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"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	ARM® Cortex®-M4/M0
Core Size	32-Bit Dual-Core
Speed	204MHz
Connectivity	CANbus, EBI/EMI, I²C, IrDA, Microwire, SD, SPI, SSI, SSP, UART/USART, USB, USB OTG
Peripherals	Brown-out Detect/Reset, DMA, I²S, POR, WDT
Number of I/O	49
Program Memory Size	512KB (512K x 8)
Program Memory Type	FLASH
EEPROM Size	16K x 8
RAM Size	104K x 8
Voltage - Supply (Vcc/Vdd)	2.2V ~ 3.6V
Data Converters	A/D 4x10b; D/A 1x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	100-TFBGA
Supplier Device Package	100-TFBGA (9x9)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/lpc4322jet100e

4. Ordering information

Table 1. Ordering information

Type number	Package		
	Name	Description	Version
LPC4357FET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC4357JET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC4357JBD208	LQFP208	Plastic low profile quad flat package; 208 leads; body 28 × 28 × 1.4 mm	SOT459-1
LPC4353FET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC4353JET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC4353JBD208	LQFP208	Plastic low profile quad flat package; 208 leads; body 28 × 28 × 1.4 mm	SOT459-1
LPC4337FET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC4337JET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC4337JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4337JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4333FET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC4333JET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC4333JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4333JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4327JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4327JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4325JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4325JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4323JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4323JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4322JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4322JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4317JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4317JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4315JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4315JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4313JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4313JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC4312JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC4312JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1

Table 3. Pin description *…continued*

Pin name	LBGA256	TFBGA100	LQFP208	LQFP144		Reset state [1]	Type	Description
P2_9	H16	B10	144	102	[2]	N; PU	I/O	**GPIO1[10] —** General purpose digital input/output pin. Boot pin (see Table 5).
							O	**CTOUT_3 —** SCT output 3. Match output 3 of timer 0.
							I/O	**U3_BAUD —** Baud pin for USART3.
							I/O	**EMC_A0 —** External memory address line 0.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P2_10	G16	E8	146	104	[2]	N; PU	I/O	**GPIO0[14] —** General purpose digital input/output pin.
							O	**CTOUT_2 —** SCT output 2. Match output 2 of timer 0.
							O	**U2_TXD —** Transmitter output for USART2.
							I/O	**EMC_A1 —** External memory address line 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P2_11	F16	A9	148	105	[2]	N; PU	I/O	**GPIO1[11] —** General purpose digital input/output pin.
							O	**CTOUT_5 —** SCT output 5. Match output 3 of timer 3.
							I	**U2_RXD —** Receiver input for USART2.
							I/O	**EMC_A2 —** External memory address line 2.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P2_12	E15	B9	153	106	[2]	N; PU	I/O	**GPIO1[12] —** General purpose digital input/output pin.
							O	**CTOUT_4 —** SCT output 4. Match output 3 of timer 3.
							-	**R —** Function reserved.
							I/O	**EMC_A3 —** External memory address line 3.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							I/O	**U2_UCLK —** Serial clock input/output for USART2 in synchronous mode.

Table 3. Pin description *…continued*

Pin name	LBGA256	TFBGA100	LQFP208	LQFP144		Reset state [1]	Type	Description
P5_0	N3	-	53	37	[2]	N; PU	I/O	**GPIO2[9] —** General purpose digital input/output pin.
							O	**MCOB2 —** Motor control PWM channel 2, output B.
							I/O	**EMC_D12 —** External memory data line 12.
							-	**R —** Function reserved.
							I	**U1_DSR —** Data Set Ready input for UART 1.
							I	**T1_CAP0 —** Capture input 0 of timer 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P5_1	P3	-	55	39	[2]	N; PU	I/O	**GPIO2[10] —** General purpose digital input/output pin.
							I	**MCI2 —** Motor control PWM channel 2, input.
							I/O	**EMC_D13 —** External memory data line 13.
							-	**R —** Function reserved.
							O	**U1_DTR —** Data Terminal Ready output for UART 1. Can also be configured to be an RS-485/EIA-485 output enable signal for UART 1.
							I	**T1_CAP1 —** Capture input 1 of timer 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P5_2	R4	-	63	46	[2]	N; PU	I/O	**GPIO2[11] —** General purpose digital input/output pin.
							I	**MCI1 —** Motor control PWM channel 1, input.
							I/O	**EMC_D14 —** External memory data line 14.
							-	**R —** Function reserved.
							O	**U1_RTS —** Request to Send output for UART 1. Can also be configured to be an RS-485/EIA-485 output enable signal for UART 1.
							I	**T1_CAP2 —** Capture input 2 of timer 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P5_3	T8	-	76	54	[2]	N; PU	I/O	**GPIO2[12] —** General purpose digital input/output pin.
							I	**MCI0 —** Motor control PWM channel 0, input.
							I/O	**EMC_D15 —** External memory data line 15.
							-	**R —** Function reserved.
							I	**U1_RI —** Ring Indicator input for UART 1.
							I	**T1_CAP3 —** Capture input 3 of timer 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.

Table 5. Boot mode when OPT BOOT_SRC bits are zero

Boot mode	Pins				Description
	P2_9	P2_8	P1_2	P1_1	
USB1	LOW	HIGH	HIGH	LOW	Boot from USB1.
SPI (SSP)	LOW	HIGH	HIGH	HIGH	Boot from SPI flash connected to the SSP0 interface on P3_3 (function SSP0_SCK), P3_6 (function SSP0_SSEL), P3_7 (function SSP0_MISO), and P3_8 (function SSP0_MOSI)[1]
USART3	HIGH	LOW	LOW	LOW	Enter ISP mode using USART3 pins P2_3 and P2_4.

[1] The boot loader programs the appropriate pin function at reset to boot using either SSP0 or SPIFI.
Remark: Pin functions for SPIFI and SSP0 boot are different.

7.14 Memory mapping

The memory map shown in Figure 7 and Figure 8 is global to both the Cortex-M4 and the Cortex-M0 processors and all SRAM, flash, and EEPROM memory is shared between both processors. Each processor uses its own ARM private bus memory map for the NVIC and other system functions.

