
#define    __R     volatile const
#define    __W     volatile
#define    __RW    volatile
```

Declaración de los PINSEL

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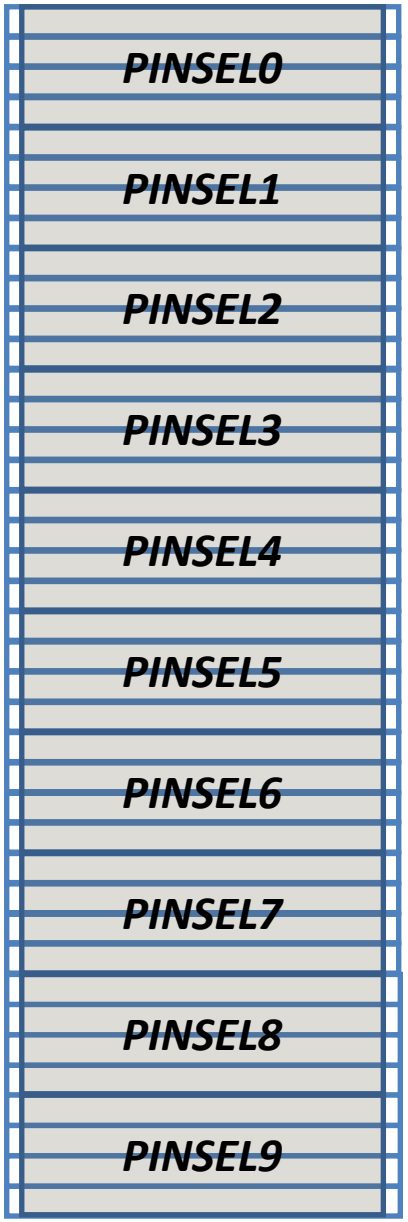
Name	Description	Access	Reset Value	Address
PINSEL0	Pin function select register 0.	R/W	0	0x4002 C000
PINSEL1	Pin function select register 1.	R/W	0	0x4002 C004
PINSEL2	Pin function select register 2.	R/W	0	0x4002 C008
PINSEL3	Pin function select register 3.	R/W	0	0x4002 C00C
PINSEL4	Pin function select register 4	R/W	0	0x4002 C010
PINSEL5	Pin function select register	R/W	0	0x4002 C014
PINSEL6	Pin function select register	R/W	0	0x4002 C018
PINSEL7	Pin function select register 7	R/W	0	0x4002 C01C
PINSEL8	Pin function select register 8	R/W	0	0x4002 C020
PINSEL9	Pin function select register 9	R/W	0	0x4002 C024

#define ***PINSEL*** *(* *(__RW uint32_t *)* ***0x4002C000UL*** *)*

PINSEL[9] => PINSEL9

0 PINSEL 0



header...

Contruyendo nuestro RegsLPC1769.h

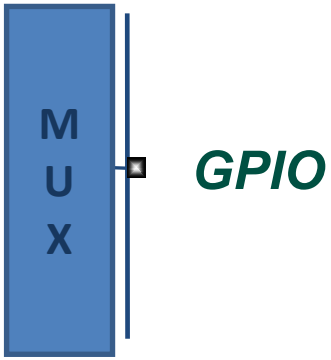
```
#define     PINSEL      ( ( __RW uint32_t * ) 0x4002C000UL )

#define     PINSEL0         PINSEL[0]
#define     PINSEL1         PINSEL[1]
#define     PINSEL2         PINSEL[2]
#define     PINSEL3         PINSEL[3]
#define     PINSEL4         PINSEL[4]
#define     PINSEL5         PINSEL[5]   //!< not used
#define     PINSEL6         PINSEL[6]   //!< not used
#define     PINSEL7         PINSEL[7]
#define     PINSEL8         PINSEL[8]   //!< not used
#define     PINSEL9         PINSEL[9]


