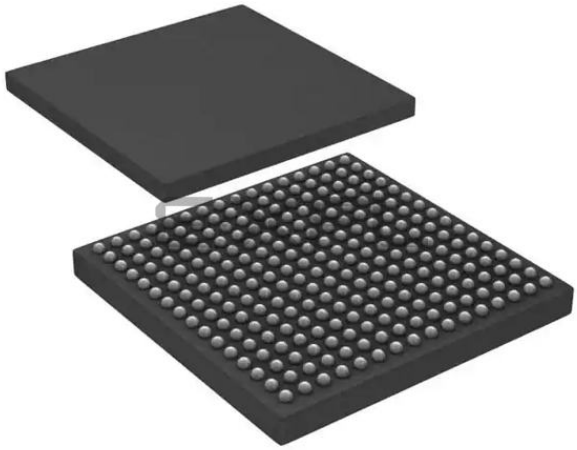

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	ARM® Cortex®-M3
Core Size	32-Bit Single-Core
Speed	180MHz
Connectivity	CANbus, EBI/EMI, Ethernet, I²C, IrDA, Microwire, QEI, SD, SPI, SSI, SSP, UART/USART, USB, USB OTG
Peripherals	Brown-out Detect/Reset, DMA, I²S, Motor Control PWM, POR, PWM, WDT
Number of I/O	164
Program Memory Size	1MB (1M x 8)
Program Memory Type	FLASH
EEPROM Size	16K x 8
RAM Size	136K x 8
Voltage - Supply (Vcc/Vdd)	2.2V ~ 3.6V
Data Converters	A/D 8x10b; D/A 1x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	256-LBGA
Supplier Device Package	256-LBGA (17x17)
Purchase URL	https://www.e-xfl.com/product-detail/nxp-semiconductors/lpc1837jet256-551

4. Ordering information

Table 1. Ordering information

Type number	Package		
	Name	Description	Version
LPC1857FET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC1857JET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC1857JBD208	LQFP208	Plastic low profile quad flat package; 208 leads; body 28 × 28 × 1.4 mm	SOT459-1
LPC1853FET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC1853JET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC1853JBD208	LQFP208	Plastic low profile quad flat package; 208 leads; body 28 × 28 × 1.4 mm	SOT459-1
LPC1837FET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC1837JET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC1837JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1837JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1833FET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC1833JET256	LBGA256	Plastic low profile ball grid array package; 256 balls; body 17 × 17 × 1 mm	SOT740-2
LPC1833JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1833JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1827JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1827JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1825JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1825JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1823JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1823JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1822JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1822JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1817JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1817JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1815JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1815JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1813JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1813JET100	TFBGA100	Plastic thin fine-pitch ball grid array package; 100 balls; body 9 × 9 × 0.7 mm	SOT926-1
LPC1812JBD144	LQFP144	Plastic low profile quad flat package; 144 leads; body 20 × 20 × 1.4 mm	SOT486-1
LPC1812JET100	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	LQFP144	LQFP208		Reset state [1]	Type	Description
P3_8	C10	E7	124	179	[2]	N; PU	-	**R —** Function reserved.
							-	**R —** Function reserved.
							I/O	**SSP0_MOSI —** Master Out Slave in for SSP0.
							I/O	**SPIFI_CS —** SPIFI serial flash chip select.
							I/O	**GPIO5[11] —** General purpose digital input/output pin.
							I/O	**SSP0_SSEL —** Slave Select for SSP0.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P4_0	D5	-	1	1	[2]	N; PU	I/O	**GPIO2[0] —** General purpose digital input/output pin.
							O	**MCOA0 —** Motor control PWM channel 0, output A.
							I	**NMI —** External interrupt input to NMI.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							O	**LCD_VD13 —** LCD data.
							I/O	**U3_UCLK —** Serial clock input/output for USART3 in synchronous mode.
							-	**R —** Function reserved.
P4_1	A1	-	3	3	[5]	N; PU	I/O	**GPIO2[1] —** General purpose digital input/output pin.
							O	**CTOUT_1 —** SCTimer/PWM output 1. Match output 3 of timer 3.
							O	**LCD_VD0 —** LCD data.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							O	**LCD_VD19 —** LCD data.
							O	**U3_TXD —** Transmitter output for USART3.
							I	**ENET_COL —** Ethernet Collision detect (MII interface).
							AI	**ADC0_1 —** ADC0 and ADC1, input channel 1. Configure the pin as GPIO input and use the ADC function select register in the SCU to select the ADC.
P4_2	D3	-	8	12	[2]	N; PU	I/O	**GPIO2[2] —** General purpose digital input/output pin.
							O	**CTOUT_0 —** SCTimer/PWM output 0. Match output 0 of timer 0.
							O	**LCD_VD3 —** LCD data.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							O	**LCD_VD12 —** LCD data.
							I	**U3_RXD —** Receiver input for USART3.
							-	**R —** Function reserved.