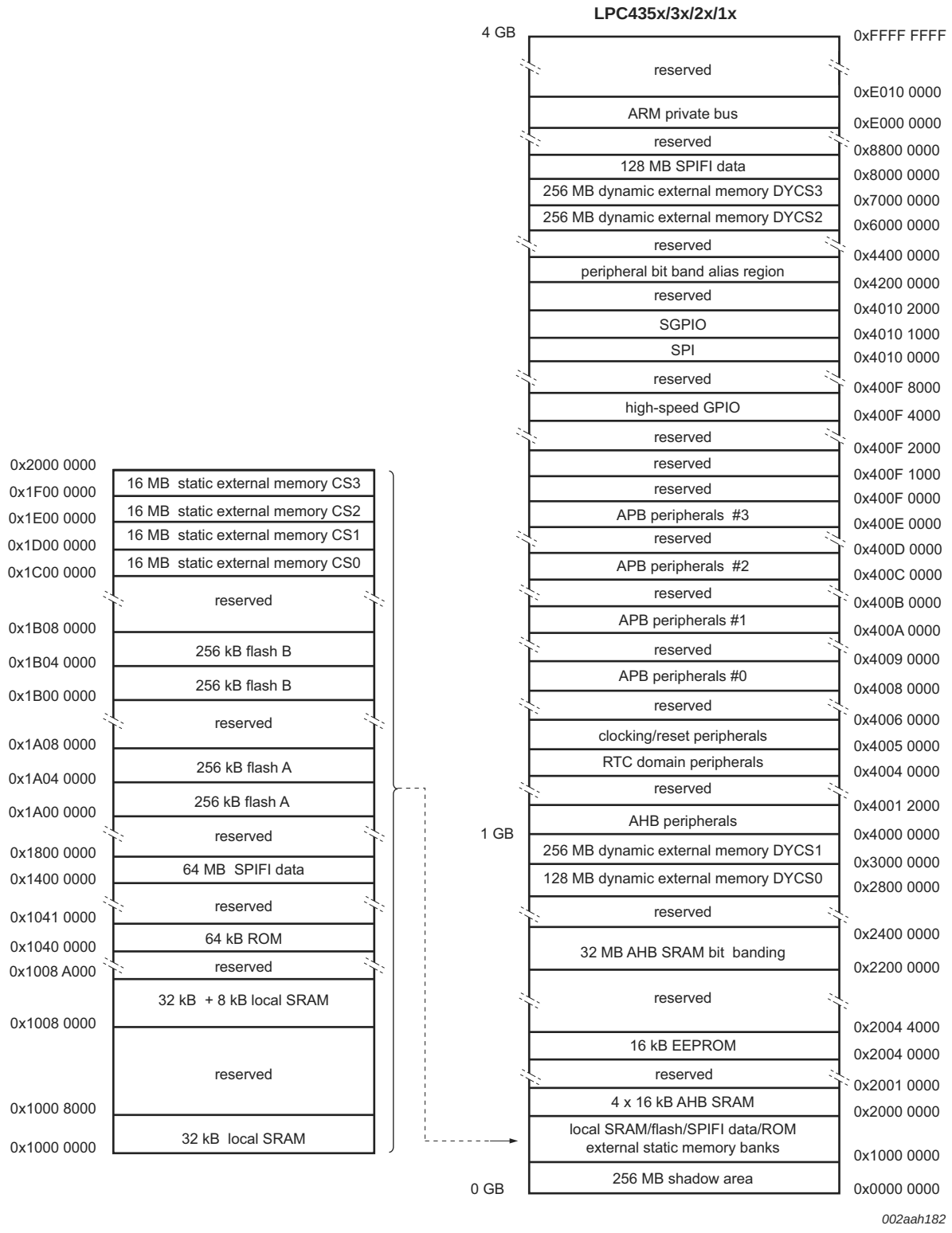


Fig 7. LPC435x/3x/2x/1x Memory mapping (overview)

Table 6. EMC pinout for different packages

Function	LBGA256	TFBGA100	LQFP208	LQFP144
$\overline{OE}$	$\overline{EMC\_OE}$	$\overline{EMC\_OE}$	$\overline{EMC\_OE}$	$\overline{EMC\_OE}$
$\overline{WE}$	$\overline{EMC\_WE}$	$\overline{EMC\_WE}$	$\overline{EMC\_WE}$	$\overline{EMC\_WE}$
CKEOUT	EMC_ CKEOUT[3:0]	EMC_ CKEOUT[1:0]	EMC_ CKEOUT[1:0]	EMC_ CKEOUT[1:0]
CLK	EMC_CLK[3:0]; EMC_CLK01, EMC_CLK23	EMC_CLK0, EMC_CLK3; EMC_CLK01, EMC_CLK23	EMC_CLK0, EMC_CLK3; EMC_CLK01, EMC_CLK23	EMC_CLK0, EMC_CLK3; EMC_CLK01, EMC_CLK23
DQMOUT	EMC_ DQMOUT[3:0]	-	EMC_ DQMOUT[1:0]	EMC_ DQMOUT[1:0]
$\overline{DYCS}$	$\overline{EMC\_DYCS[3:0]}$	$\overline{EMC\_DYCS[1:0]}$	$\overline{EMC\_DYCS[2:0]}$	$\overline{EMC\_DYCS[1:0]}$
$\overline{CAS}$	$\overline{EMC\_CAS}$	$\overline{EMC\_CAS}$	$\overline{EMC\_CAS}$	$\overline{EMC\_CAS}$
$\overline{RAS}$	$\overline{EMC\_RAS}$	$\overline{EMC\_RAS}$	$\overline{EMC\_RAS}$	$\overline{EMC\_RAS}$

7.18.4.1 Features

- Dynamic memory interface support including single data rate SDRAM.
- Asynchronous static memory device support including RAM, ROM, and NOR flash, with or without asynchronous page mode.
- Low transaction latency.
- Read and write buffers to reduce latency and to improve performance.
- 8/16/32 data and 24 address lines wide static memory support.
- 16 bit and 32 bit wide chip select SDRAM memory support.
- Static memory features include:
  - Asynchronous page mode read
  - Programmable Wait States
  - Bus turnaround delay
  - Output enable and write enable delays
  - Extended wait
- Four chip selects for synchronous memory and four chip selects for static memory devices.
- Power-saving modes dynamically control EMC_CKEOUT and EMC_CLK signals to SDRAMs.
- Dynamic memory self-refresh mode controlled by software.
- Controller supports 2048 (A0 to A10), 4096 (A0 to A11), and 8192 (A0 to A12) row address synchronous memory parts. Those are typically 512 MB, 256 MB, and 128 MB parts, with 4, 8, 16, or 32 data bits per device.
- Separate reset domains allow the for auto-refresh through a chip reset if desired.
- SDRAM clock can run at full or half the Cortex-M4 core frequency.

