



Data Sheet

USB2.0 Flash Disk Controller

SN20086

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Revision 0.2

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1 General Description

SN20086 is a high-performance integrated circuit to access the NAND type Flash memory via the 480 MHz USB 2.0 bus. It provides a flexible and cost efficient single chip solution for external storage applications such as USB Disk (Flash Disk). With all the features inherited from the popular SN11085/86/88, the users can easily upgrade to SN20086 and enjoy the tremendous speed increment.

Although the USB speed is increased 40 times from 12 M to 480 M, the external crystal frequency of SN20086 is still kept at 6MHz, keeping the EMI at low level. The functions that ensure the data integrity like the embedded translation table, the Sonix proprietary randomization algorithm, and the real time ECC correction function are all implemented as the USB 1.1 version. SN20086 also incorporates Sonix in-house algorithm to improve the performance of the flash disk.

To enrich the product line of the OEM manufacture and reduce the effort of component sourcing, SN20086 supports both single channel and dual channel modes in a single chip. In addition, SN20086 supports NAND flash memories of Samaung, Toshiba, Hynix, STMicroelectronics and Micron, providing more flexibility for the flash memory's purchasing.

With the ability to support 8 pieces of flash memories and the new types of 2G, 4G, and 8G bits flashes, SN20086 can be used to build up a storage device up to 8 Giga bytes large.

The USB Mass Storage Class compliance capability of SN20086 makes it a truly "plug-and-play" device without vendor drivers under Windows 2000/ME/XP, Mac OS 8.6/9/10, and Linux. SN20086 also provides PC boot up function as a USB floppy disk (1.44M), USB ZIP, USB HDD or USB CD-ROM, which makes it an ideal replacement for the legacy floppy disk.

2 Features

- USB 2.0 480 MHz high-speed compatible
- USB 1.1 Mass Storage Class compliant
- USB Mass Storage Class Bulk-Only Transport 1.0 supported
- USB Mass Storage Class SCSI transparent command set supported
- Low system clock (6MHz) to reduce EMI
- Customized USB VID, PID, serial number, and USB vendor/product strings
- 28 characters of Vendor/Product/Revision string supported for each LUN separately
- Support Samsung and Toshiba NAND-type flash memory, from 32Mbits to 1Gbits
- Support new type of Samsung NAND type flash memory, from 1Gbits to 8Gbits
- Support Hynix / Micron / STMicroelectronics flash memories
- Support FDD/ZIP/HDD/CD-ROM format through Sonix mass production tool
- Support Autorun function
- Support CD-RW function
- Real-time ECC correction circuit for data integrity and memory access speed acceleration
- Embedded SRAM for logical-to-physical address translation to extend the life time of NAND-type flash
- Support up to 8 NAND type flash memories are supported (single channel mode)
- Support dual channel mode for speed improvement (two NAND flash memories only)
- Support up to 8 Gbytes of disk capacity
- Embedded FIFO for upstream and downstream data transfer
- Built-in power MOS to meet USB suspend requirement (500 uA)
- Data transfer rate up to 60MB/s (burst)
- LED indicator pin
- Three modes of LED flashing patterns can be selected
- Five speed of LED flashing speed provided
- PC boot up capability (host BIOS with USB boot up support is necessary)
- Flash disk security function provided, up to 16 characters of password for high sensitive data protection from illegally access
- Five types of security functions can be selected
- ROM-type flash disk capability provided (permanent write protect)
- Different LUN can be set to write protect separately
- No driver needed under Microsoft Windows ME/2000/XP, Mac OS 8.6/9.x/10.xNo driver needed for Linux kernel 2.4 or above
- Sonix Driver for Microsoft Windows 98/98SE
- Sonix mass production tool available for mass production (under win2k/xp)



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- Sonix utility program available (under Windows and Mac 10.2 or above)
- Sonix driver and utility program available (under Mac 9, version 9.1 or above)
- Single 3.3V operation
- 48 pin LQFP package

