Features

- **USB 2.0 Full Speed Host/Function Processor**
  - **Real-time Host/Function Switching Capability**
  - **Internal USB and System Interface Controllers**
  - **32-bit Generic System Processor Interface with DMA**
  - **Separate Tx and Rx Buffers for Host and Function Operations**
  - **In-System Software Upgrade**
- **Autonomous USB Host Operation without System Processor Intervention**
  - **Device Enumeration**
  - **USB Protocol Management**
  - **Bus Bandwidth Reclamation**
  - **Status Handling**
  - **Control, Bulk, Interrupt and Isochronous Transfers**
- **Full-speed Function Controller**
  - **1 Bi-directional Control Endpoint**
  - **6 Programmable (Packet Size and Endpoint type) Endpoints Supporting Interrupt, Bulk and Isochronous Transfers**
  - **Automatic Retry for Non-isochronous End-points**
- **Integrated USB Firmware**
  - **Easy-to-use, ANSI C Compliant API for USB Device Driver Development**
  - **Embedded, OS Agnostic USB Host Stack**
  - **Embedded System Interface Driver**
  - **Embedded USB Hub Driver**
- **6 Mhz Operation**
- **3.3/1.8V Operation**
- **100-pin LQFP Packages**

Overview

Atmel's AT43USB370 is a USB 2.0 compliant, dual role, full speed Host/Function processor designed specifically to enable point-to-point USB connectivity for embedded devices. It features integrated USB host stack, system interface drivers, on-chip USB hardware, 32-bit generic system processor interface with DMA support, and on-the-fly host/function switching capability.

The on-chip USB hardware features USB transceiver, serial interface engine (SIE), SIE controller and SOF generation block. It supports the physical and data link layer of the USB protocol whereas the USB transaction layer is implemented in firmware.

In host mode, the integrated USB firmware consists of the USB host stack running on the USB controller and the system interface driver resident on the system interface controller. The USB host stack provides complete USB protocol management including device enumeration, transaction management, scheduling and frame management, and bus reclamation. The system interface driver serves as an interface between the USB host stack and the applications resident on the external system processor. It handles all of the high-level data flow management during a USB transaction. Together, the USB host stack and the system interface driver deliver complete USB host operations autonomously, without the intervention of the system processor.

USB 2.0 Full-Speed Host/Function Processor

AT43USB370

Summary

Rev. 3340BS–USB–4/14/03

The AT43USB370 communicates with the external system processor through its generic 32-bit system processor interface. This system interface features 2 Kbytes of FIFO and a DMA engine designed to ensure maximum bus utilization. The automatic USB retry mechanism built into the AT43USB370 further minimizes data traffic across the system interface.

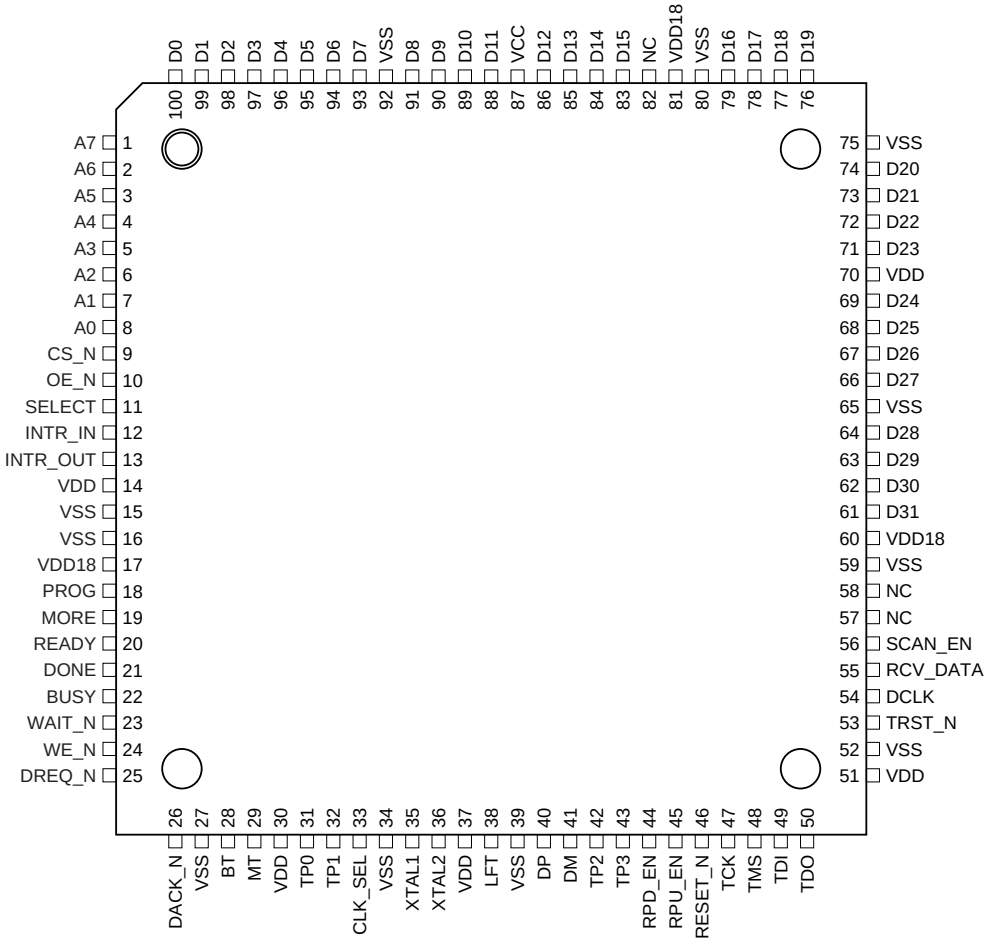
As a function, the AT43USB370 operates in full speed mode. It supports one control endpoint and a maximum of six programmable (max packet size and endpoint type) endpoints. The internal USB controller runs the function firmware that manages USB enumeration and data flow control without system processor intervention.