Note: Synchronous static memory devices (synchronous burst mode) are not supported.

7.23.7 System PLL1

The PLL1 accepts an input clock frequency from an external oscillator in the range of 1 MHz to 25 MHz. The input frequency is multiplied up to a high frequency with a Current Controlled Oscillator (CCO). The multiplier can be an integer value from 1 to 32. The CCO operates in the range of 156 MHz to 320 MHz. This range is possible through an additional divider in the loop to keep the CCO within its frequency range while the PLL is providing the desired output frequency. The output divider can be set to divide by 2, 4, 8, or 16 to produce the output clock. Since the minimum output divider value is 2, it is insured that the PLL output has a 50 % duty cycle. The PLL is turned off and bypassed following a chip reset. After reset, software can enable the PLL. The program must configure and activate the PLL, wait for the PLL to lock, and then connect to the PLL as a clock source. The PLL settling time is 100 μs.

7.23.8 Reset Generation Unit (RGU)

The RGU allows generation of independent reset signals for individual blocks and peripherals on the LPC435x/3x/2x/1x.

7.23.9 Power Management Controller (PMC)

The PMC controls the power to the cores, peripherals, and memories.

The LPC435x/3x/2x/1x support the following power modes in order from highest to lowest power consumption:

1. Active mode
2. Sleep mode
3. Power-down modes:
   a. Deep-sleep mode
   b. Power-down mode
   c. Deep power-down mode

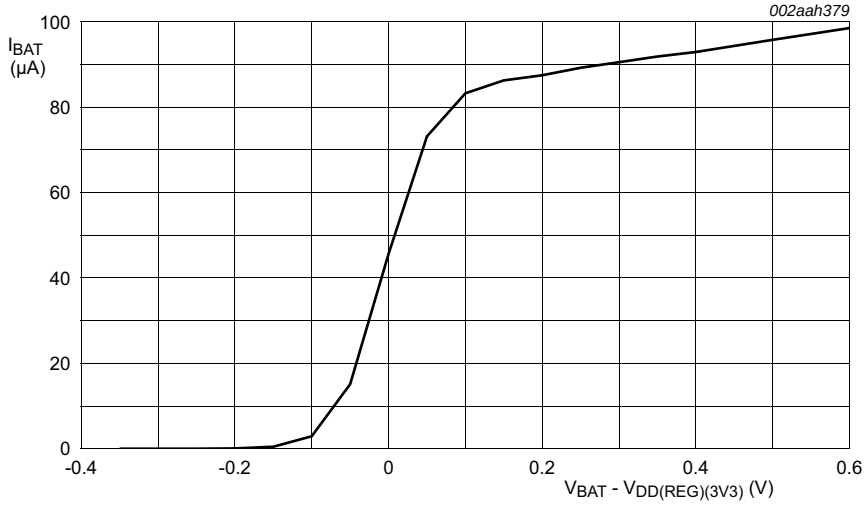
Active mode and sleep mode apply to the state of the core. In a dual-core system, either core can be in active or sleep mode independently of the other core.

If the core is in Active mode, it is fully operational and can access peripherals and memories as configured by software. If the core is in Sleep mode, it receives no clocks, but peripherals and memories remain running.

Either core can enter sleep mode from active mode independently of the other core and while the other core remains in active mode or is in sleep mode.

Power-down modes apply to the entire system. In the Power-down modes, both cores and all peripherals except for peripherals in the always-on power domain are shut down. Memories can remain powered for retaining memory contents as defined by the individual power-down mode.

Either core in active mode can put the part into one of the three power down modes if the core is enabled to do so. If both cores are enabled for putting the system into power-down, then the system enters power-down only once both cores have received a WFI or WFE instruction.



Conditions: $V_{DD(REG)(3V3)}$ = 3.0 V; V_{BAT} = 2.6 V to 3.6 V; CCLK = 12 MHz.

Remark: The recommended operating condition for the battery supply is $V_{DD(REG)(3V3)} > V_{BAT} + 0.2$ V.

Fig 19. Typical battery supply current in Active mode

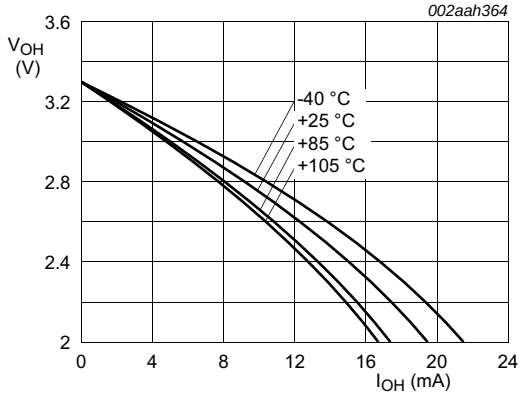
10.2 Peripheral power consumption

The typical power consumption at T = 25 °C for each individual peripheral is measured as follows:

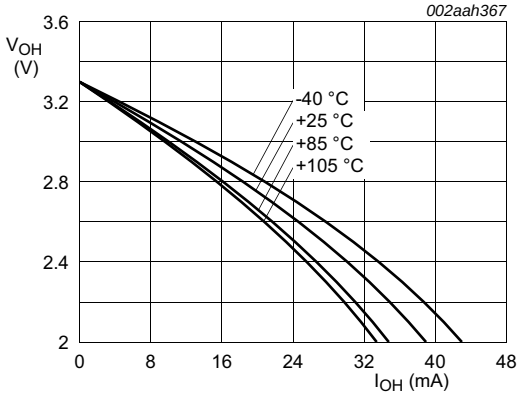
1. Enable all branch clocks and measure the current $I_{DD(REG)(3V3)}$.
2. Disable the branch clock to the peripheral to be measured and keep all other branch clocks enabled.
3. Calculate the difference between measurement 1 and 2. The result is the peripheral power consumption.