Table 3. Pin description *…continued*

Pin name	LBGA256	TFBGA100	LQFP144	LQFP208		Reset state [1]	Type	Description
P5_3	T8	-	54	76	[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 UART1.
							I	**T1_CAP3 —** Capture input 3 of timer 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P5_4	P9	-	57	80	[2]	N; PU	I/O	**GPIO2[13] —** General purpose digital input/output pin.
							O	**MCOB0 —** Motor control PWM channel 0, output B.
							I/O	**EMC_D8 —** External memory data line 8.
							-	**R —** Function reserved.
							I	**U1_CTS —** Clear to Send input for UART1.
							O	**T1_MAT0 —** Match output 0 of timer 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P5_5	P10	-	58	81	[2]	N; PU	I/O	**GPIO2[14] —** General purpose digital input/output pin.
							O	**MCOA1 —** Motor control PWM channel 1, output A.
							I/O	**EMC_D9 —** External memory data line 9.
							-	**R —** Function reserved.
							I	**U1_DCD —** Data Carrier Detect input for UART1.
							O	**T1_MAT1 —** Match output 1 of timer 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P5_6	T13	-	63	89	[2]	N; PU	I/O	**GPIO2[15] —** General purpose digital input/output pin.
							O	**MCOB1 —** Motor control PWM channel 1, output B.
							I/O	**EMC_D10 —** External memory data line 10.
							-	**R —** Function reserved.
							O	**U1_TXD —** Transmitter output for UART1.
							O	**T1_MAT2 —** Match output 2 of timer 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.

Table 3. Pin description *…continued*

Pin name	LBGA256	TFBGA100	LQFP144	LQFP208		Reset state [1]	Type	Description
P7_5	A7	-	133	191	[5]	N; PU	I/O	**GPIO3[13] —** General purpose digital input/output pin.
							O	**CTOUT_12 —** SCTimer/PWM output 12. Match output 3 of timer 3.
							-	**R —** Function reserved.
							O	**LCD_VD8 —** LCD data.
							O	**LCD_VD23 —** LCD data.
							O	**TRACEDATA[1] —** Trace data, bit 1.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
							AI	**ADC0_3 —** ADC0 and ADC1, input channel 3. Configure the pin as GPIO input and use the ADC function select register in the SCU to select the ADC.
P7_6	C7	-	134	194	[2]	N; PU	I/O	**GPIO3[14] —** General purpose digital input/output pin.
							O	**CTOUT_11 —** SCTimer/PWM output 1. Match output 3 of timer 2.
							-	**R —** Function reserved.
							O	**LCD_LP —** Line synchronization pulse (STN). Horizontal synchronization pulse (TFT).
							-	**R —** Function reserved.
							O	**TRACEDATA[2] —** Trace data, bit 2.
							-	**R —** Function reserved.
							-	**R —** Function reserved.
P7_7	B6	-	140	201	[5]	N; PU	I/O	**GPIO3[15] —** General purpose digital input/output pin.
							O	**CTOUT_8 —** SCTimer/PWM output 8. Match output 0 of timer 2.
							-	**R —** Function reserved.
							O	**LCD_PWR —** LCD panel power enable.
							-	**R —** Function reserved.
							O	**TRACEDATA[3] —** Trace data, bit 3.
							O	**ENET_MDC —** Ethernet MIIM clock.
							-	**R —** Function reserved.
							AI	**ADC1_6 —** ADC1 and ADC0, input channel 6. Configure the pin as GPIO input and use the ADC function select register in the SCU to select the ADC.