#define     FUNCION_GPIO    0
#define     FUNCION_1       1
#define     FUNCION_2       2
#define     FUNCION_3       3
```

Register	Controls	
PINSEL0	P0[15:0]	
PINSEL1	P0 [31:16]	
PINSEL2	P1 [15:0] (Ethernet)	
PINSEL3	P1 [31:16]	
PINSEL4	P2 [15:0]	
PINSEL5	P2 [31:16]	not used
PINSEL6	P3 [15:0]	not used
PINSEL7	P3 [31:16]	
PINSEL8	P4 [15:0]	not used
PINSEL9	P4 [31:16]	

PINMODE

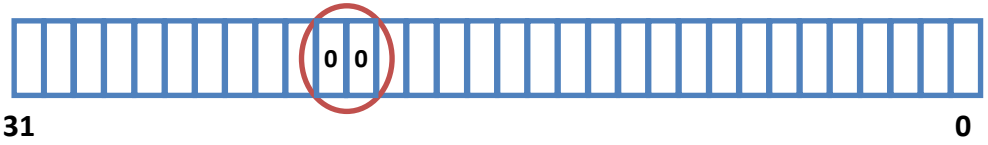
Si elegimos GPIO…. Deberemos configurar o el PINMODE o el PINMODE_OD

PINSEL	Function	
00	GPIO pin.	P0[26]
01	A/D converter 0, input 3.	AD0[3]
10	D/A converter output.	AOUT
11	Receiver input for UART3.	RXD3



GPIO

PINSEL1



Deberíamos decidir si el PIN será Entrada o Salida….

(lo sabremos hacer al final de esta clase)

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GPIO Como entrada: Registros PINMODEx

Si el nivel de la señal es bajo se activa el Pull –down
Y si el nivel de la señal es alto se activa Pull –Up
Evita que este flotante

contamos con 4 modos de trabajo

Pull - Up

PINMODE0 to PINMODE9 Values	Function	Value after Reset
00	Pin has an on-chip pull-up resistor enabled.	00
01	Repeater mode	
10	Pin has neither pull-up nor pull-down resistor enabled.	
11	Pin has an on-chip pull-down resistor enabled.	

Ni Pull – Up
Ni Pull - Down

Pull - Down

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Pin Mode Select register 0 (*PINMODE0 - 0x4002C040*)

Name	Description
PINMODE6	Pin mode select regi

Name	Description	Access	Reset Value[1]	Address
PINSEL0	Pin function select register 0.	R/W	0	0x4002 C000
PINSEL1	Pin function select register 1.	R/W	0	0x4002 C004
PINSEL2	Pin function select register 2.	R/W	0	0x4002 C008
PINSEL3	Pin function select register 3.	R/W	0	0x4002 C00C
PINSEL4	Pin function select register 4	R/W	0	0x4002 C010
PINSEL7	Pin function select register 7	R/W	0	0x4002 C01C
PINSEL8	Pin function select register 8	R/W	0	0x4002 C020
PINSEL9	Pin function select register 9	R/W	0	0x4002 C024
PINMODE0	Pin mode select register 0	R/W	0	0x4002 C040
PINMODE1	Pin mode select register 1	R/W	0	0x4002 C044
PINMODE2	Pin mode select register 2	R/W	0	0x4002 C048
PINMODE3	Pin mode select register 3.	R/W	0	0x4002 C04C
PINMODE4	Pin mode select register 4	R/W	0	0x4002 C050
PINMODE5	Pin mode select register 5	R/W	0	0x4002 C054
PINMODE6	Pin mode select register 6	R/W	0	0x4002 C058
PINMODE7	Pin mode select register 7	R/W	0	0x4002 C05C
PINMODE9	Pin mode select register 9	R/W	0	0x4002 C064
PINMODE_OD0	Open drain mode control register 0	R/W	0	0x4002 C068
PINMODE_OD1	Open drain mode control register 1	R/W	0	0x4002 C06C
PINMODE_OD2	Open drain mode control register 2	R/W	0	0x4002 C070
PINMODE_OD3	Open drain mode control register 3	R/W	0	0x4002 C074
PINMODE_OD4	Open drain mode control register 4	R/W	0	0x4002 C078
I2CPADCFG	I^2C Pin Configuration register	R/W	0	0x4002 C07C

[1] Reset Value reflects the data stored in used bits only. It does not include reserved bits content.

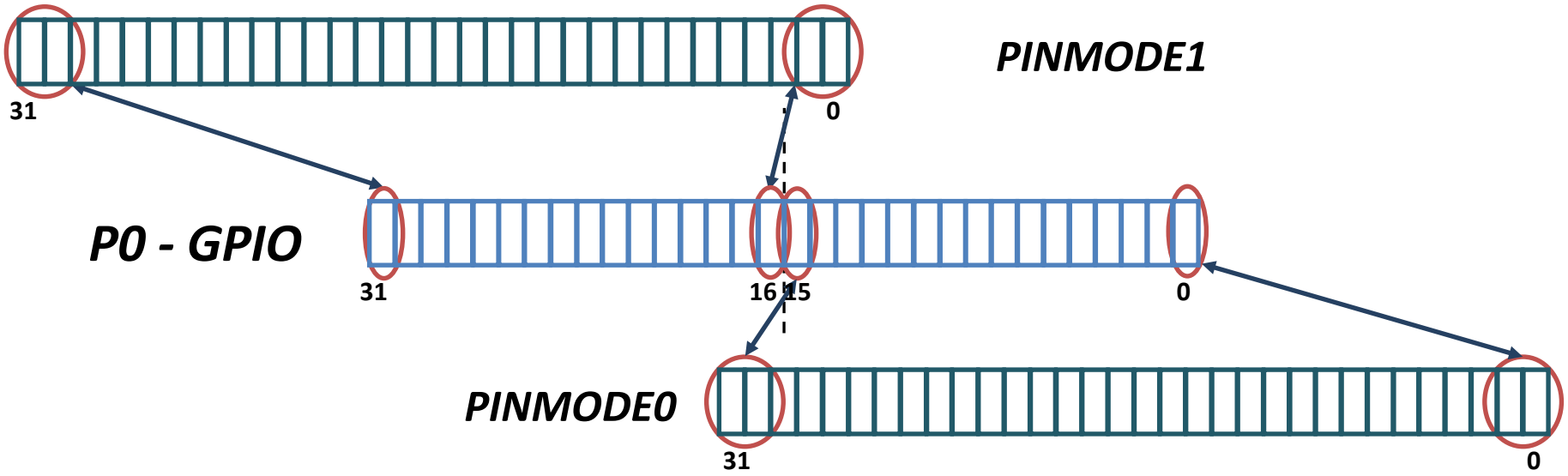
Ejemplo PINMODE0

PINMODE0	Symbol	Value	Description	Reset value
1:0	P0.00MODE		Port 0 pin 0 on-chip pull-up/down resistor control.	00
		00	P0.0 pin has a pull-up resistor enabled.	
		01	P0.0 pin has repeater mode enabled.	
		10	P0.0 pin has neither pull-up nor pull-down.	
