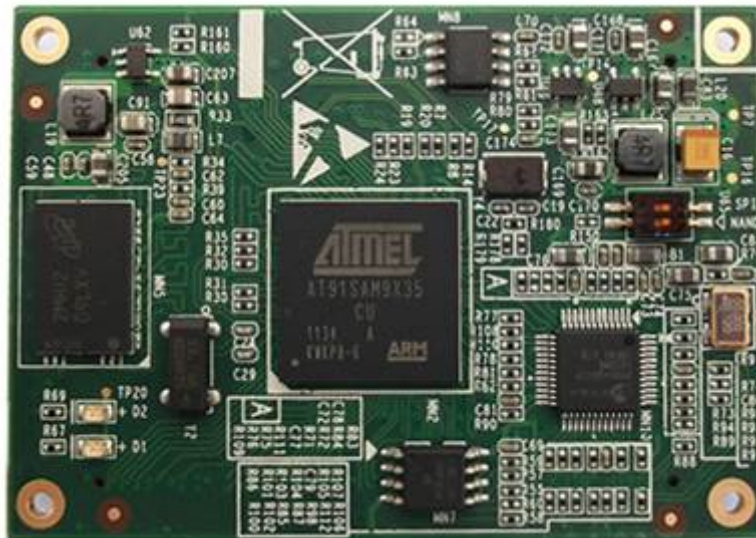# MINI6935 CPU Core Board

Atmel AT91SAM9X35 Powered CPU Core Module
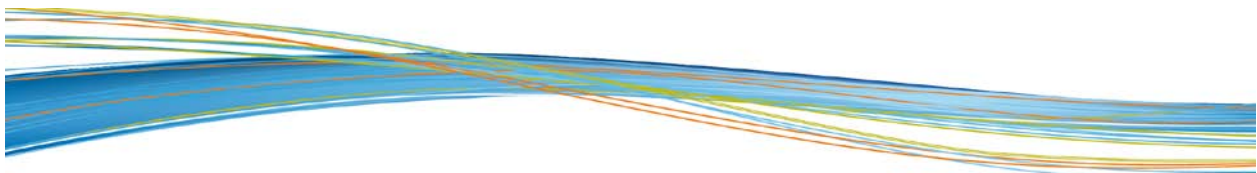
BY

element14

Product Overview

Version 1.0

Dated: 3rd December 2013

Revision History:

Version	Date	Description
1.0	03/12/2013	Original Version

Table of Contents

1 Product Overview

1.1 Introduction

The MINI6935 is compact yet powerful embedded core module built on the Atmel AT91SAM9X35, a 32bit ARM 926EJ-S™ microcontroller. By utilising a compatible expansion board users can quickly add extra functionality allowing dramatically reduced design time.

Despite the MINI6935's small size it manages to squeeze in 128MB of DDR2 SDRAM, 256MB of NAND Flash and 4MB of DataFlash, as well as abundant interfaces which may be further expanded with a compatible expansion board. The MINI6359 also features:

- Support for the Linux2.6.39 operating system
- Support for custom GUI's created via Linux QT
- Support for multiple file systems such as ROM, CRAM, EXT2, EXT3, FAT, NFS, JFFS2, YAFFS2, UBIFS

1.2 Kit Contents

- ✓ MINI6935 Core Board×1
- ✓ CD-ROM×1

Optional

- ✓ Expansion Board (EDM6070-01 or EDM6070R-01)