Table 3. Pin description *…continued*

Pin name	LBGA256	TFBGA100	LQFP144	LQFP208		Reset state [1]	Type	Description
PC_7	G5	-	-	-	[2]	N; PU	-	**R —** Function reserved.
							I/O	**USB1_ULPI_D1 —** ULPI link bidirectional data line 1.
							-	**R —** Function reserved.
							I	**ENET_RXD3 —** Ethernet receive data 3 (MII interface).
							I/O	**GPIO6[6] —** General purpose digital input/output pin.
							-	**R —** Function reserved.
							O	**T3_MAT0 —** Match output 0 of timer 3.
							I/O	**SD_DAT3 —** SD/MMC data bus line 3.
PC_8	N4	-	-	-	[2]	N; PU	-	**R —** Function reserved.
							I/O	**USB1_ULPI_D0 —** ULPI link bidirectional data line 0.
							-	**R —** Function reserved.
							I	**ENET_RX_DV —** Ethernet Receive Data Valid (RMII/MII interface).
							I/O	**GPIO6[7] —** General purpose digital input/output pin.
							-	**R —** Function reserved.
							O	**T3_MAT1 —** Match output 1 of timer 3.
							I	**SD_CD —** SD/MMC card detect input.
PC_9	K2	-	-	-	[2]	N; PU	-	**R —** Function reserved.
							I	**USB1_ULPI_NXT —** ULPI link NXT signal. Data flow control signal from the PHY.
							-	**R —** Function reserved.
							I	**ENET_RX_ER —** Ethernet receive error (MII interface).
							I/O	**GPIO6[8] —** General purpose digital input/output pin.
							-	**R —** Function reserved.
							O	**T3_MAT2 —** Match output 2 of timer 3.
							O	**SD_POW —** SD/MMC power monitor output.
PC_10	M5	-	-	-	[2]	N; PU	-	**R —** Function reserved.
							O	**USB1_ULPI_STP —** ULPI link STP signal. Asserted to end or interrupt transfers to the PHY.
							I	**U1_DSR —** Data Set Ready input for UART1.
							-	**R —** Function reserved.
							I/O	**GPIO6[9] —** General purpose digital input/output pin.
							-	**R —** Function reserved.
							O	**T3_MAT3 —** Match output 3 of timer 3.
							I/O	**SD_CMD —** SD/MMC command signal.

7. Functional description

7.1 Architectural overview

The ARM Cortex-M3 includes three AHB-Lite buses: the system bus, the I-code bus, and the D-code bus. The I-code and D-code core buses allow for concurrent code and data accesses from different slave ports.

The LPC185x/3x/2x/1x use a multi-layer AHB matrix to connect the ARM Cortex-M3 buses and other bus masters to peripherals. Flexible connections allow different bus masters to access peripherals that are on different slave ports of the matrix simultaneously.

7.2 ARM Cortex-M3 processor

The ARM Cortex-M3 is a general purpose, 32-bit microprocessor, which offers high performance and low-power consumption. The ARM Cortex-M3 offers many new features, including a Thumb-2 instruction set, low interrupt latency, hardware division, hardware single-cycle multiply, interruptable/continuable multiple load and store instructions, automatic state save and restore for interrupts, tightly integrated interrupt controller with wake-up interrupt controller, and multiple core buses capable of simultaneous accesses.

Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.

The ARM Cortex-M3 processor is described in detail in the Cortex-M3 Technical Reference Manual.

7.3 System Tick timer (SysTick)

The ARM Cortex-M3 includes a system tick timer (SYSTICK) that is intended to generate a dedicated SYSTICK exception at a 10 ms interval.