		11	P0.0 has a pull-down resistor enabled.	
3:2	P0.01MODE		Port 0 pin 1 control, see P0.00MODE.	00
5:4	P0.02MODE		Port 0 pin 2 control, see P0.00MODE.	00
7:6	P0.03MODE		Port 0 pin 3 control, see P0.00MODE.	00
9:8	P0.04MODE[1]		Port 0 pin 4 control, see P0.00MODE.	00
11:10	P0.05MODE[1]		Port 0 pin 5 control, see P0.00MODE.	00
13:12	P0.06MODE		Port 0 pin 6 control, see P0.00MODE.	00
15:14	P0.07MODE		Port 0 pin 7 control, see P0.00MODE.	00
17:16	P0.08MODE		Port 0 pin 8 control, see P0.00MODE.	00
19:18	P0.09MODE		Port 0 pin 9control, see P0.00MODE.	00
21:20	P0.10MODE		Port 0 pin 10 control, see P0.00MODE.	00
23:22	P0.11MODE		Port 0 pin 11 control, see P0.00MODE.	00
29:24	-		Reserved.	NA
31:30	P0.15MODE		Port 0 pin 15 control, see P0.00MODE.	00

PINMODEx: ¿Cómo trabajarlos?

PINMODE0 to PINMODE9 Values	Function	Value after Reset
00	Pin has an on-chip pull-up resistor enabled.	00
01	Repeater mode	
10	Pin has neither pull-up nor pull-down resistor enabled.	
11	Pin has an on-chip pull-down resistor enabled.	

¡igual que los PINSEL!!!



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PINMODEx: *Resumen*

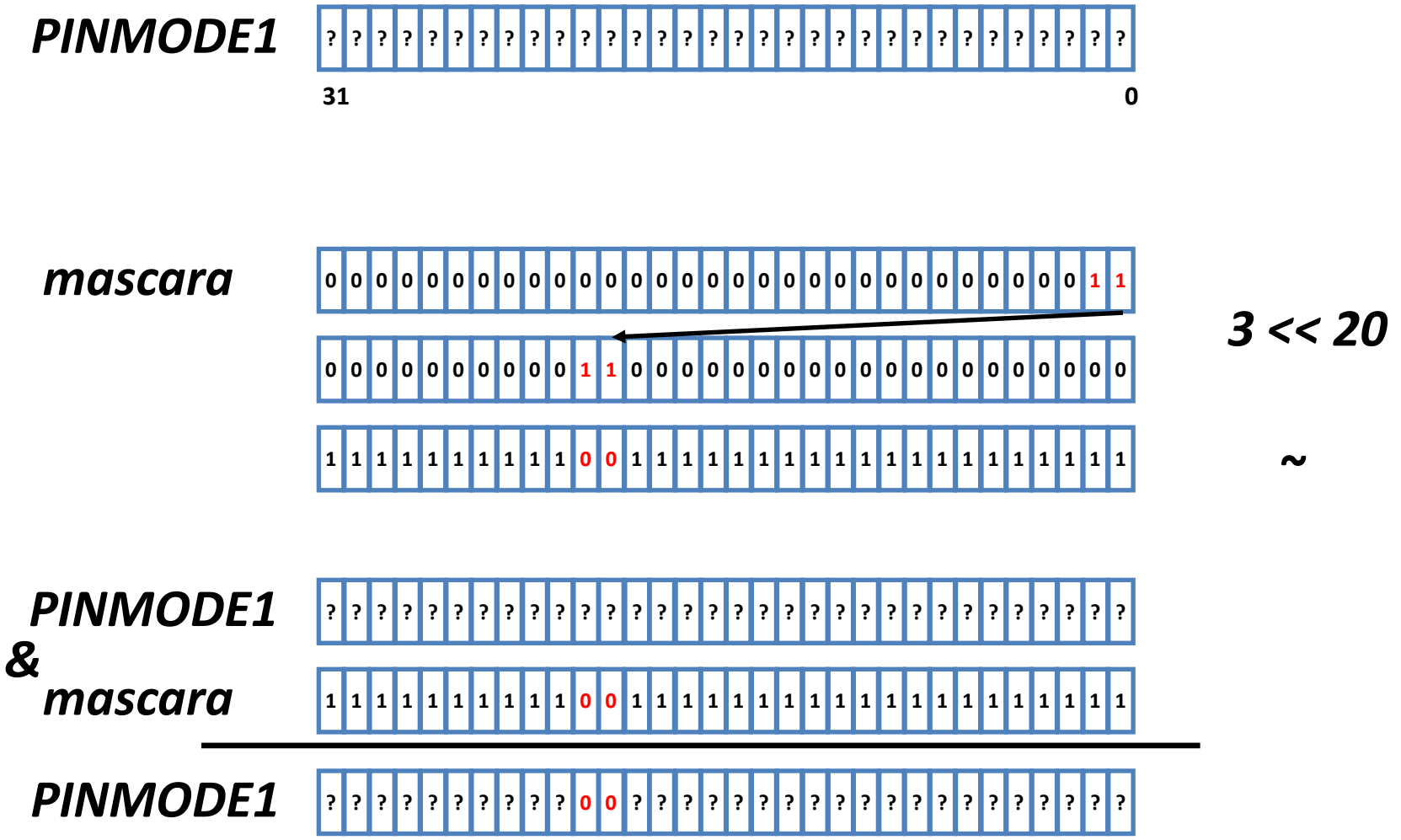
Posiciones correlativas

Name	Description	Access	Reset Value	Address	
PINMODE0	Pin mode select register 0	R/W	0	0x4002 C040	*Configura P0*
PINMODE1	Pin mode select register 1	R/W	0	0x4002 C044	
PINMODE2	Pin mode select register 2	R/W	0	0x4002 C048	*Configura P1*
PINMODE3	Pin mode select register 3.	R/W	0	0x4002 C04C	
PINMODE4	Pin mode select register 4	R/W	0	0x4002 C050	*Configura P2*
PINMODE5	Pin mode select register 5	R/W	0	0x4002 C054	
PINMODE6	Pin mode select register 6	R/W	0	0x4002 C058	*Configura P3*
PINMODE7	Pin mode select register 7	R/W	0	0x4002 C05C	
PINMODE8	Pin mode select register 8	R/W	0	0x4002 C060	*Configura P4*
PINMODE9	Pin mode select register 9	R/W	0	0x4002 C064	

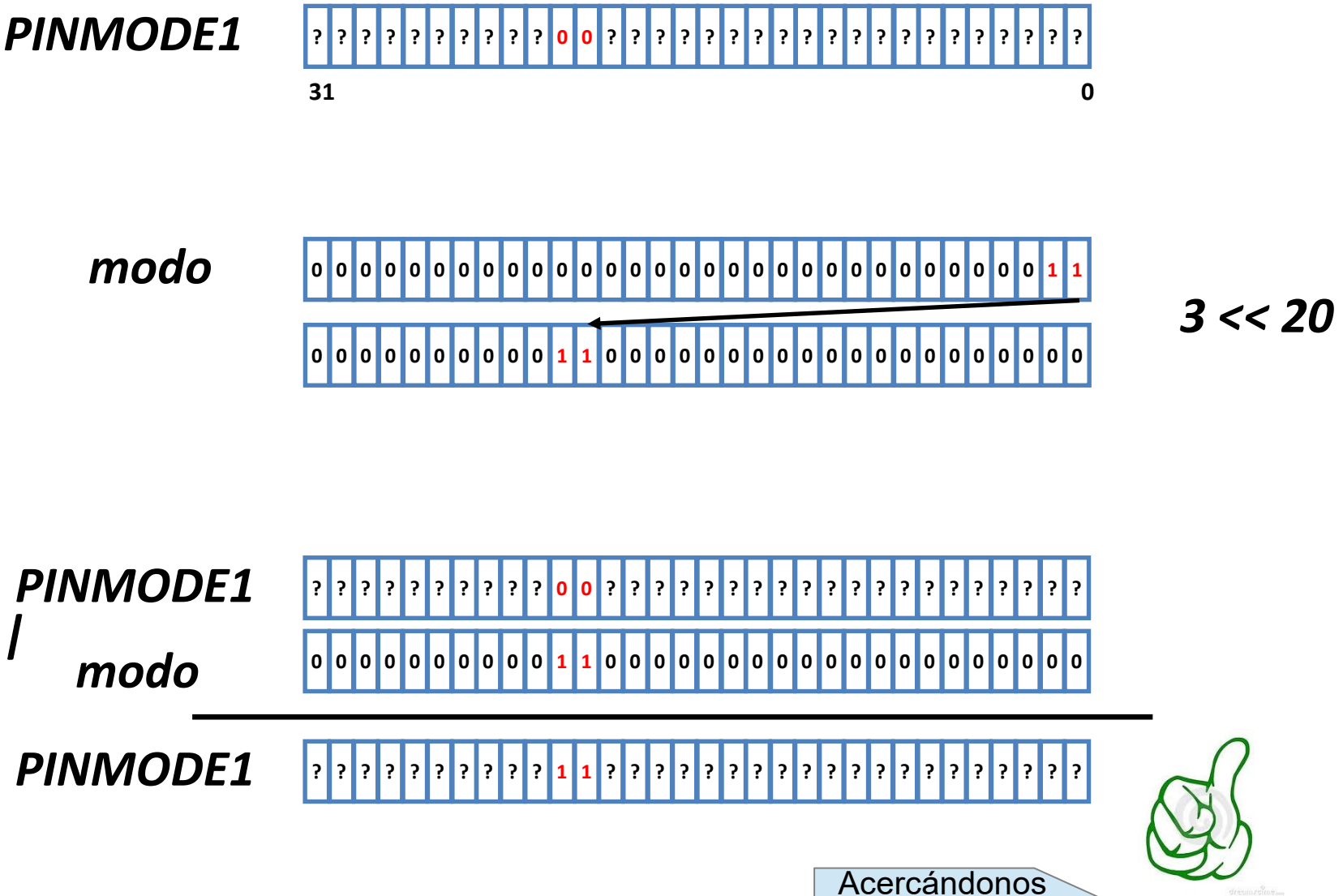
Register	Controls	
PINMODE0	P0[15:0]	
PINMODE1	P0 [31:16]	
PINMODE2	P1 [15:0]	
PINMODE3	P1 [31:16]	
PINMODE4	P2 [15:0]	
PINMODE5	P2 [31:16]	not used
PINMODE6	P3 [15:0]	not used
PINMODE7	P3 [31:16]	
PINMODE8	P4 [15:0]	not used
PINMODE9	P4 [31:16]	

Ejemplo P0.26

Ejemplo PINMODE1: **P0.26 como Pull Down** [1:2]



Ejemplo PINMODE1: **P0.26 como Pull Down** [2:2]



Acercándonos al C.

Declaración de los PINMODEx

(*PINMODE*

Name	Description	Access	Reset Value	Address
PINMODE0	Pin mode select register 0	R/W	0	0x4002 C040
PINMODE1	Pin mode select register 1	R/W	0	0x4002 C044
PINMODE2	Pin mode select register 2	R/W	0	0x4002 C048
PINMODE3	Pin mode select register 3.	R/W	0	0x4002 C04C
PINMODE4	Pin mode select register 4	R/W	0	0x4002 C050
PINMODE5	Pin mode select register 5	R/W	0	0x4002 C054
PINMODE6	Pin mode select register 6	R/W	0	0x4002 C058
PINMODE7	Pin mode select register 7	R/W	0	0x4002 C05C
PINMODE8	Pin mode select register 8	R/W	0	0x4002 C060
PINMODE9	Pin mode select register 9	R/W	0	0x4002 C064

#define ***PINMODE*** *((__RW uint32_t *)* ***0x4002C040UL*** *)*

PINMODE[9] => PINMODE9

PINMOD_ODx

PINMODE0

PINMODE1

PINMODE2

PINMODE3

PINMODE4

PINMODE5

PINMODE6

PINMODE7

PINMODE8

PINMODE9

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Seguimos construyendo nuestro RegsLPC1769.h