3. Pin Assignment

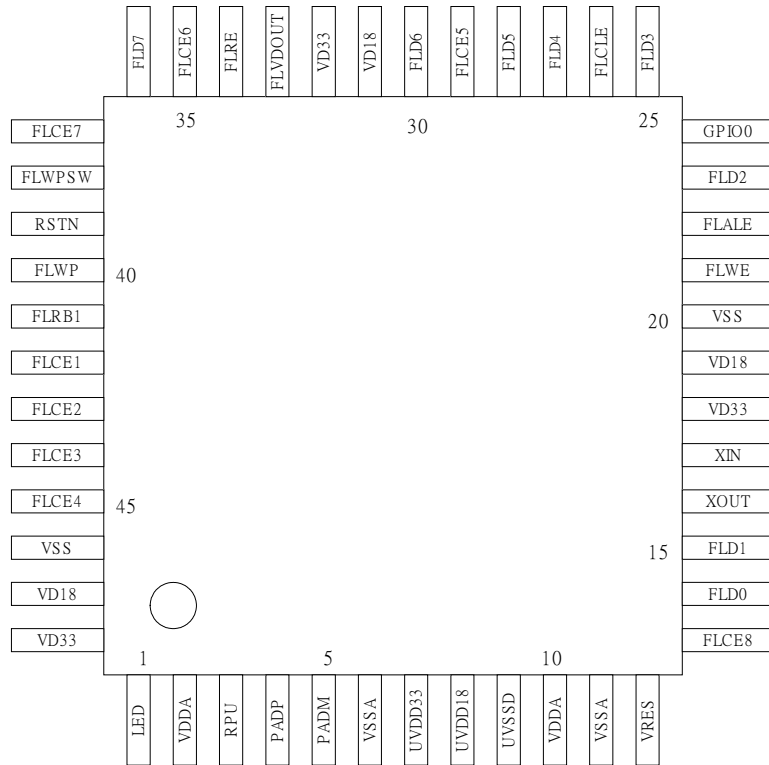


Table 1 SN20086 pin list

#	pin name	type	drive	description
1	LED	DO	8mA	LED output
2	VDDA	PWR		Analog 3.3V
3	RPU	AIO		Connect to 1.5K pull up resistor
4	DPLUS	AIO		USB D+
5	DMINUS	AIO		USB D-
6	VSSA	PWR		Analog ground
7	UVDD33	PWR		UTMI Digital 3.3V
8	UVDD18	PWR		UTMI Digital 1.8V
9	UVSSD	PWR		UTMI Digital ground
10	VDDA	PWR		Analog 3.3V
11	VSSA	PWR		Analog ground

12	VRES	AIO		Reference voltage, connect to 6.2K resistor
13	FLCE8	DIO	8mA	Flash chip select 8 / Flash data 15
14	FLD0	DIO	8mA	Flash data 0
15	FLD1	DIO	8mA	Flash data 1
16	XOUT	DO		Crystal output
17	XIN	DI		Crystal input
18	VD33	PWR		Digital 3.3V
19	VD18	PWR		Digital 1.8V
20	VSS	PWR		Digital ground
21	FLWE	DO	8mA	Flash write enable
22	FLALE	DO	8mA	Flash address latch enable
23	FLD2	DIO	8mA	Flash data 2
24	GPIO0	DIO	8mA	General purpose input/output 0 / flash chip enable (dual channel mode), PU: dual channel mode, PD: single channel mode
25	FLD3	DIO	8mA	Flash data 3
26	FLCLE	DO	8mA	Flash command latch enable
27	FLD4	DIO	8mA	Flash data 4
28	FLD5	DIO	8mA	Flash data 5
29	FLCE5	DIO	8mA	Flash chip enable 5 / Flash data 12
30	FLD6	DIO	8mA	Flash data 6
31	VD18	PWR		Digital 1.8V
32	VD33	PWR		Digital 3.3V
33	FLVDOUT	PWR		Flash power 3.3V
34	FLRE	DO	8mA	Flash read enable
35	FLCE6	DIO	8mA	Flash chip enable 6 / Flash data 13
36	FLD7	DIO	8mA	Flash data 7
37	FLCE7	DIO	8mA	Flash chip enable 7 / Flash data 14
38	FLWPSW	DI		Write protect switch input
39	RSTN	DI	-	Chip mater reset
40	FLWP	DO	8mA	Flash write protect
41	FLRB1	DI		Flash ready/busy
42	FLCE1	DIO	8mA	Flash chip enable 1 / Flash data 8
43	FLCE2	DIO	8mA	Flash chip enable 2 / Flash data 9
44	FLCE3	DIO	8mA	Flash chip enable 3 / Flash data 10