Developing application specific USB device drivers requires the use of a small set of high level, ANSI C compliant APIs (system interface APIs) that provides communication between the system processor and the AT43USB370. The encapsulation of USB operations into this small set of APIs leads to unprecedented ease in device driver development and RTOS support.

The AT43USB370, with its highly integrated USB hardware/firmware architecture, not only hides the complexity of the traditional USB design, but also frees system resources from being burdened by timing critical USB activities. It is an ideal solution for point-to-point USB connectivity in the resource constrained embedded environment.

Pin Configuration

Figure 1. AT43USB370 100-Lead TQFP



Pin Assignment

Table 1. Pin Assignment for the AT43USB370

Pin #	Signal	Type	Pin #	Signal	Type	Pin #	Signal	Type
1	A7	Input	35	XTAL1	Input	68	D25	Bi-directional
2	A6	Input	36	XTAL2	Output	69	D24	Bi-directional
3	A5	Input	36	XTAL2	Output	70	VDD	Power Supply/Gnd
4	A4	Input	37	VDD	Power Supply/Gnd	71	D23	Bi-directional
5	A3	Input	38	LFT	Input	72	D22	Bi-directional
6	A2	Input	39	VSS	Power Supply/Gnd	73	D21	Bi-directional
7	A1	Input	40	DP	Bi-directional	74	D20	Bi-directional
8	A0	Input	41	DM	Bi-directional	75	VSS	Power Supply/Gnd
9	CS_N	Input	42	TP2	Input	76	D19	Bi-directional
10	OE_N	Input	43	TP3	Input	77	D18	Bi-directional
11	SELECT	Input	44	RPD_EN	Output	78	D17	Bi-directional
12	INTR_IN	Input	45	RPU_EN	Output	79	D16	Bi-directional
13	INTR_OUT	Output	46	RESET_N	Input	80	VSS	Power Supply/Gnd
14	VDD	Power Supply/Gnd	47	TCK	Input	81	VDD18	Power Supply/Gnd
15	VSS	Power Supply/Gnd	48	TMS	Input	82	NC	Not Connected
16	VSS	Power Supply/Gnd	49	TDI	Input	83	D15	Bi-directional
17	VDD18	Power Supply/Gnd	50	TDO	Output	84	D14	Bi-directional
18	PROG	Input	51	VDD	Power Supply/Gnd	85	D13	Bi-directional
19	MORE	Input	52	VSS	Power Supply/Gnd	86	D12	Bi-directional
20	READY	Output	53	TRST_N	Input	87	VCC	Power Supply/Gnd
21	DONE	Input	54	DCLK	Output	88	D11	Bi-directional
22	BUSY	Output	55	RCV_DATA	Output	89	D10	Bi-directional
23	WAIT_N	Output	56	SCAN_EN	Input	90	D9	Bi-directional
24	WE_N	Input	57	NC	Not Connected	91	D8	Bi-directional
25	DREQ_N	Output	58	NC	Not Connected	92	VSS	Power Supply/Gnd
26	DACK_N	Input	59	VSS	Power Supply/Gnd	93	D7	Bi-directional
27	VSS	Power Supply/Gnd	60	VDD18	Power Supply/Gnd	94	D6	Bi-directional
28	BT	Input	61	D31	Bi-directional	95	D5	Bi-directional
29	MT	Input	62	D30	Bi-directional	96	D4	Bi-directional
30	VDD	Power Supply/Gnd	63	D29	Bi-directional	97	D3	Bi-directional
31	TP0	Input	64	D28	Bi-directional	98	D2	Bi-directional
32	TP1	Output	65	VSS	Power Supply/Gnd	99	D1	Bi-directional
33	CLK_SEL	Input	66	D27	Bi-directional	100	D0	Bi-directional
34	VSS	Power Supply/Gnd	67	D26	Bi-directional			