```
#define          PINMODE                ( ( __RW uint32_t * ) 0x4002C040UL )

#define          PINMODE0               PINMODE[0]
#define          PINMODE1               PINMODE[1]
#define          PINMODE2               PINMODE[2]
#define          PINMODE3               PINMODE[3]
#define          PINMODE4               PINMODE[4]
#define          PINMODE5               PINMODE[5]       //!< not used
#define          PINMODE6               PINMODE[6]       //!< not used
#define          PINMODE7               PINMODE[7]
#define          PINMODE8               PINMODE[8]       //!< not used
#define          PINMODE9               PINMODE[9]

#define          PINMODE_PULLUP         0
#define          PINMODE_REPEAT         1
#define          PINMODE_NONE           2
#define          PINMODE_PULLDOWN       3
```

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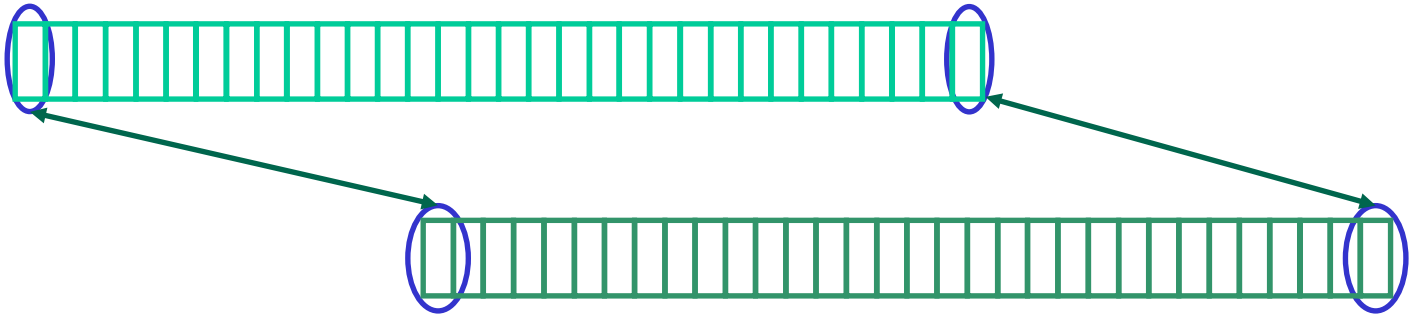
GPIO Como salida: Registros PINMODE_ODx

Para cuando configuramos el puerto como salida

El pin se mantiene en estado bajo si el dato es 0
El pin se apaga si el dato es 1
→Esta situación simula una salida de ***Open Drain*** .

PINMODE_OD0 to PINMODE_OD4 Values	Function
0	Pin is in the normal (not open drain) mode.
1	Pin is in the open drain mode.

Ejemplo para P0



Open Drain Control Register 0 (*PINMODE_OD0 - 0x4002C068*)

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Ejemplo PINMODE_OD0

PINMODE_OD0	Symbol	Value	Description	Reset value
0	P0.00OD[3]		Port 0 pin 0 open drain mode control.	0
		0	P0.0 pin is in the normal (not open drain) mode.	
		1	P0.0 pin is in the open drain mode.	
1	P0.01OD[3]		Port 0 pin 1 open drain mode control, see P0.00OD	0
2	P0.02OD		Port 0 pin 2 open drain mode control, see P0.00OD	0
3	P0.03OD		Port 0 pin 3 open drain mode control, see P0.00OD	0
4	P0.04OD		Port 0 pin 4 open drain mode control, see P0.00OD	0
5	P0.05OD		Port 0 pin 5 open drain mode control, see P0.00OD	0
6	P0.06OD		Port 0 pin 6 open drain mode control, see P0.00OD	0
7	P0.07OD		Port 0 pin 7 open drain mode control, see P0.00OD	0
8	P0.08OD		Port 0 pin 8 open drain mode control, see P0.00OD	0
9	P0.09OD		Port 0 pin 9 open drain mode control, see P0.00OD	0

Name	Description	Access	Reset Value[1]	Address
PINSEL0	Pin function select register 0.	R/W	0	0x4002 C000
PINSEL1	Pin function select register 1.	R/W	0	0x4002 C004
PINSEL2	Pin function select register 2.	R/W	0	0x4002 C008
PINSEL3	Pin function select register 3.	R/W	0	0x4002 C00C
PINSEL4	Pin function select register 4	R/W	0	0x4002 C010
PINSEL7	Pin function select register 7	R/W	0	0x4002 C01C
PINSEL8	Pin function select register 8	R/W	0	0x4002 C020
PINSEL9	Pin function select register 9	R/W	0	0x4002 C024
PINSEL10	Pin function select register 10	R/W	0	0x4002 C028
PINMODE0	Pin mode select register 0	R/W	0	0x4002 C040