Table 12. Peripheral power consumption

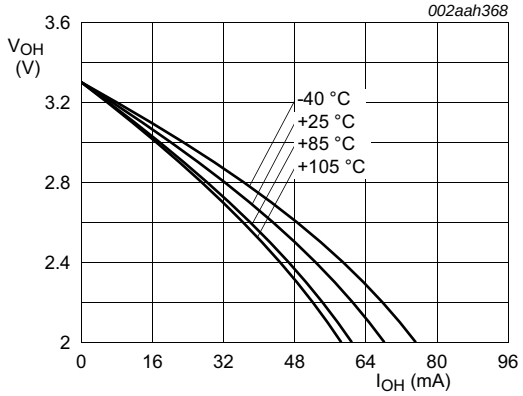
Peripheral	Branch clock	$I_{DD(REG)(3V3)}$ in mA	
		Branch clock frequency = 48 MHz	Branch clock frequency = 96 MHz
M0 core	CLK_M4_M0APP	3.3	6.6
I2C1	CLK_APB3_I2C1	0.01	0.01
I2C0	CLK_APB1_I2C0	< 0.01	0.02
DAC	CLK_APB3_DAC	0.01	0.02
ADC0	CLK_APB3_ADC0	0.07	0.07
ADC1	CLK_APB3_ADC1	0.07	0.07
CAN0	CLK_APB3_CAN0	0.17	0.17
CAN1	CLK_APB1_CAN1	0.16	0.15
MOTOCON	CLK_APB1_MOTOCON	0.04	0.04
I2S	CLK_APB1_I2S	0.09	0.08
SPIFI	CLK_SPIFI, CLK_M4_SPIFI	1.14	2.29



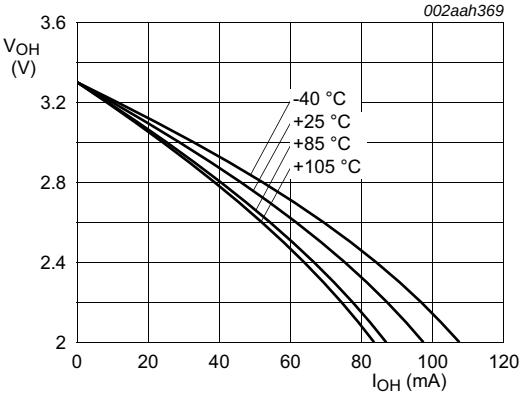
Conditions: $V_{DD(REG)(3V3)} = V_{DD(IO)} = 3.3$ V; normal-drive; EHD = 0x0.



Conditions: $V_{DD(REG)(3V3)} = V_{DD(IO)} = 3.3$ V; medium-drive; EHD = 0x1.



Conditions: $V_{DD(REG)(3V3)} = V_{DD(IO)} = 3.3$ V; high-drive; EHD = 0x2.



Conditions: $V_{DD(REG)(3V3)} = V_{DD(IO)} = 3.3$ V; ultra high-drive; EHD = 0x3.

Fig 23. High-drive pins; typical HIGH level output voltage V_{OH} versus HGH level output current I_{OH}

11. Dynamic characteristics

11.1 Flash/EEPROM memory

Table 15. Flash characteristics

T_{amb} = −40 °C to +105 °C, unless otherwise specified. $V_{DD(REG)(3V3)}$ = 2.4 V to 3.6 V for read operations; $V_{DD(REG)(3V3)}$ = 2.7 V to 3.6 V for erase/program operations.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
N_{endu}	endurance	sector erase/program	[1]	10000	-	-	cycles
		page erase/program; page in large sector		1000	-	-	cycles
		page erase/program; page in small sector		10000	-	-	cycles
t_{ret}	retention time	powered		10	-	-	years
		unpowered		10	-	-	years
t_{er}	erase time	page, sector, or multiple consecutive sectors		-	100	-	ms
t_{prog}	programming time		[2]	-	1	-	ms

[1] Number of erase/program cycles.

[2] Programming times are given for writing 512 bytes from RAM to the flash. Data must be written to the flash in blocks of 512 bytes.

Table 16. EEPROM characteristics

T_{amb} = −40 °C to +105 °C; $V_{DD(REG)(3V3)}$ = 2.7 V to 3.6 V.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
f_{clk}	clock frequency			800	1500	1600	kHz
N_{endu}	endurance			100 000	-	-	cycles
t_{ret}	retention time	T_{amb} = −40 °C to +85 °C		20	-	-	years
		85 °C < T_{amb} ≤ 105 °C		10	-	-	years
t_a	access time	read		-	120	-	ns
		erase/program; f_{clk} = 1500 kHz		-	1.99	-	ms
		erase/program; f_{clk} = 1600 kHz		-	1.87	-	ms
t_{wait}	wait time	read; RPHASE1	[1]	70	-	-	ns
		read; RPHASE2	[1]	35	-	-	ns
		write; PHASE1	[1]	20	-	-	ns
		write; PHASE2	[1]	40	-	-	ns
		write; PHASE3	[1]	10	-	-	ns

[1] See the LPC43xx user manual how to program the wait states for the different read (RPHASEx) and erase/program phases (PHASEx)

11.4 Crystal oscillator

Table 19. Dynamic characteristic: oscillator

T_{amb} = −40 °C to +105 °C; $V_{DD(IO)}$ over specified ranges; 2.4 V ≤ $V_{DD(REG)(3V3)}$ ≤ 3.6 V.[1]

Symbol	Parameter	Conditions		Min	Typ[2]	Max	Unit
Low-frequency mode (1-20 MHz)[5]							
$t_{jit(per)}$	period jitter time	5 MHz crystal	[3][4]	-	13.2	-	ps
		10 MHz crystal		-	6.6	-	ps
		15 MHz crystal		-	4.8	-	ps
High-frequency mode (20 - 25 MHz)[6]							
$t_{jit(per)}$	period jitter time	20 MHz crystal	[3][4]	-	4.3	-	ps
		25 MHz crystal		-	3.7	-	ps

[1] Parameters are valid over operating temperature range unless otherwise specified.