Pin Description

Table 2. Pin Description for the AT43USB370

Pin Name	Type	Description
A[7:0]	Input	ADDRESS BUS - System Address Bus (Least Significant Byte only)
CS_N	Input	CHIP_SELECT - from System Processor. Active Low
OE_N	Input	OUTPUT_ENABLE - from System Processor. Active Low
SELECT	Input	PROCESSOR_SELECT - from System Processor - used to select between USBC and SIC when PROG is active. Active High
INTR_IN	Input	Interrupt to AT43USB370 - from System Processor. Active High
INTR_OUT	Output	Interrupt from AT43USB370 - to System Processor. Active High
VCC	Power Supply/Gnd	3.3V Power Net
VDD	Power Supply/Gnd	3.3V Power Supply
VSS	Power Supply/Gnd	Ground
VDD18	Power Supply/Gnd	1.8V Power Supply - Bus interface IO pads
PROG	Input	PROGRAM_LOAD_ENABLE - from System Processor - set program mode to USBC and SIC. Active High.
MORE	Input	PIO Mode Handshake signal from System Processor. Active High
READY	Output	PIO Mode Handshake signal to System Processor. Active High
DONE	Input	PIO Mode Handshake signal from System Processor. Active High
BUSY	Output	BUSY - to System Processor - indicates the AT43USB370 cannot accept external interrupts. Active High
WAIT_N	Output	WAIT - to System Processor. Active Low
WE_N	Input	WRITE_ENABLE - from System Processor. Active Low
DREQ_N	Output	DMA Request - to System Processor. Active Low
DACK_N	Input	DMA Acknowledge - from System Processor. Active Low
BT	Input	BIST- Test Signal
MT	Input	Memory - Test Signal
TP0	Input	Test Pin 0
TP1	Output	Test Pin 1
TP2	Input	Test Pin 2
TP3	Input	Test Pin 3
CLK_SEL	Input	External/PLL Clock Selection - Low selects crystal-PLL clock source while a High uses XTAL1, bypassing PLL.
XTAL1	Input	Oscillator Input - Input to the inverting oscillator amplifier.
XTAL2	Output	Oscillator Output - Output of the inverting oscillator amplifier.
LFT	Input	PLL Loop Filter
DP	Bi-directional	D+ (USB Line)
DM	Bi-directional	D- (USB Line)
RPD_EN	Output	Pull Down Enable

Table 2. Pin Description for the AT43USB370 (Continued)

Pin Name	Type	Description
RPU_EN	Output	Pull Up Enable
RESET_N	Input	RESET - for AT43USB370. Active Low
TCK	Input	JTAG Clock
TMS	Input	JTAG Mode Select
TDI	Input	JTAG Serial Data IN
TDO	Output	JTAG Serial Data OUT
TRST_N	Input	JTAG Reset - Active Low
DCLK	Output	Test Pin
RCV_DATA	Output	Test Pin
SCAN_EN	Input	Test Pin-Scan Control
NC	–	Not Connected
D[31:0]	Bi-directional	System Data Bus