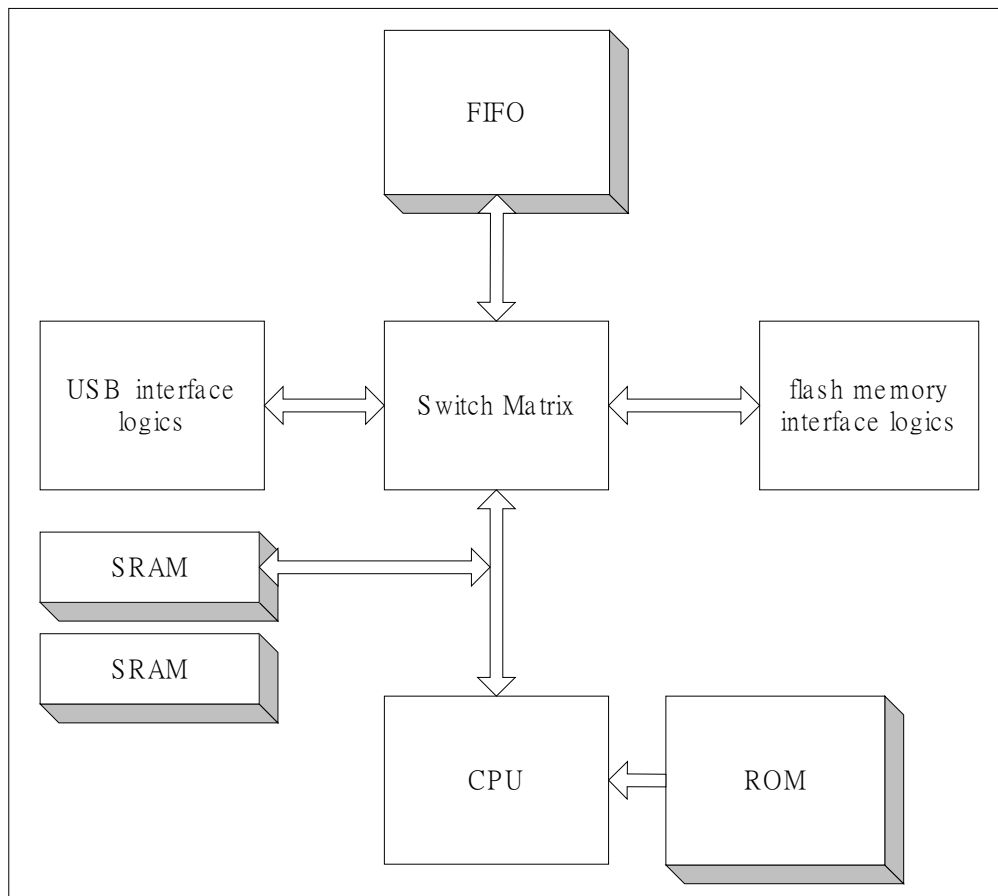


45	FLCE4	DIO	8mA	Flash chip enable 4 / Flash data 11
46	VSS	PWR		Digital ground
47	VD18	PWR		Digital 1.8 V
48	VD33	PWR	-	Digital 3.3V

Note:

1. P: power pin; AI: analog input pin, AIO: analog input/output pin; DI: digital input pin; DO: digital output pin; DIO: digital input/output pin.
2. PD: pull down; PU: pull up.
3. All pads are Schmitt triggered and with slew rate control

4 Block diagram



5 Functional description

5.1 Flash memory connection

In single channel mode, up to 8 NAND type flash memories can be connected to SN20086 (in dual channel mode, only 2 flash memories can be connected), the number of flash memory connected can be detected automatically upon power on. Each flash memory has its own chip enable control signal path (FLCE 1 to FLCE8). All flash memories connected to SN20086 must be of the same capacity. There is no special rule for the number of flash memory. (e.g. not necessarily to be the multiples

of 2 or 4).