[2] Typical ratings are not guaranteed. The values listed are at room temperature (25 °C), nominal supply voltages.

[3] Indicates RMS period jitter.

[4] PLL-induced jitter is not included.

[5] Select HF = 0 in the XTAL_OSC_CTRL register.

[6] Select HF = 1 in the XTAL_OSC_CTRL register.

11.5 IRC oscillator

Table 20. Dynamic characteristic: IRC oscillator

2.4 V ≤ $V_{DD(REG)(3V3)}$ ≤ 3.6 V

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$f_{osc(RC)}$	internal RC oscillator frequency	-40 °C ≤ T_{amb} < 0 °C	12.0 - 3 %	12.0	12.0 + 3 %	MHz
		0 °C ≤ T_{amb} ≤ 85 °C	12.0 - 1.5 %	12.0	12.0 + 1.5 %	MHz
		85 °C < T_{amb} < 105 °C	12.0 - 3 %	12.0	12.0 + 3 %	MHz

[1] Typical ratings are not guaranteed. The values listed are at room temperature (25 °C), nominal supply voltages.

11.6 RTC oscillator

See Section 13.3 for connecting the RTC oscillator to an external clock source.

Table 21. Dynamic characteristic: RTC oscillator

T_{amb} = −40 °C to +105 °C; 2.4 V ≤ $V_{DD(REG)(3V3)}$ ≤ 3.6 V or 2.4 V ≤ V_{BAT} ≤ 3.6 V[1]

Symbol	Parameter	Conditions		Min	Typ[1]	Max	Unit
f_i	input frequency	-		-	32.768	-	kHz
$I_{CC(osc)}$	oscillator supply current				280	800	nA

[1] Parameters are valid over operating temperature range unless otherwise specified.