Block Diagram

Figure 2. AT43USB370 Hardware

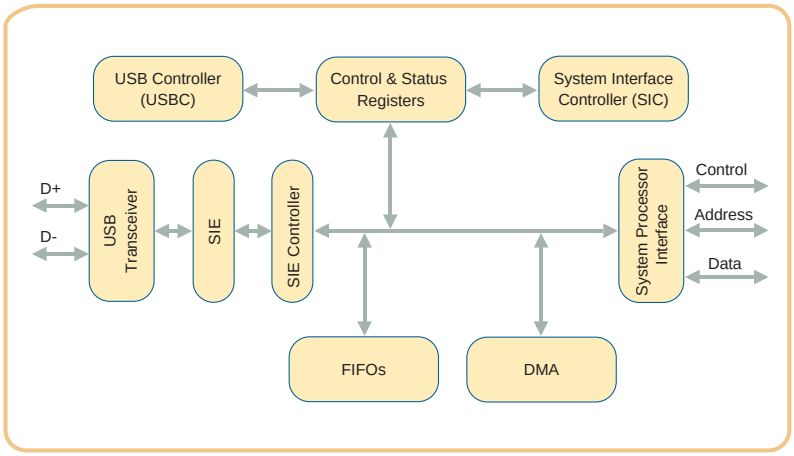
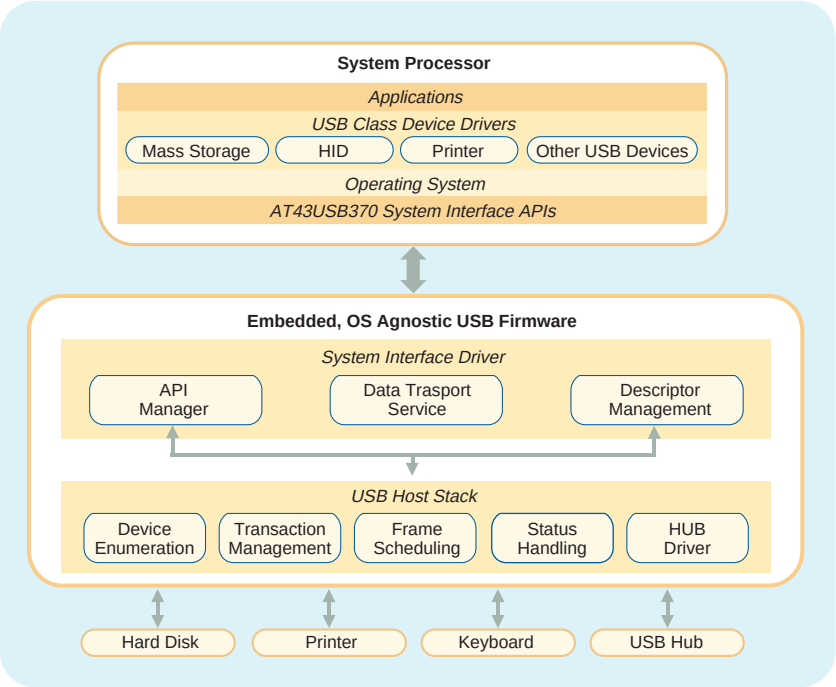


Figure 3. AT43USB370 Architecture

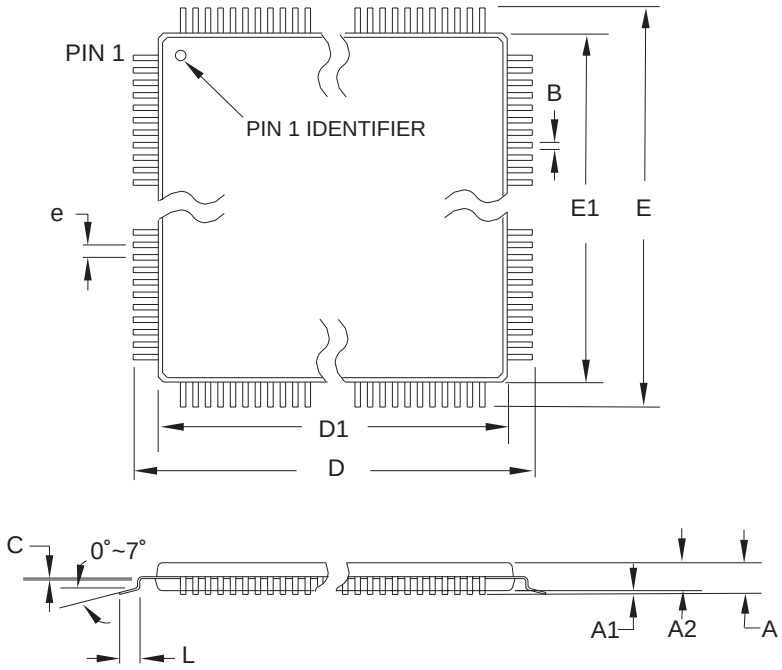


Development Support

The AT43USB370 is supported by the AT43DK370, a complete development kit. The AT43DK370 includes a reference design board with an ARM7 system processor, the USB 2.0 compliant host stack and system interface firmware, sample application code and the complete documentation (PCB layout, schematics, BOM, etc.). The “USB Clinic”, an Atmel USB software debugging utility is included in the development kit.

Packaging Information

100 Pin – LQFP



COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	1.60	
A1	0.05	–	0.15	
A2	1.35	1.40	1.45	
D	15.75	16.00	16.25	
D1	13.90	14.00	14.10	Note 2
E	15.75	16.00	16.25	
E1	13.90	14.00	14.10	Note 2
B	0.17	–	0.27	
C	0.09	–	0.20	
L	0.45	–	0.75	
e	0.50 TYP			

Notes:
1. This package conforms to JEDEC reference MS-026, Variation AED.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is 0.25 mm per side. Dimensions D1 and E1 are maximum plastic body size dimensions including mold mismatch.
3. Lead coplanarity is 0.08 mm maximum.

04/29/2002

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**100AA,** 100-lead, 14 x 14 mm Body Size, 1.4 mm Body Thickness, 0.5 mm Lead Pitch, Low Profile Quad Flat Pack (LQFP)	100AA	C

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