7.4 AHB multilayer matrix

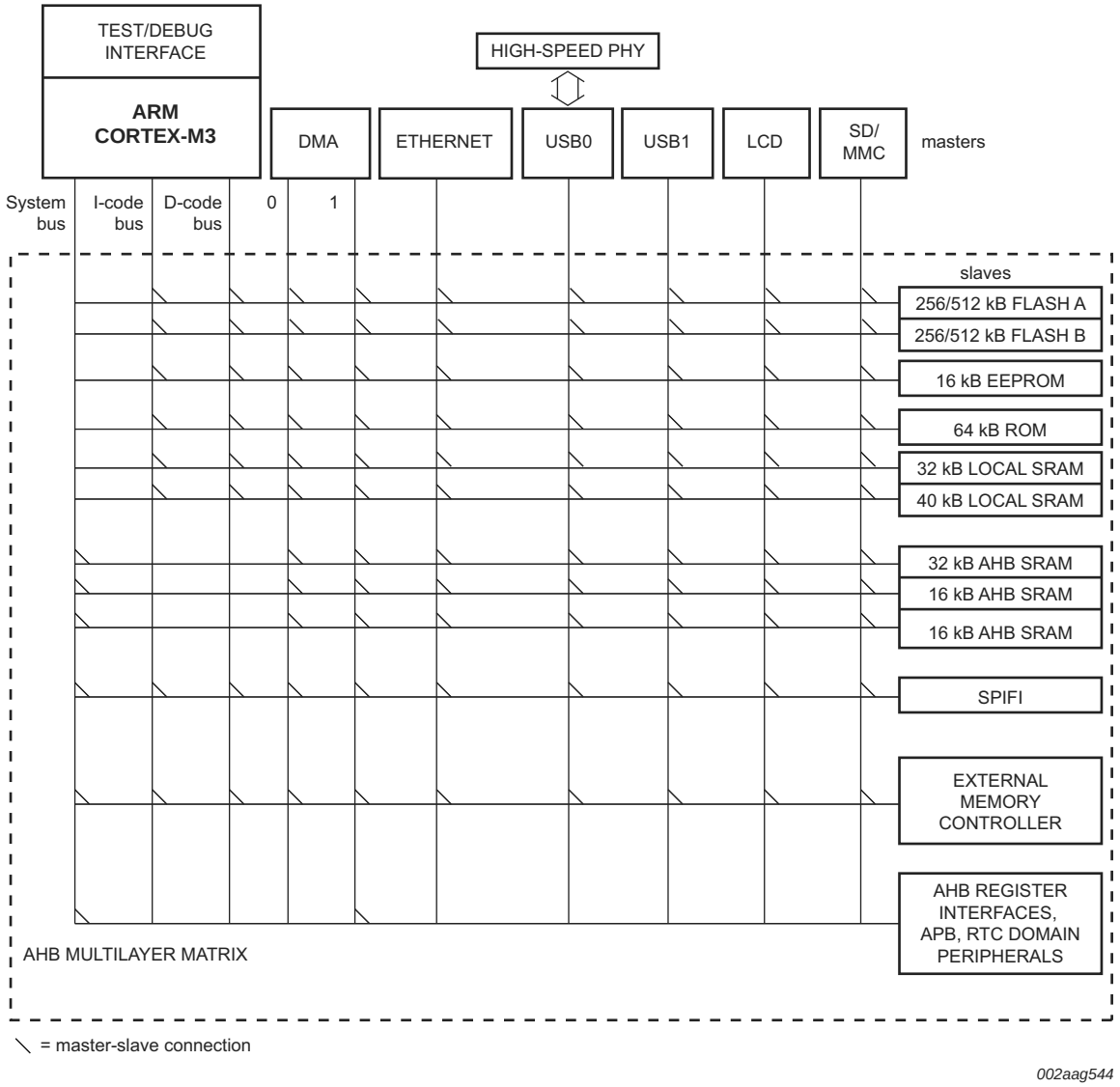


Fig 6. AHB multilayer matrix master and slave connections

7.5 Nested Vectored Interrupt Controller (NVIC)

The NVIC is part of the Cortex-M3. The tight coupling to the CPU allows for low interrupt latency and efficient processing of late arriving interrupts.

7.5.1 Features

- Controls system exceptions and peripheral interrupts.
- On the LPC185x/3x/2x/1x, the NVIC supports 53 vectored interrupts.
- Eight programmable interrupt priority levels, with hardware priority level masking.
- Relocatable vector table.

- Non-Maskable Interrupt (NMI).
- Software interrupt generation.

7.5.2 Interrupt sources

Each peripheral device has one interrupt line connected to the NVIC but can have several interrupt flags. Individual interrupt flags can also represent more than one interrupt source.

7.6 Event router

The event router combines various internal signals, interrupts, and the external interrupt pins (WAKEUP[3:0]) to create an interrupt in the NVIC, if enabled. In addition, the event router creates a wake-up signal to the ARM core and the CCU for waking up from Sleep, Deep-sleep, Power-down, and Deep power-down modes. Individual events can be configured as edge or level sensitive and can be enabled or disabled in the event router. The event router can be battery powered.

The following events if enabled in the event router can create a wake-up signal from sleep, deep-sleep, power-down, and deep power-down modes and/or create an interrupt:

- External pins WAKEUP0/1/2/3 and $\overline{\text{RESET}}$
- Alarm timer, RTC (32 kHz oscillator running)

The following events if enabled in the event router can create a wake-up signal from sleep mode only and/or create an interrupt:

- WWDT, BOD interrupts.
- C_CAN0/1 and QEI interrupts.
- Ethernet, USB0, USB1 signals.
- Selected outputs of combined timers (SCTimer/PWM and timer0/1/3).