11.14 SSP/SPI timing diagrams

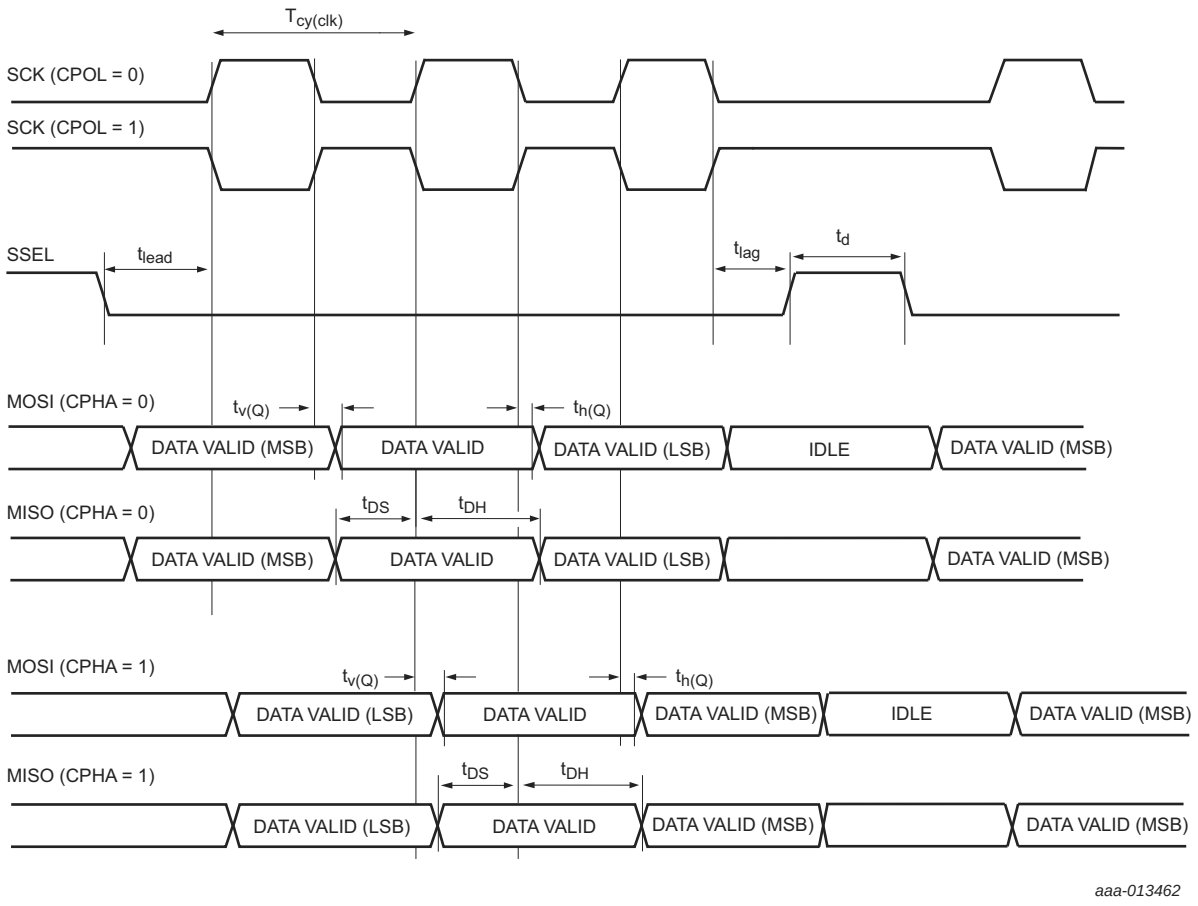


Fig 31. SSP in SPI mode and SPI master timing

Table 30. Dynamic characteristics: SGPIO

T_{amb} = −40 °C to +105 °C; 2.4 V ≤ $V_{DD(REG)(3V3)}$ ≤ 3.6 V; 2.7 V ≤ $V_{DD(IO)}$ ≤ 3.6 V. Simulated values.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$t_{su(D)}$	data input set-up time			2	-	-	ns
$t_{h(D)}$	data input hold time		[1]	T_{SGPIO} + 2	-	-	ns
$t_{su(D)}$	data input set-up time	sampled by SGPIO_CLOCK	[1]	T_{SGPIO} + 2	-	-	ns
$t_{h(D)}$	data input hold time	sampled by SGPIO_CLOCK	[1]	T_{SGPIO} + 2	-	-	ns
$t_{v(Q)}$	data output valid time		[1]	-	-	2 × T_{SGPIO}	ns
$t_{h(Q)}$	data output hold time		[1]	T_{SGPIO}	-		ns
$t_{v(Q)}$	data output valid time	sampled by SGPIO_CLOCK	[1]	-3	-	3	ns
$t_{h(Q)}$	data output hold time	sampled by SGPIO_CLOCK	[1]	-3	-	3	ns

[1] SGPIO_CLOCK is the internally generated SGPIO clock. $T_{SGPIO} = 1/f_{SGPIO\_CLOCK}$.

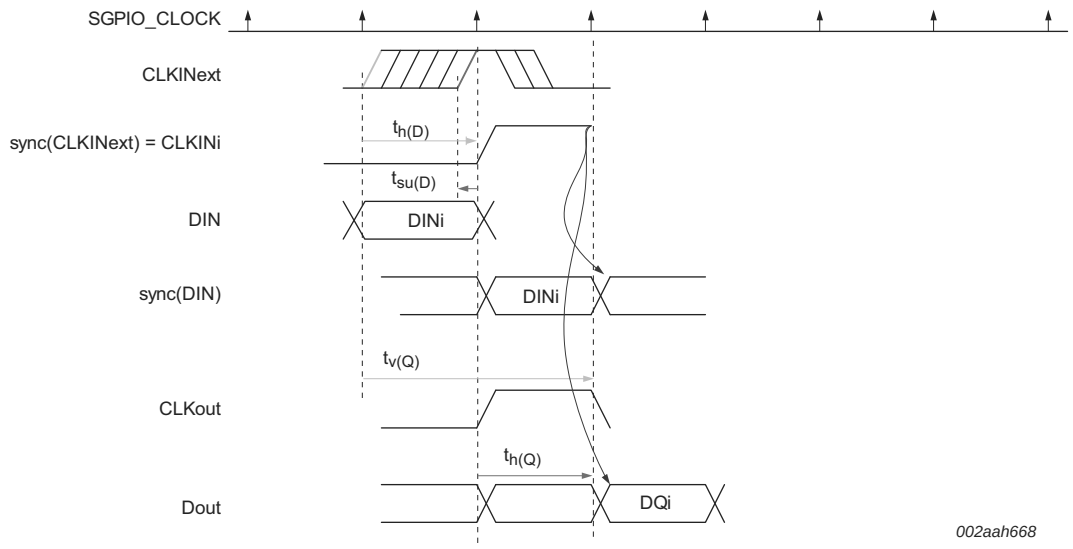


Fig 34. SGPIO timing

11.20 SD/MMC

Table 37. Dynamic characteristics: SD/MMC

T_{amb} = −40 °C to +105 °C, 2.4 V ≤ $V_{DD(REG)(3V3)}$ ≤ 3.6 V; 2.7 V ≤ $V_{DD(IO)}$ ≤ 3.6 V, C_L = 20 pF. SAMPLE_DELAY = 0x9, DRV_DELAY = 0x6 in the SDDELAY register, sampled at 90 % and 10 % of the signal level, EHS = 1 for SD_CLK pin, EHS = 0 for SD_DATn and SD_CMD pins. Simulated values.

Symbol	Parameter	Conditions	Min	Max	Unit
f_{clk}	clock frequency	on pin SD_CLK; data transfer mode	-	52	MHz
$t_{su(D)}$	data input set-up time	on pins SD_DATn as inputs	5.2	-	ns
		on pins SD_CMD as inputs	7	-	ns
$t_{h(D)}$	data input hold time	on pins SD_DATn as inputs	0.2	-	ns
		on pins SD_CMD as inputs	−1		ns
$t_{d(QV)}$	data output valid delay time	on pins SD_DATn as outputs	-	15.7	ns
		on pins SD_CMD as outputs	-	15.9	ns
$t_{h(Q)}$	data output hold time	on pins SD_DATn as outputs	3.5	-	ns
		on pins SD_CMD as outputs	3.5	-	ns

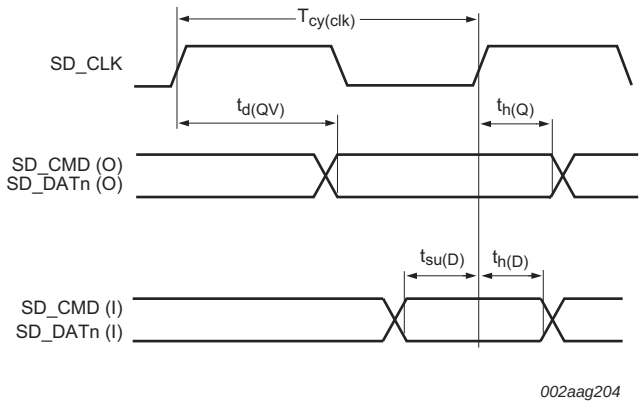


Fig 40. SD/MMC timing

11.21 LCD

Table 38. Dynamic characteristics: LCD

T_{amb} = −40 °C to 105 °C; 2.4 V ≤ $V_{DD(REG)(3V3)}$ ≤ 3.6 V; 2.7 V ≤ $V_{DD(IO)}$ ≤ 3.6 V; C_L = 20 pF. Simulated values.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_{clk}	clock frequency	on pin LCD_DCLK	-	50	-	MHz
$t_{d(QV)}$	data output valid delay time		-	-	17	ns
$t_{h(Q)}$	data output hold time		8.5	-	-	ns