PINMODE1	Pin mode select register 1	R/W	0	0x4002 C044
PINMODE2	Pin mode select register 2	R/W	0	0x4002 C048
PINMODE3	Pin mode select register 3.	R/W	0	0x4002 C04C
PINMODE4	Pin mode select register 4	R/W	0	0x4002 C050
PINMODE5	Pin mode select register 5	R/W	0	0x4002 C054
PINMODE6	Pin mode select register 6	R/W	0	0x4002 C058
PINMODE7	Pin mode select register 7	R/W	0	0x4002 C05C
PINMODE9	Pin mode select register 9	R/W	0	0x4002 C064
PINMODE_OD0	Open drain mode control register 0	R/W	0	0x4002 C068
PINMODE_OD1	Open drain mode control register 1	R/W	0	0x4002 C06C
PINMODE_OD2	Open drain mode control register 2	R/W	0	0x4002 C070
PINMODE_OD3	Open drain mode control register 3	R/W	0	0x4002 C074
PINMODE_OD4	Open drain mode control register 4	R/W	0	0x4002 C078
I2CPADCFG	I²C Pin Configuration register	R/W	0	0x4002 C07C

[1] Reset Value reflects the data stored in used bits only. It does not include reserved bits content.

PINSEL8	Pin function select registe			
r 9		R/W	0	0x4002 C064
PINMODE_OD0	ol register 0	R/W	0	0x4002 C068
PINMODE_OD1	ol register 1	R/W	0	0x4002 C06C
PINMODE_OD2	ol register 2	R/W	0	0x4002 C070
PINMODE_OD3	ol register 3	R/W	0	0x4002 C074
PINMODE_OD4	Open drain mode control register 4	R/W	0	0x4002 C078
I2CPADCFG	I²C Pin Configuration register	R/W	0	0x4002 C07C

[1] Reset Value reflects the data stored in used bits only. It does not include reserved bits content.

Sigue.....

Resumen configu-ración GPIO

Ejemplo PINMODE_OD0: **P0.27 como Open Drain**

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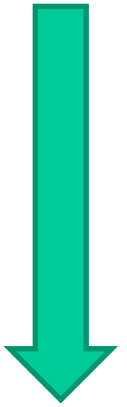
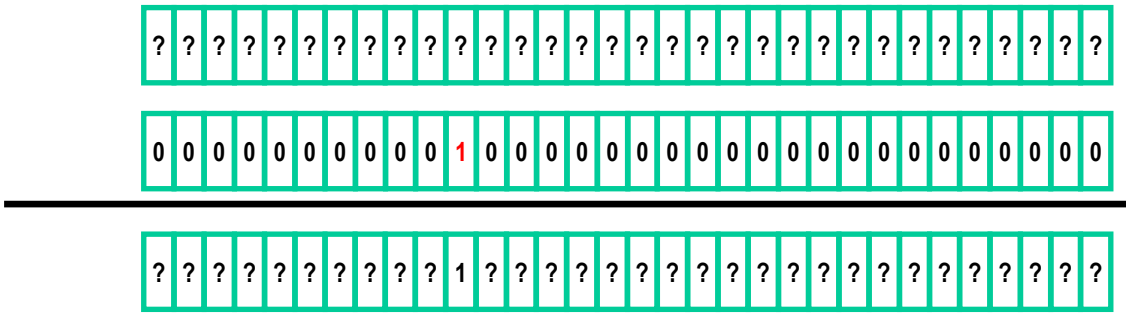
Name	Description	Access	Reset Value	Address	
PINMODE_OD0	Open drain mode control register 0	R/W	0	0x4002 C068	*Configura P0*
PINMODE_OD1	Open drain mode control register 1	R/W	0	0x4002 C06C	*Configura P1*
PINMODE_OD2	Open drain mode control register 2	R/W	0	0x4002 C070	*Configura P1*
PINMODE_OD3	Open drain mode control register 3	R/W	0	0x4002 C074	*Configura P1*
PINMODE_OD4	Open drain mode control register 4	R/W	0	0x4002 C078	*Configura P1*

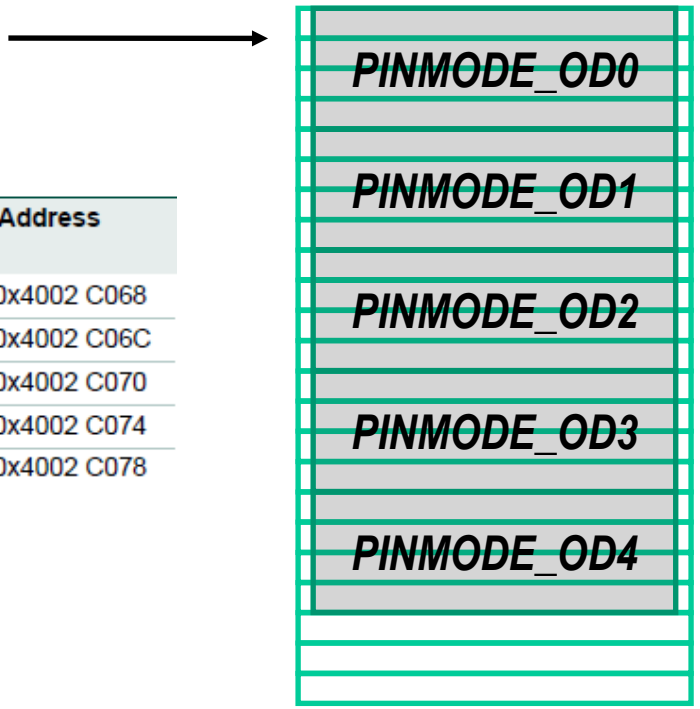


- ***Ejemplo P0.27***



Declaración de los PINMODE_ODx

Name	Description	Access	Reset Value	Address
PINMODE_OD0	Open drain mode control register 0	R/W	0	0x4002 C068
PINMODE_OD1	Open drain mode control register 1	R/W	0	0x4002 C06C
PINMODE_OD2	Open drain mode control register 2	R/W	0	0x4002 C070
PINMODE_OD3	Open drain mode control register 3	R/W	0	0x4002 C074
PINMODE_OD4	Open drain mode control register 4	R/W	0	0x4002 C078



PINMODE_OD[4] => PINMODE_OD4

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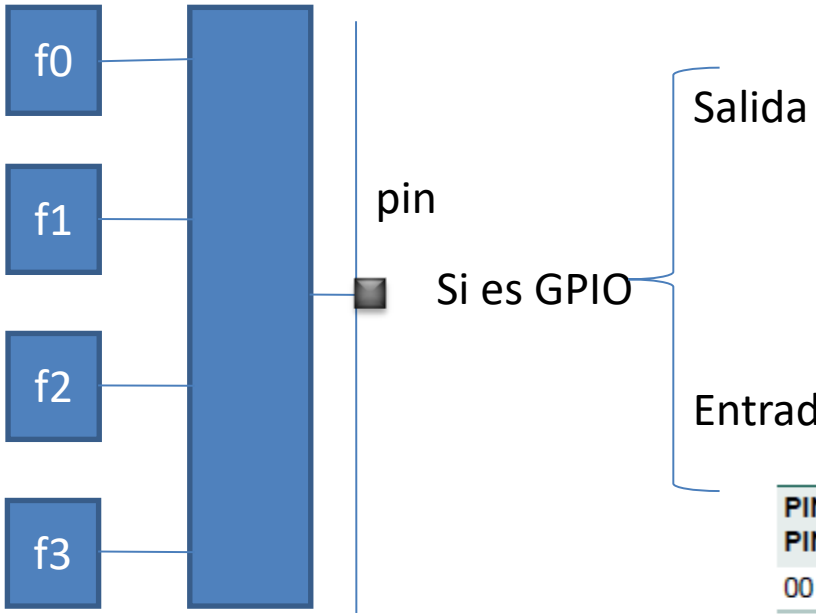
Seguimos construyendo nuestro RegsLPC1769.h

```
#define          PINMODE_OD          ( ( __RW uint32_t * ) 0x4002C040UL )