Remark: Any interrupt can wake up the ARM Cortex-M3 from sleep mode if enabled in the NVIC.

7.7 Global Input Multiplexer Array (GIMA)

The GIMA routes signals to event-driven peripheral targets like the SCTimer/PWM, timers, event router, or the ADCs.

7.7.1 Features

- Single selection of a source.
- Signal inversion.
- Can capture a pulse if the input event source is faster than the target clock.
- Synchronization of input event and target clock.
- Single-cycle pulse generation for target.

7.8 On-chip static RAM

The LPC185x/3x/2x/1x support up to 136 kB SRAM with separate bus master access for higher throughput and individual power control for low-power operation.

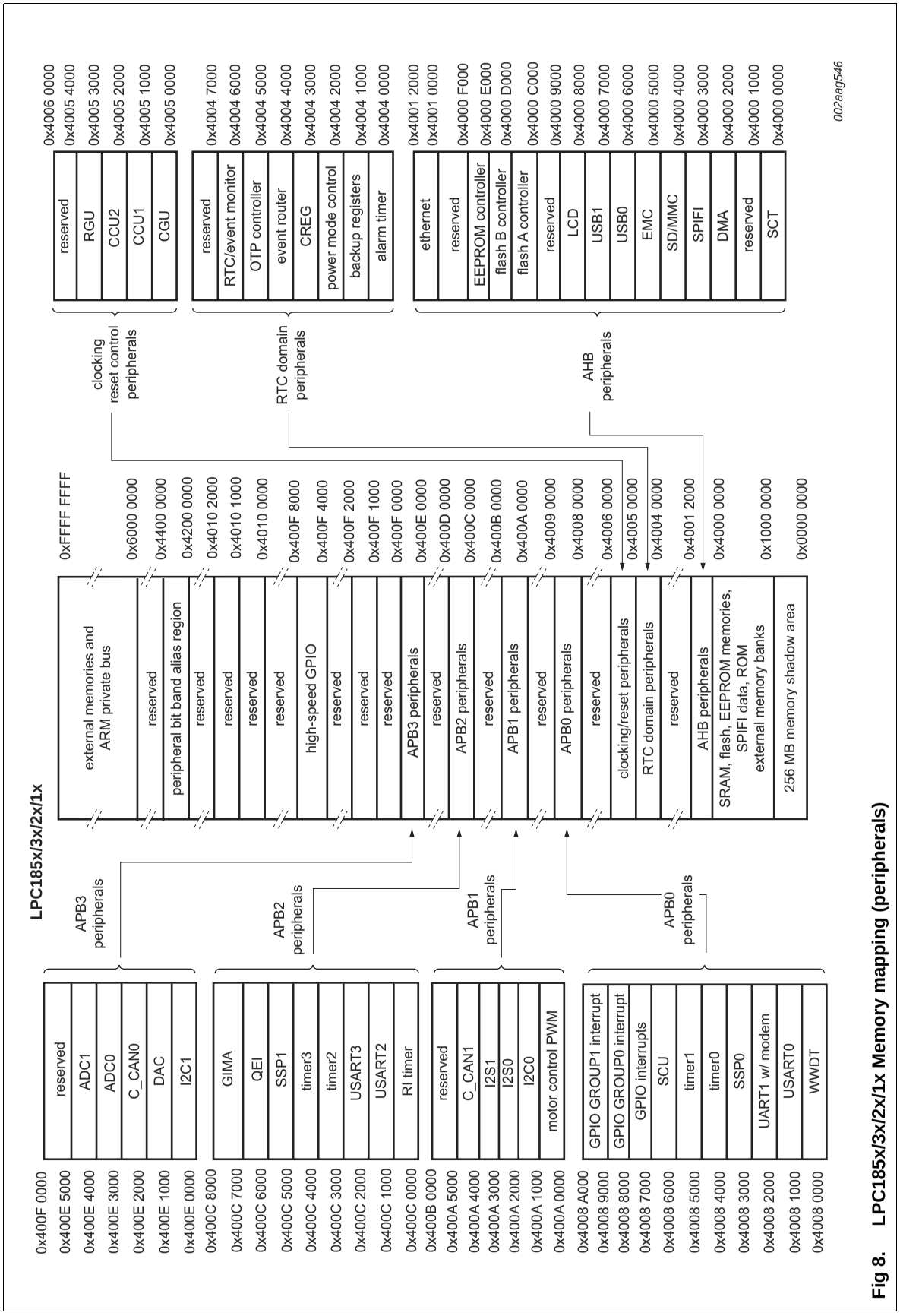


Fig 8. LPC185x/3x/2x/1x Memory mapping (peripherals)