12. ADC/DAC electrical characteristics

Table 39. ADC characteristics

$V_{DDA(3V3)}$ over specified ranges; T_{amb} = −40 °C to +105 °C; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{IA}	analog input voltage			0	-	$V_{DDA(3V3)}$	V
C_{ia}	analog input capacitance			-	-	2	pF
E_D	differential linearity error	2.7 V ≤ $V_{DDA(3V3)}$ ≤ 3.6 V	[1][2]	-	±0.8	-	LSB
		2.4 V ≤ $V_{DDA(3V3)}$ < 2.7 V		-	±1.0	-	LSB
$E_{L(adj)}$	integral non-linearity	2.7 V ≤ $V_{DDA(3V3)}$ ≤ 3.6 V	[3]	-	±0.8	-	LSB
		2.4 V ≤ $V_{DDA(3V3)}$ < 2.7 V		-	±1.5	-	LSB
E_O	offset error	2.7 V ≤ $V_{DDA(3V3)}$ ≤ 3.6 V	[4]	-	±0.15	-	LSB
		2.4 V ≤ $V_{DDA(3V3)}$ < 2.7 V		-	±0.15	-	LSB
E_G	gain error	2.7 V ≤ $V_{DDA(3V3)}$ ≤ 3.6 V	[5]	-	±0.3	-	%
		2.4 V ≤ $V_{DDA(3V3)}$ < 2.7 V		-	±0.35	-	%
E_T	absolute error	2.7 V ≤ $V_{DDA(3V3)}$ ≤ 3.6 V	[6]	-	±3	-	LSB
		2.4 V ≤ $V_{DDA(3V3)}$ < 2.7 V		-	±4	-	LSB
R_{vsi}	voltage source interface resistance	see Figure 42		-	-	$1/(7 \times f_{clk(ADC)} \times C_{ia})$	kΩ
R_i	input resistance		[7][8]	-	-	1.2	MΩ
$f_{clk(ADC)}$	ADC clock frequency			-	-	4.5	MHz
f_s	sampling frequency	10-bit resolution; 11 clock cycles		-	-	400	kSamples/s
		2-bit resolution; 3 clock cycles				1.5	MSamples/s

[1] The ADC is monotonic, there are no missing codes.

[2] The differential linearity error (E_D) is the difference between the actual step width and the ideal step width. See Figure 41.

[3] The integral non-linearity ($E_{L(adj)}$) is the peak difference between the center of the steps of the actual and the ideal transfer curve after appropriate adjustment of gain and offset errors. See Figure 41.

[4] The offset error (E_O) is the absolute difference between the straight line which fits the actual curve and the straight line which fits the ideal curve. See Figure 41.

[5] The gain error (E_G) is the relative difference in percent between the straight line fitting the actual transfer curve after removing offset error, and the straight line which fits the ideal transfer curve. See Figure 41.

[6] The absolute error (E_T) is the maximum difference between the center of the steps of the actual transfer curve of the non-calibrated ADC and the ideal transfer curve. See Figure 41.

[7] T_{amb} = 25 °C.

[8] Input resistance R_i depends on the sampling frequency fs: $R_i = 2\ k\Omega + 1 / (f_s \times C_{ia})$.

13.3 RTC oscillator

In the RTC oscillator circuit, only the crystal (XTAL) and the capacitances C_{RTCX1} and C_{RTCX2} need to be connected externally. Typical capacitance values for C_{RTCX1} and C_{RTCX2} are $C_{RTCX1/2}$ = 20 (typical) $\pm$ 4 pF.

An external clock can be connected to RTCX1 if RTCX2 is left open. The recommended amplitude of the clock signal is $V_{i(RMS)}$ = 100 mV to 200 mV with a coupling capacitance of 5 pF to 10 pF.

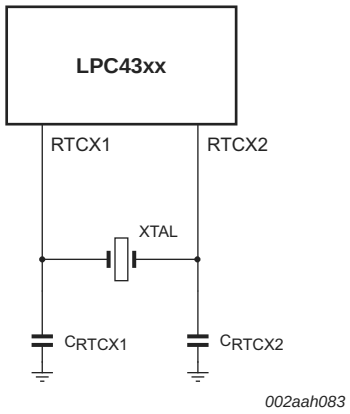


Fig 45. RTC 32 kHz oscillator circuit

13.4 XTAL and RTCX Printed Circuit Board (PCB) layout guidelines

Connect the crystal on the PCB as close as possible to the oscillator input and output pins of the chip. Take care that the load capacitors C_{X1}, C_{X2}, and C_{X3} in case of third overtone crystal usage have a common ground plane. Also connect the external components to the ground plain. To keep the noise coupled in via the PCB as small as possible, make loops and parasitics as small as possible. Choose smaller values of C_{X1} and C_{X2} if parasitics increase in the PCB layout.

Ensure that no high-speed or high-drive signals are near the RTCX1/2 signals.