#define          PINMODE_OD0         PINMODE_OD[0]
#define          PINMODE_OD1         PINMODE_OD[1]
#define          PINMODE_OD2         PINMODE_OD[2]
#define          PINMODE_OD3         PINMODE_OD[3]
#define          PINMODE_OD4         PINMODE_OD[4]
```

En resumen…



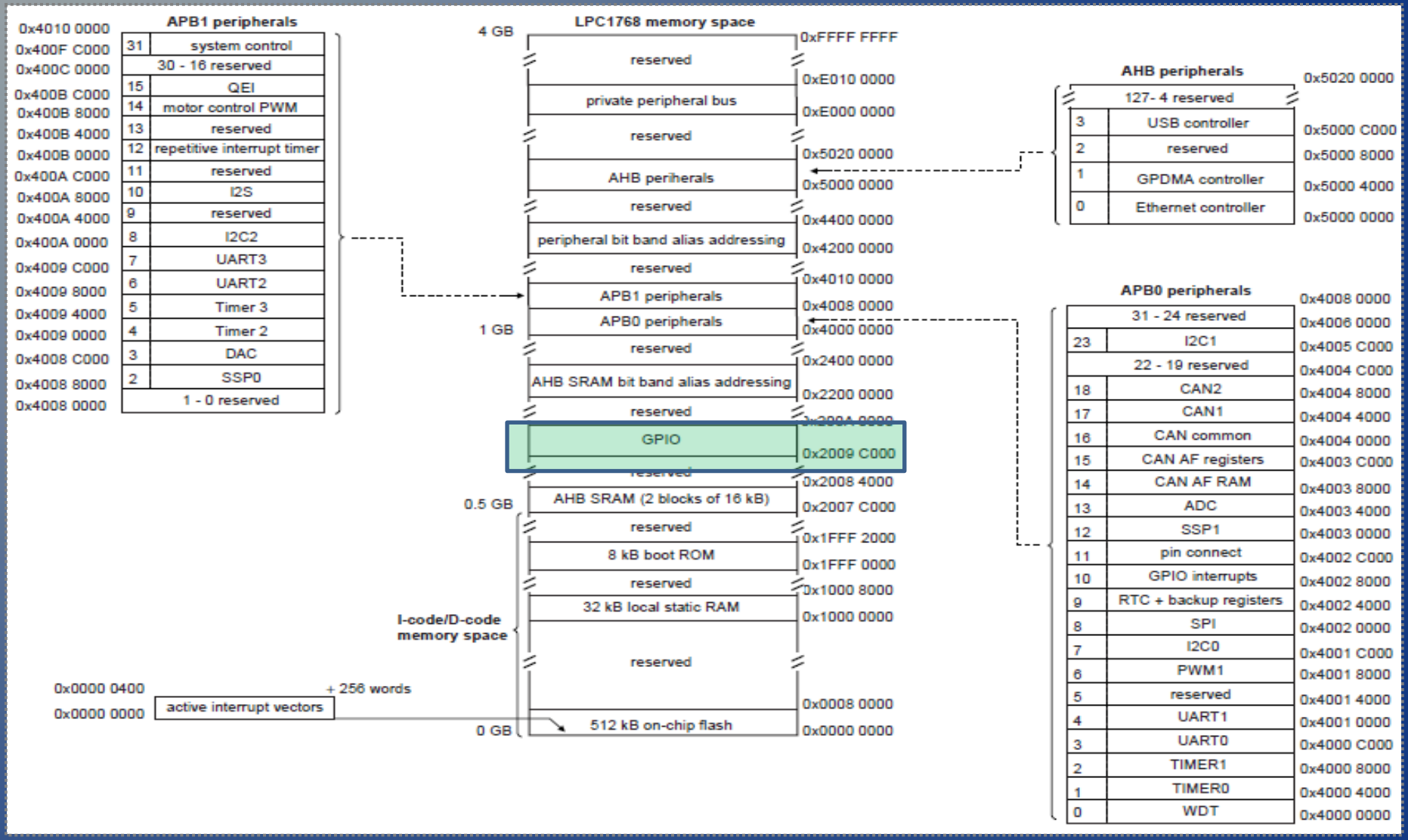
PINMODE_OD0 to PINMODE_OD4 Values	Function
0	Pin is in the normal (not open drain) mode.
1	Pin is in the open drain mode.

PINSEL0 to PINSEL9 Values	Function
00	Primary (default) function, typically GPIO port
01	First alternate function
10	Second alternate function
11	Third alternate function

PINMODE0 to PINMODE9 Values	Function
00	Pin has an on-chip pull-up resistor enabled.
01	Repeater mode
10	Pin has neither pull-up nor pull-down resistor enabled.
11	Pin has an on-chip pull-down resistor enabled.

GPIO

Mapa de memoria y periféricos - LPC1769



Mapa de las GPIO del LPC1769

Establezco Dirección (0 = entrada 1 = salida)

máscara (0 = enable)

Lectura/escritura de pin (FIOMASK = 0, todo habilitado)

Con un “1” Escribo un 1

Con un “1” escribo un 0

Table 101. GPIO register map (local bus accessible registers - enhanced GPIO features)

Generic Name	Description	Access	Reset value[1]	PORTn Register Name & Address
FIODIR	Fast GPIO Port Direction control register. This register individually controls the direction of each port pin.	R/W	0	FIO0DIR - 0x2009 C000 FIO1DIR - 0x2009 C020 FIO2DIR - 0x2009 C040 FIO3DIR - 0x2009 C060 FIO4DIR - 0x2009 C080
FIOMASK	Fast Mask register for port. Writes, sets, clears, and reads to port (done via writes to FIOPIN, FIOSET, and FIOCLR, and reads of FIOPIN) alter or return only the bits enabled by zeros in this register.	R/W	0	FIO0MASK - 0x2009 C010 FIO1MASK - 0x2009 C030 FIO2MASK - 0x2009 C050 FIO3MASK - 0x2009 C070 FIO4MASK - 0x2009 C090
FIOPIN	Fast Port Pin value register using FIOMASK. The current state of digital port pins can be read from this register, regardless of pin direction or alternate function selection (as long as pins are not configured as an input to ADC). The value read is masked by ANDing with inverted FIOMASK. Writing to this register places corresponding values in all bits enabled by zeros in FIOMASK. **Important:** if an FIOPIN register is read, its bit(s) masked with 1 in the FIOMASK register will be read as 0 regardless of the physical pin state.	R/W	0	FIO0PIN - 0x2009 C014 FIO1PIN - 0x2009 C034 FIO2PIN - 0x2009 C054 FIO3PIN - 0x2009 C074 FIO4PIN - 0x2009 C094
FIOSET	Fast Port Output Set register using FIOMASK. This register controls the state of output pins. Writing 1s produces highs at the corresponding port pins. Writing 0s has no effect. Reading this register returns the current contents of the port output register. Only bits enabled by 0 in FIOMASK can be altered.	R/W	0	FIO0SET - 0x2009 C018 FIO1SET - 0x2009 C038 FIO2SET - 0x2009 C058 FIO3SET - 0x2009 C078 FIO4SET - 0x2009 C098
FIOCLR	Fast Port Output Clear register using FIOMASK. This register controls the state of output pins. Writing 1s produces lows at the corresponding port pins. Writing 0s has no effect. Only bits enabled by 0 in FIOMASK can be altered.	WO	0	FIO0CLR - 0x2009 C01C FIO1CLR - 0x2009 C03C FIO2CLR - 0x2009 C05C FIO3CLR - 0x2009 C07C FIO4CLR - 0x2009 C09C

[1] Reset value reflects the data stored in used bits only. It does not include reserved bits content.

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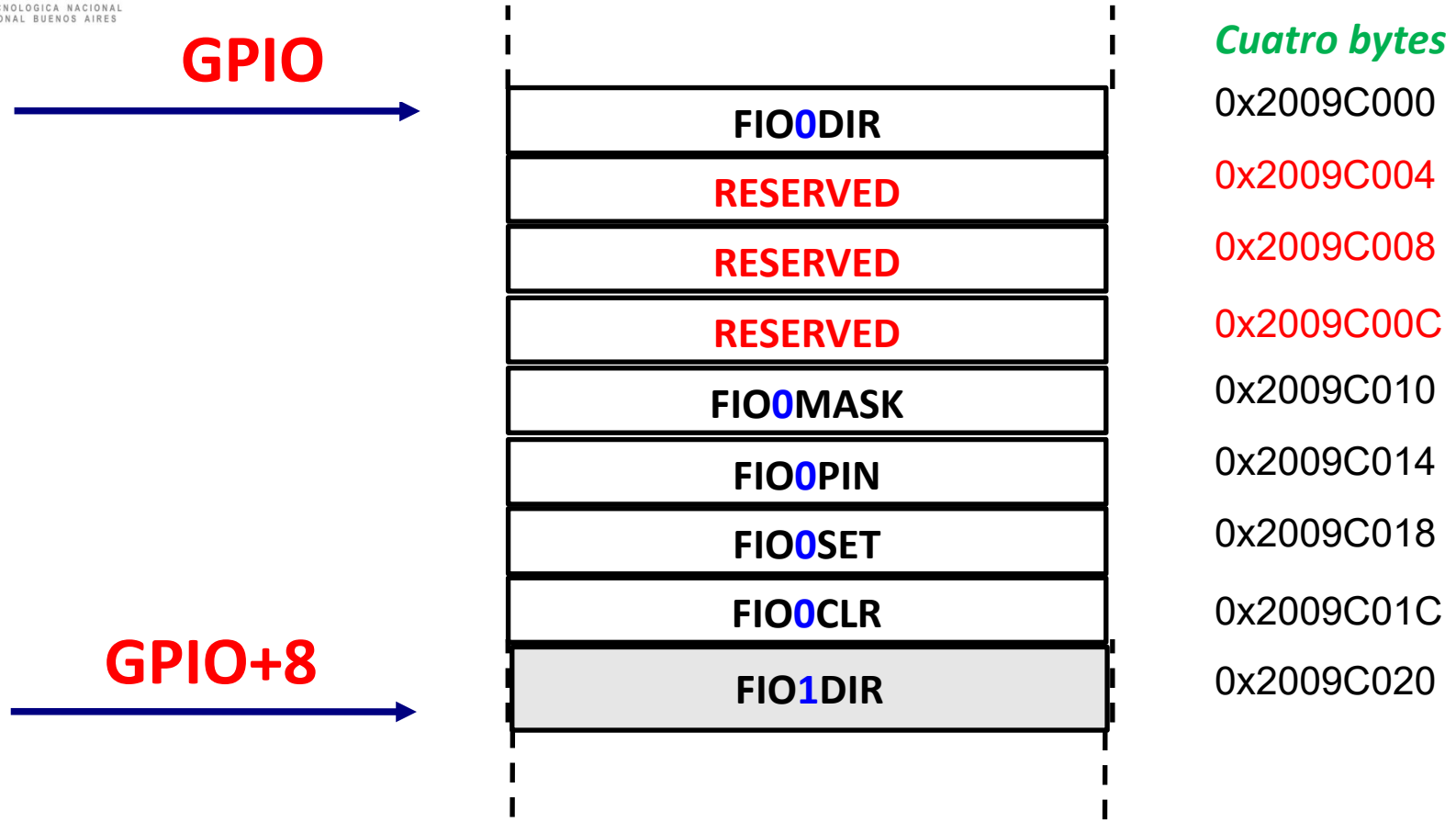
Mapa de las GPIO del LPC1769