- Dedicated battery power supply pin.
- RTC power supply is isolated from the rest of the chip.
- Calibration counter allows adjustment to better than ±1 sec/day with 1 sec resolution.
- Periodic interrupts can be generated from increments of any field of the time registers.
- Alarm interrupt can be generated for a specific date/time.

7.19.2 Event monitor/recorder

The event monitor/recorder allows recording and creating a time stamp of events related to the WAKEUP pins. Sensors report changes to the state of the WAKEUP pins, and the event monitor/recorder stores records of such events. The event recorder can be powered by the backup battery.

The event monitor/recorder can monitor the integrity of the device and record any tampering events.

7.19.2.1 Features

- Supports three digital event inputs in the VBAT power domain.
- An event is defined as a level change at the digital event inputs.
- For each event channel, two timestamps mark the first and the last occurrence of an event. Each channel also has a dedicated counter tracking the total number of events. Timestamp values are taken from the RTC.
- Runs in VBAT power domain, independent of system power supply. The event/recorder/monitor can therefore operate in Deep power-down mode.
- Low power consumption.
- Interrupt available if system is running.
- A qualified event can be used as a wake-up trigger.
- State of event interrupts accessible by software through GPIO.

7.19.3 Alarm timer

The alarm timer is a 16-bit timer and counts down at 1 kHz from a preset value generating alarms in intervals of up to 1 min. The counter triggers a status bit when it reaches 0x00 and asserts an interrupt, if enabled.

The alarm timer is part of the RTC power domain and can be battery powered.

7.20 System control

7.20.1 Configuration registers (CREG)

The following settings are controlled in the configuration register block:

- BOD trip settings
- Oscillator output
- DMA-to-peripheral muxing
- Ethernet mode
- Memory mapping

Table 11. Static characteristics *…continued*
T_{amb} = −40 °C to +105 °C, unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ[1]	Max	Unit
I_{OL}	LOW-level output current	V_{OL} = 0.4 V		8	-	-	mA
I_{OHS}	HIGH-level short-circuit output current	drive HIGH; connected to ground	[10]	-	-	86	mA
I_{OLS}	LOW-level short-circuit output current	drive LOW; connected to $V_{DD(IO)}$	[10]	-	-	76	mA
I_{pd}	pull-down current	$V_I = V_{DD(IO)}$	[12] [13] [14]	-	62	-	μA
I_{pu}	pull-up current	V_I = 0 V	[12] [13] [14]	-	−62	-	μA
		$V_{DD(IO)} < V_I \leq 5$ V		-	0	-	μA
Open-drain I^2C0-bus pins							
V_{IH}	HIGH-level input voltage			0.7 × $V_{DD(IO)}$	-	-	V
V_{IL}	LOW-level input voltage			0	0.14	0.3 × $V_{DD(IO)}$	V
V_{hys}	hysteresis voltage			0.1 × $V_{DD(IO)}$	-	-	V
V_{OL}	LOW-level output voltage	I_{OLS} = 3 mA		-	-	0.4	V
I_{LI}	input leakage current	$V_I = V_{DD(IO)}$	[11]	-	4.5	-	μA
		V_I = 5 V		-	-	10	μA
Oscillator pins							
$V_{i(XTAL1)}$	input voltage on pin XTAL1			−0.5	-	1.2	V
$V_{o(XTAL2)}$	output voltage on pin XTAL2			−0.5	-	1.2	V
C_{io}	input/output capacitance		[15]	-	-	0.8	pF
USB0 pins[16]							
V_I	input voltage	on pins USB0_DP; USB0_DM; USB0_VBUS					
		$V_{DD(IO)} \geq 2.4$ V		0	-	5.5	V
		$V_{DD(IO)}$ = 0 V		0	-	3.6	V
R_{pd}	pull-down resistance	on pin USB0_VBUS		48	64	80	kΩ
V_{IC}	common-mode input voltage	high-speed mode		−50	200	500	mV
		full-speed/low-speed mode		800	-	2500	mV
		chirp mode		−50	-	600	mV
$V_{i(dif)}$	differential input voltage			100	400	1100	mV
USB1 pins (USB1_DP/USB1_DM)[16]							
I_{OZ}	OFF-state output current	0 V < V_I < 3.3 V	[16]	-	-	±10	μA