5.2 USB VID/PID/SN and Strings format

The USB vendor ID, product ID, serial number, and the strings can be changed by using the Sonix Mass Production tool. The vendor name and product name of each LUN can also be changed. The serial number (defined in mass storage device class) can also be customized or disabled. It should be noted that the VID and PID values cannot be set to 0x0000 or 0xFFFF or any value that reserved by the USB standard. If there is no customized VID/PID, default USB vendor ID (hex 0C45) and product ID (hex 2060) are returned to the host.

5.3 Software support

Sonix provides the following software to customers. Please contact Sonix sales for detail.

- 1) Application software and driver for Win98/2000/Me/XP; boot up utility is included for Win98/Me
- 2) Application software and driver for Mac OS9 (version 9.1 or above)*
- 3) Application software for Mac OS 10.2 or above*
- 4) Mass production tool under Win2000/XP

* The functions of the application software between different OS might be different

6 Operating rating and electrical characteristics

6.1 Absolute maximum rating

Table 2

symbol	Parameter	value	unit
Dvmin	min digital supply voltage	DGND – 0.3	V
Dvmax	max digital supply voltage	DGND + 3.6	V
Avmin	min analog supply voltage	AGND – 0.3	V
Avmax	max analog supply voltage	AGND + 3.6	V
Dvinout	voltage on any digital input or output pin	DGND –0.3 to 3.6	V
Avinout	voltage on any analog input or output pin	AGND –0.3 to Avdd + 0.3	V
T _{stg}	storage temperature range	-40 to +125	°C
ESD (HBM)	ESD human body mode C=100pF, R=1.5KΩ	5000	V
ESD (MM)	ESD machine mode	200	V
I _{off}	leakage current	10	uA
I _{latch}	minimum latch up current	100	mA

6.2 Operation conditions

Table 3

symbol	Parameter	value	unit
DVdd	digital supply voltage	+3 to +3.6	V
Avdd	analog supply voltage	+3 to +3.6	V
T _A	operating ambient temperature range	0 to 70	°C
T _J	operating junction temperature range	0 to 115	°C

6.3 DC electrical characteristics

Table 4

symbol	parameter	test condition	value	unit
V _{DI}	USB full speed differential input	(D+) – (D-)	0.2 (min)	V
V _{CM}	USB full speed differential common mode range	Included V _{DI} range	0.8 (min) 2.5 (max)	V
V _{HSSQ}	USB high speed squelch detection threshold		100 (min) 150 (max)	mV
V _{HSDSC}	USB high speed disconnect detection threshold		525 (min) 625 (max)	mV
V _{HSSQ}	USB high speed data signaling common mode voltage range		-50 (min) 500 (max)	mV
V _{IH}	high level input voltage		2.0 (min)	V
V _{IL}	low level input voltage		0.8 (max)	V
V _{OH}	high level output voltage	I _{OH} = -4 mA	2.3 (min)	V
V _{OL}	low level output voltage	I _{OL} = 4 mA	0.5 (max)	V
I _{IL}	low level input current	V _I = 0 V	RSTN pin : - 50.0 (max) the other pins : - 3.0 (max)	μA
I _{IH}	high level input current	V _I = 3.6 V	3.0 (max)	μA
I _{DD}	input supply current		20 (max)	mA
I _{suspend}	supply current in suspend		TBD	μA

6.4 AC electrical characteristics

6.4.1 USB transceiver signal (full speed mode)

Table 5

symbol	parameter	test condition	min	max	unit
Tr	transition rise time for DP or DM		4	20	ns
Tf	transition fall time for DP or DM		4	20	ns
Trfm	rise / fall time matching	(Tr / Tf) * 100	90	111.11	%
Vo(crs)	signal crossover voltage		1.3	2.0	V