```
#define   BASE  ( ( __RW uint32_t*)  0x2009C000UL)
```

Mapa de las GPIO del LPC1769

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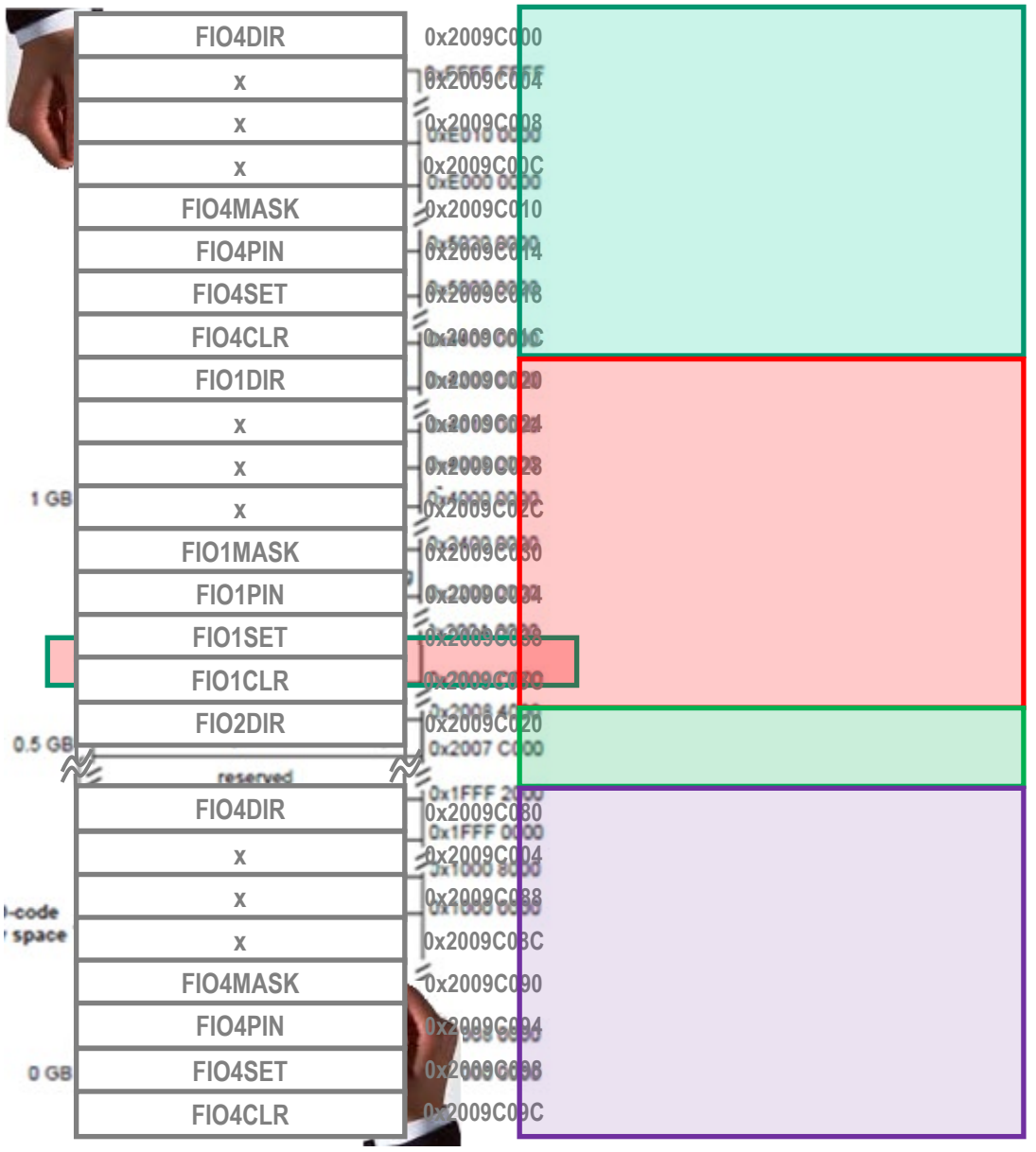
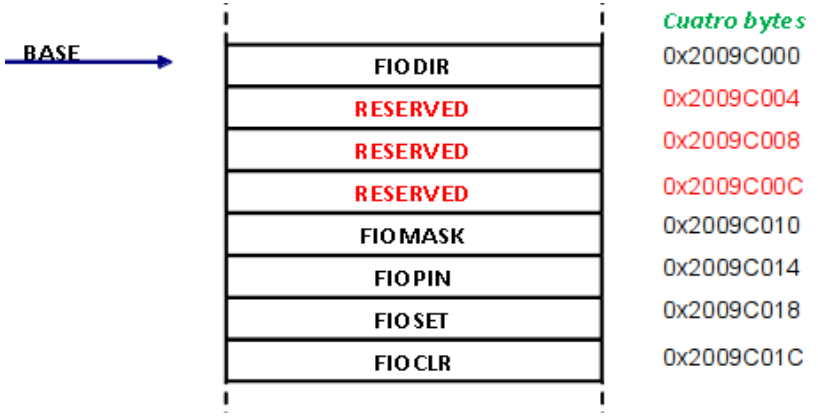
PUERTO 4



Seguimos construyendo nuestro RegsLPC1769.h

#define GPIOs ((__RW uint32_t*) 0x2009C000UL)