Table 32. Static characteristics: USB0 PHY pins[1]

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
High-speed mode							
P_{cons}	power consumption		[2]	-	68	-	mW
$I_{DDA(3V3)}$	analog supply current (3.3 V)	on pin USB0_VDDA3V3_DRIVER; total supply current	[3]	-	18	-	mA
		during transmit		-	31	-	mA
		during receive		-	14	-	mA
		with driver tri-stated		-	14	-	mA
I_{DDD}	digital supply current			-	7	-	mA
Full-speed/low-speed mode							
P_{cons}	power consumption		[2]	-	15	-	mW
$I_{DDA(3V3)}$	analog supply current (3.3 V)	on pin USB0_VDDA3V3_DRIVER; total supply current		-	3.5	-	mA
		during transmit		-	5	-	mA
		during receive		-	3	-	mA
		with driver tri-stated		-	3	-	mA
I_{DDD}	digital supply current			-	3	-	mA
Suspend mode							
$I_{DDA(3V3)}$	analog supply current (3.3 V)			-	24	-	μA
		with driver tri-stated		-	24	-	μA
		with OTG functionality enabled		-	3	-	mA
I_{DDD}	digital supply current			-	30	-	μA
VBUS detector outputs							
V_{th}	threshold voltage	for VBUS valid		4.4	-	-	V
		for session end		0.2	-	0.8	V
		for A valid		0.8	-	2	V
		for B valid		2	-	4	V
V_{hys}	hysteresis voltage	for session end		-	150	10	mV
		A valid		-	200	10	mV
		B valid		-	200	10	mV

[1] Characterized but not implemented as production test.

[2] Total average power consumption.

[3] The driver is active only 20 % of the time.

12. ADC/DAC electrical characteristics

Table 37. 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 40		-	-	$1/(7 \times f_{clk(ADC)} \times C_{ia})$	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 39.

[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 39.

[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 39.

[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 39.

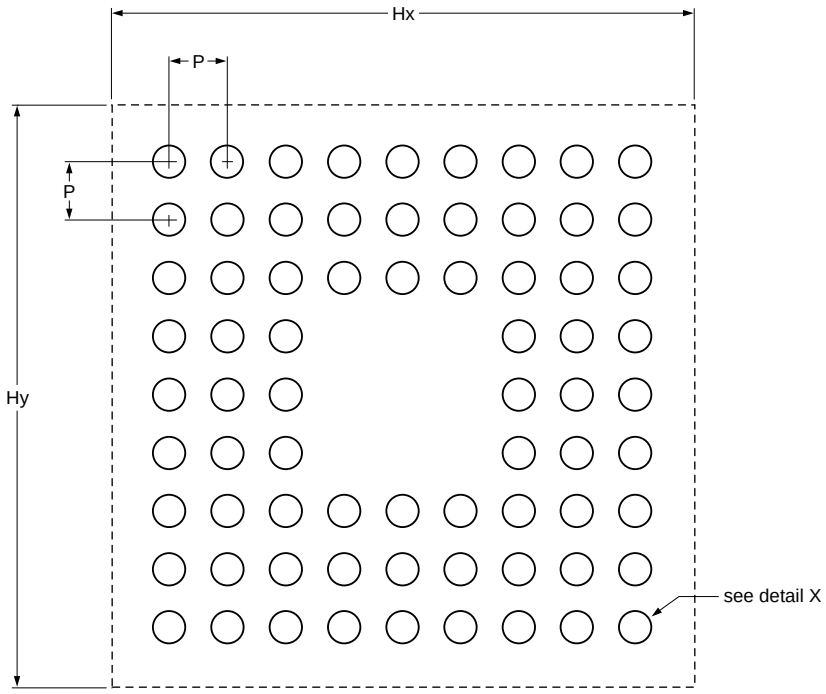
[6] The absolute error (E_T) is the maximum difference between the center of the steps of the actual transfer curve of the non-calibrated ADC and the ideal transfer curve. See Figure 39.

[7] T_{amb} = 25 °C.