6.4.2 USB transceiver signal (high speed mode)

Table 6

symbol	parameter	test condition	min	max	unit
Tr	transition rise time for DP or DM		0.5		ns
Tf	transition fall time for DP or DM		0.5		ns

6.4.3 Operation clocks

Table 7

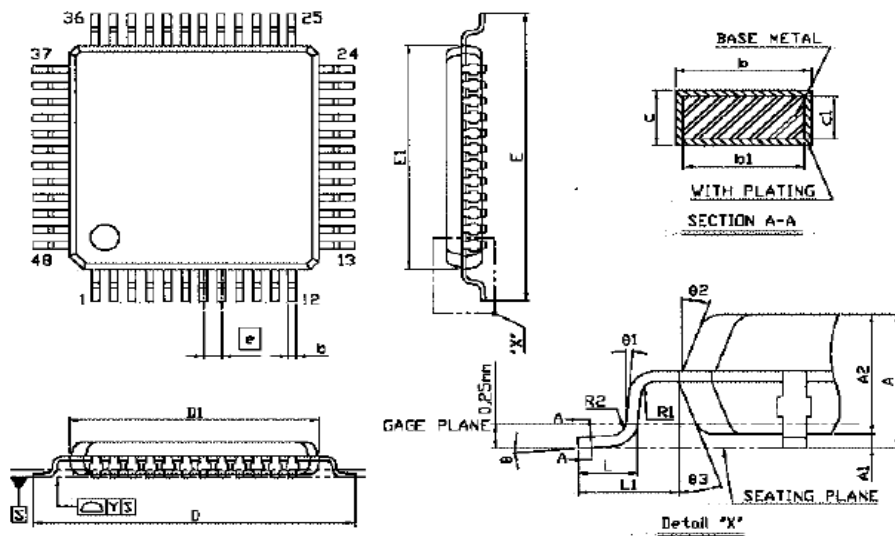
symbol	parameter	value	unit
USBCLKin	XI/XOUT crystal value	6 (typ)	MHz
	USBCLKin duty cycle	50 ± 2	%

6.5 Power consumption

Table 8

symbol	parameter	value	unit
Io_max	Max current in operation	80	mA
Is_max	Max current in suspend mode	TBD	uA

7. Packaging dimension



SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1.60			63
A1	0.05		0.15	2		6
A2	1.35	1.40	1.45	53	55	57
b	0.17	0.22	0.27	7	9	11
b1	0.17	0.20	0.23	7	8	12
c	0.09		0.20	4		8
c1	0.09		0.16	4		6
D	9.00 BSC			354 BSC		
D1	7.00 BSC			276 BSC		
E	9.00 BSC			354 BSC		
E1	7.00 BSC			276 BSC		
e	0.50 BSC			20 BSC		
L	0.45	0.60	0.75	18	24	30
L1	1.00 REF			39 REF		
R1	0.08			3		
R2	0.08		0.20	3		8
Y			0.075			3
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°			0°		
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°

NOTE:

1.REFER TO JEDEC MS-026/BBC

2.DIMENSION D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.

ALLOWABLE PROTRUSION IS 0.25mm PER SIDE D1 AND E1 ARE

MAXIMUM PLASTIC BODY SIZE DIMENSION INCLUDING MOLD MISMATCH.

3.DIMENSION 'b' DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE

DAMBAR PROTRUSION SHALL NOT CAUSE THE LEAD WIDTH TO EXCEED

THE MAXIMUM b DIMENSION BY MORE THAN 0.08mm.

4.ALL DIMENSIONS IN MILLIMETERS.

**Revision History**

<i>Revision</i>	<i>Revision Date</i>	<i>Description of changes</i>
Revision V0.1	Oct. 08, 2004	Draft release.
Revision V0.2	Dec. 13,2004	GPIO0 Definition Modify.



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