```
#define   FIO0DIR    GPIOs[0]
#define   FIO1DIR    GPIOs[8]
#define   FIO2DIR    GPIOs[16]
#define   FIO3DIR    GPIOs[24]
#define   FIO4DIR    GPIOs[32]

#define   FIO0MASK   GPIOs[4]
#define   FIO1MASK   GPIOs[12]
#define   FIO2MASK   GPIOs[20]
#define   FIO3MASK   GPIOs[28]
#define   FIO4MASK   GPIOs[36]
```

```
#define   FIO0PIN    GPIOs[5]
#define   FIO1PIN    GPIOs[13]
#define   FIO2PIN    GPIOs[21]
#define   FIO3PIN    GPIOs[29]
#define   FIO4PIN    GPIOs[37]

#define   FIO0SET    GPIOs[6]
#define   FIO1SET    GPIOs[14]
#define   FIO2SET    GPIOs[22]
#define   FIO3SET    GPIOs[30]
#define   FIO4SET    GPIOs[38]

#define   FIO0CLR    GPIOs[7]
#define   FIO1CLR    GPIOs[15]
#define   FIO2CLR    GPIOs[23]
#define   FIO3CLR    GPIOs[31]
#define   FIO4CLR    GPIOs[39]
```

Ejemplo en C

Ejemplo: Encender y apagar un led ubicado en P03, según el estado presente en P09

```
void main ( void )
{
uint8_t  flagEntrada = 0;  //variable auxiliar

Inicializar ();

Inicialización...

while ( 1 )
{
    if ( ((GPIO[5]>>9)&0x01) = = 0 && flagEntrada = = 0 )
    {
        flagEntrada = 1;
        GPIO[5] |= 0x01<<3;
    }

    if ( ((GPIO[5]>>9)&0x01) = = 1 && flagEntrada = = 1 )
    {
        flagEntrada = 0;
        GPIO[5] &= ~(0x01<<3);
    }

}
}
```

```
#define   LEDon      GPIO[5] |= (0x01<<3)
#define   LEDoff     GPIO[5] &= ~(0x01<<3)
#define   ENTRADA    (GPIO[5]>>9) & 0x01
```

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Portabilidad...

```
void main ( void )
{
unsigned char flagEntrada = 0;

Inicializar() ;

while ( 1 )
{
      if ( ENTRADA == 0 && flagEntrada == 0 )
      {
            flagEntrada = 1;
            LEDon;
      }

      if ( ENTRADA == 1 && flagEntrada == 1 )
      {
            flagEntrada = 0;
            LEDoff;
      }
}
}
```

```
#define   LEDon      GPIO[5] |= (0x01<<3)
#define   LEDoff     GPIO[5] &= ~(0x01<<3)
#define   ENTRADA    (GPIO[5]>>9) & 0x01
```

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Hagámonos la vida mas fácil....
(hagamos crecer nuestro RegsLPC1769.h)

Construyámonos un .h que incluya:

```
#define     PORT0           0
#define     PORT1           1
#define     PORT2           2
#define     PORT3           3
#define     PORT4           4

#define     FUNCION_GPIO    0
#define     FUNCION_1       1
#define     FUNCION_2       2
#define     FUNCION_3       3

#define     MODO_0          0
#define     MODO_1          1
#define     MODO_2          2
#define     MODO_3          3

#define     ENTRADA         0
#define     SALIDA          1
```

```
#define     __R             volatile const
#define     __W             volatile
#define     __RW            volatile

typedef unsigned int                uint32_t;
typedef unsigned short          uint16_t;
typedef unsigned char           uint8_t;
```

```
#define GPIO      ( ( __RW uint32_t * ) 0x2009C000UL )

#define PINSEL  ( ( __RW uint32_t * ) 0x4002C000UL )

#define PINMODE  ( ( __RW uint32_t * ) 0x4002C040UL )
```

y todo aquello otro que consideremos necesario....

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Hagámonos la vida mas fácil....

¿y si desarrollamos algunas funciones para manipular los registros a nivel de bits que nos “alejen de las asperezas” del HW?

- ➔ SetPIN: Establece un ESTADO en un determinado PIN de un determinado PUERTO
- ➔ GetPIN: Devuelve el ESTADO de un determinado PIN de un determinado PUERTO.
- ➔ SetPINSEL: Selección de modo de los puertos (4 modos)

```
#define   FUNCION_GPIO   0
#define   FUNCION_1      1
#define   FUNCION_2      2
#define   FUNCION_3      3
```

- ➔ SetDIR: Establece si un determinado PIN de un determinado PUERTO (previamente configurado como GPIO) es entrada o salida.
- ➔ SetPINMODE: Establece el modo de la entrada

a trabajar...