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

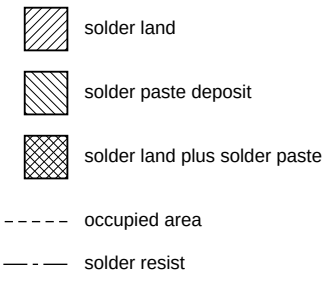
15. Soldering

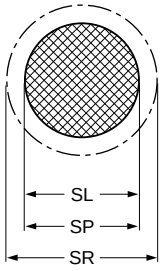
Footprint information for reflow soldering of LBGA256 package **SOT740-2**



Generic footprint pattern

Refer to the package outline drawing for actual layout





detail X

DIMENSIONS in mm

P	SL	SP	SR	Hx	Hy
1.00	0.450	0.450	0.600	17.500	17.500

sot740-2_fr

Fig 53. Reflow soldering for the LBGA256 package

Table 44. Abbreviations *…continued*

Acronym	Description
USART	Universal Synchronous Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
UTMI	USB 2.0 Transceiver Macrocell Interface

17. References

[1] LPC18xx User manual UM10430:
http://www.nxp.com/documents/user_manual/UM10430.pdf

[2] LPC18xx Errata sheet:
http://www.nxp.com/documents/errata_sheet/ES_LPC18XX.pdf

18. Revision history

Table 45. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
LPC185X_3X_2X_1X v.5.2	20160308	Product data sheet	-	LPC185X_3X_2X_1X v.5.1
Modifications:	• Updated Table 29 “Dynamic characteristics: Dynamic external memory interface”: Read cycle parameters $t_{h(D)}$ min value is 2.2 ns and max value is “-”.			
LPC185X_3X_2X_1X v.5.1	20151117	Product data sheet	2015110041	LPC185X_3X_2X_1X v.5
Modifications:	• Updated Table 2 “Ordering options”; TFBGA100 packages do not support ULPI interface. • Updated SSP slave and SSP master values in Table 27 “Dynamic characteristics: SSP pins in SPI mode”. Updated footnote 2 to: $T_{cy(clk)} \geq 12 \times T_{cy(PCLK)}$. – removed $t_{v(Q)}$, data output valid time in SPI mode, minimum value of 3 ´ (1/PCLK) from SSP slave mode. – added units to t_d, delay time, for SSP slave and master mode. • Added GPCLKIN section and table. See Section 11.7 “GPCLKIN” and Table 22 “Dynamic characteristic: GPCLKIN”.			
LPC185X_3X_2X_1X v.5	20150429	Product data sheet	-	LPC185X_3X_2X_1X v.4.1

Table 45. Revision history *…continued*

Document ID	Release date	Data sheet status	Change notice	Supersedes
LPC1857_53 v.3.1	20120904	Preliminary data sheet	-	LPC1857_53 v.3
Modifications:	• SSP0 boot pin functions added in Table 5 and Table 4. Pin P3_3 = SSP0_SCK, pin P3_6 = SSP0_SSEL, pin P3_7 = SSP0_MISO, pin P3_8 = SSP0_MOSI. • Peripheral power consumption data added in Table 12. • BOD de-assertion levels add in Table 13. • Minimum value for all supply voltages changed to -0.5 V n Table 7.			
LPC1857_53 v.3	20120711	Preliminary data sheet	-	LPC1857_53 v.2
Modifications:	• Data sheet status changed to preliminary. • AES removed. Available on parts LPC18Sxx only. • Minimum value of V_I for conditions “USB0 pins USB0_DP; USB0_DM; USB0_VBUS”, “USB0 pins USB0_ID; USB0_RREF”, and “USB1 pins USB1_DP and USB1_DM” changed to −0.3 V in Table 6. • Dynamic characteristics of the SD/MMC controller updated in Table 29. • Dynamic characteristics of the LCD controller updated in Table 30. • Dynamic characteristics of the SSP controller updated in Table 22. • Section 10.2 added. • Table 8 “Thermal resistance value (BGA packages)” added. • Description of pins USB1_DP and USB1_DM updated in Table 3. • Editorial updates. • Parameters I_{IL} and I_{IH} renamed to I_{LL} and I_{LH} in Table 9.			
LPC1857_53 v.2	20120515	Objective data sheet	-	LPC1857_53 v.1
LPC1857_53 v.1	20111214	Objective data sheet	-	-

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21. Contents

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Date of release: 8 March 2016
Document identifier: LPC185X_3X_2X_1X