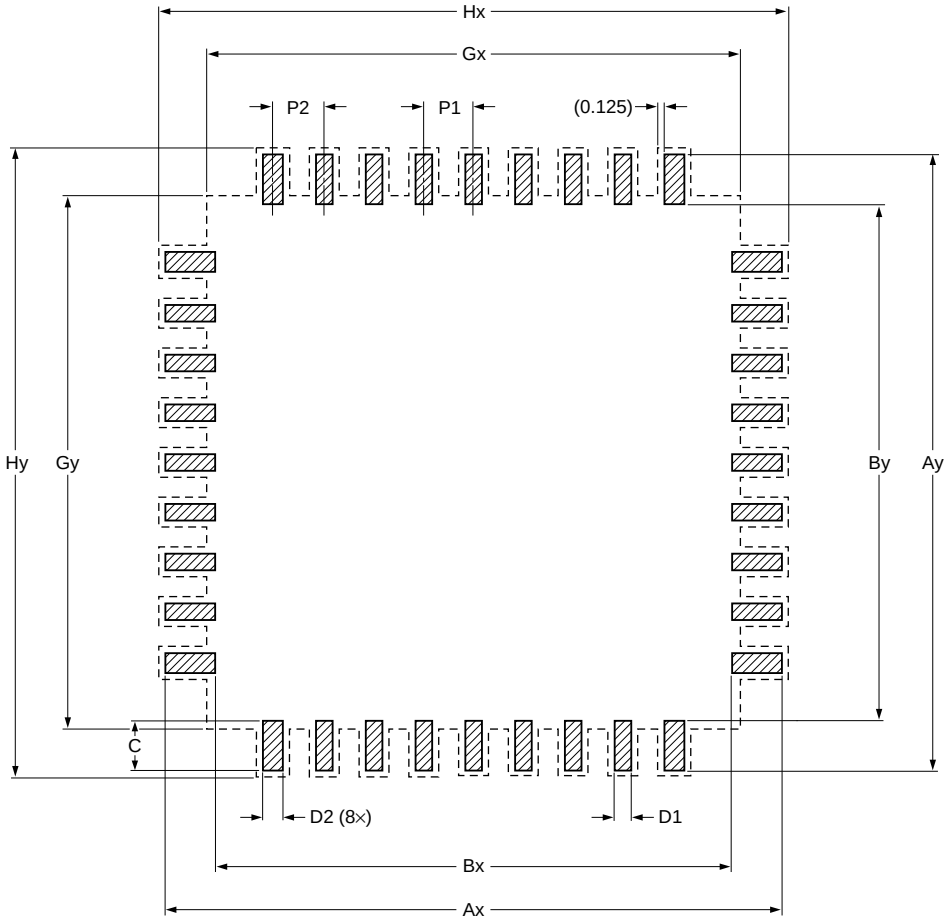
13.5 Standard I/O pin configuration

Figure 46 shows the possible pin modes for standard I/O pins with analog input function:

- Digital output driver enabled/disabled
- Digital input: Pull-up enabled/disabled
- Digital input: Pull-down enabled/disabled
- Digital input: Repeater mode enabled/disabled
- Digital input: Input buffer enabled/disabled
- Analog input

The default configuration for standard I/O pins is input buffer disabled and pull-up enabled. The weak MOS devices provide a drive capability equivalent to pull-up and pull-down resistors.

Footprint information for reflow soldering of LQFP208 package **SOT459-1**



Generic footprint pattern

Refer to the package outline drawing for actual layout

solder land

occupied area

DIMENSIONS in mm

P1	P2	Ax	Ay	Bx	By	C	D1	D2	Gx	Gy	Hx	Hy
0.500	0.560	31.300	31.300	28.300	28.300	1.500	0.280	0.400	28.500	28.500	31.550	31.550

sot459-1_fr

Fig 56. Reflow soldering of the LQFP208 package

16. Abbreviations

Table 46. Abbreviations

Acronym	Description
ADC	Analog-to-Digital Converter
AHB	Advanced High-performance Bus
APB	Advanced Peripheral Bus
API	Application Programming Interface
BOD	BrownOut Detection
CAN	Controller Area Network
CMAC	Cipher-based Message Authentication Code
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
DAC	Digital-to-Analog Converter
DC-DC	Direct Current-to-Direct Current
DMA	Direct Memory Access
GPIO	General Purpose Input/Output
IRC	Internal RC
IrDA	Infrared Data Association
JTAG	Joint Test Action Group
LCD	Liquid Crystal Display
LSB	Least Significant Bit
MAC	Media Access Control
MCU	MicroController Unit
MIIM	Media Independent Interface Management
n.c.	not connected
OHCI	Open Host Controller Interface
OTG	On-The-Go
PHY	Physical Layer
PLL	Phase-Locked Loop
PMC	Power Mode Control
PWM	Pulse Width Modulator
RIT	Repetitive Interrupt Timer
RMII	Reduced Media Independent Interface
SDRAM	Synchronous Dynamic Random Access Memory
SIMD	Single Instruction Multiple Data
SPI	Serial Peripheral Interface
SSI	Serial Synchronous Interface
SSP	Synchronous Serial Port
UART	Universal Asynchronous Receiver/Transmitter
ULPI	UTMI+ Low Pin Interface
USART	Universal Synchronous Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
UTMI	USB2.0 Transceiver Macrocell Interface

Table 47. Revision history *…continued*

Document ID	Release date	Data sheet status	Change notice	Supersedes
Modifications:	• Updated Section 1 “General description”. • Minimum operating voltage changed from 2.2 V to 2.4 V for $V_{DD(REG)(3V3)}$, $V_{DD(IO)}$, $V_{DDA(3V3)}$, V_{BAT} in Table 11. • Operating temperature corrected in Table 27. Tamb = T_{amb} = -40 °C to 105 °C. • Max and min values of parameters t_{lag} and t_{lead} corrected for SSP master mode in Table 27. • Figure 32 “SSP in SPI mode and SPI slave timing” updated. • Typical values for parameters t_{DS}, t_{DH}, $t_{v(Q)}$, $t_{h(Q)}$ for SSP slave mode replaced by min and max numbers in Table 25. • Parameters t_{lead}, t_{lag}, and t_d added to SSP slave mode in Table 27. • SPIFI timing data restated for CL = 20 pF in Table 29 “Dynamic characteristics: SPIFI”. • USART timing added for master and slave mode in Figure 30 “USART timing”. • USB0_VBUS changed to input only. See Table 3 “Pin description”. • Changed the flash erase time (t_{er}) to 100ms. See Table 15. • Updated Dynamic characteristics: SD/MMC table. See Table 37. • Added Band gap characteristics table. See Table 14. • Updated Table 2: Motor control PWM instead of PWM. • Updated Dynamic characteristics: USB0 and USB1 pins (full-speed). See Table 34. • Added a table note: The values in the table have been calculated with WAITTURN = 0x0 in STATICWAITTURN register. See Table 31. • Added a remark to Table 34. • Updated Table 13 “BOD static characteristics[1]”. Removed BOD interrupt levels 0 and 1; removed Reset levels 0 and 1. Not applicable.			
LPC435X_3X_2X_1X v.4	20140819	Product data sheet	-	LPC435X_3X_2X_1X v.3

19. Legal information

19.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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