1.3 Board Interfaces
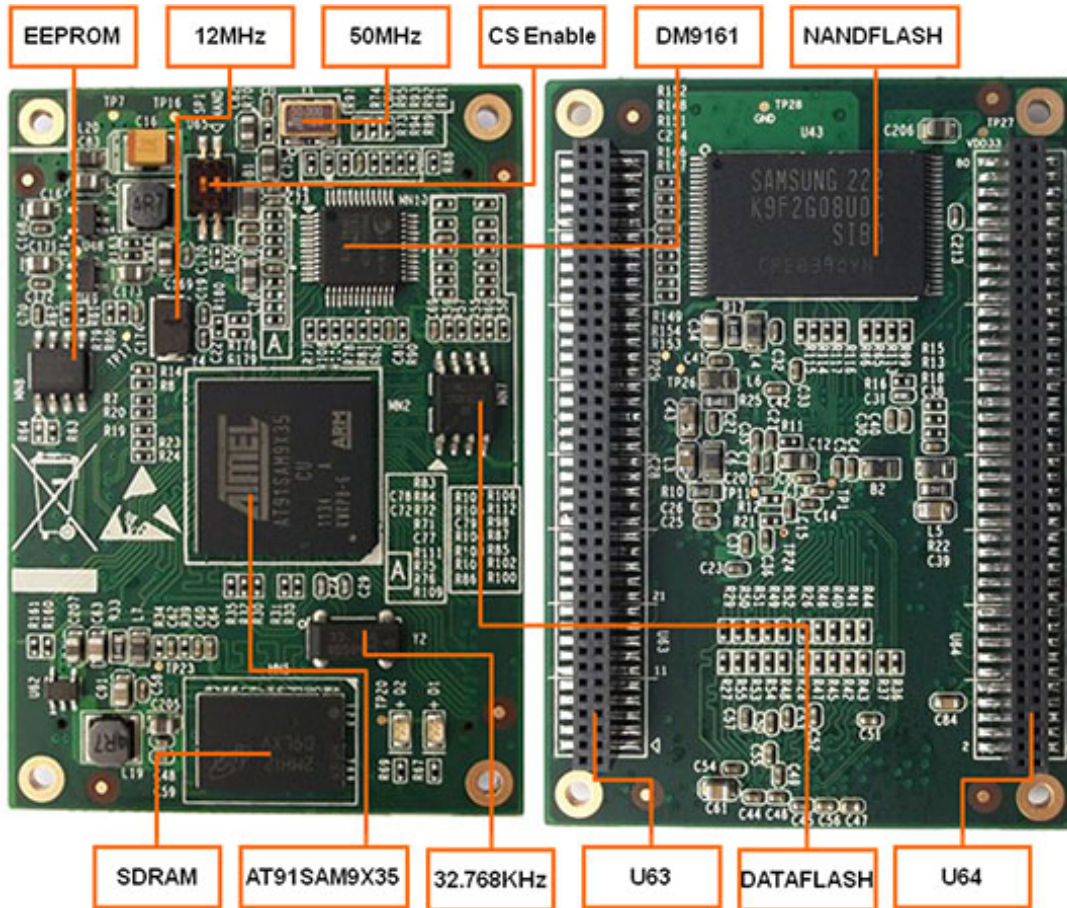
Figure 1: *MINI6935 CPU Module Interfaces*

1.4 System Block Diagram
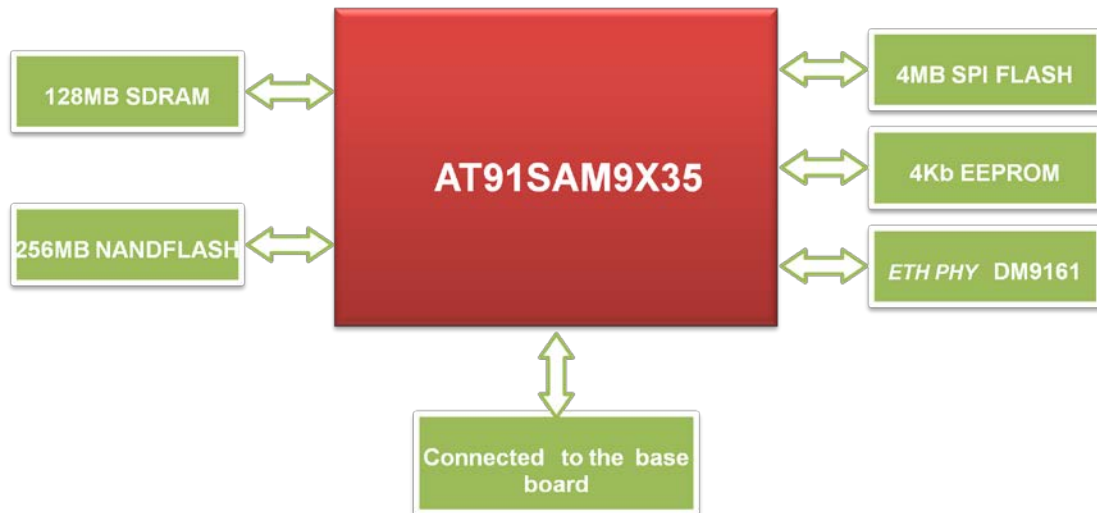
Figure 2: *System Block Diagram*

1.5 Physical Dimensions (mm)
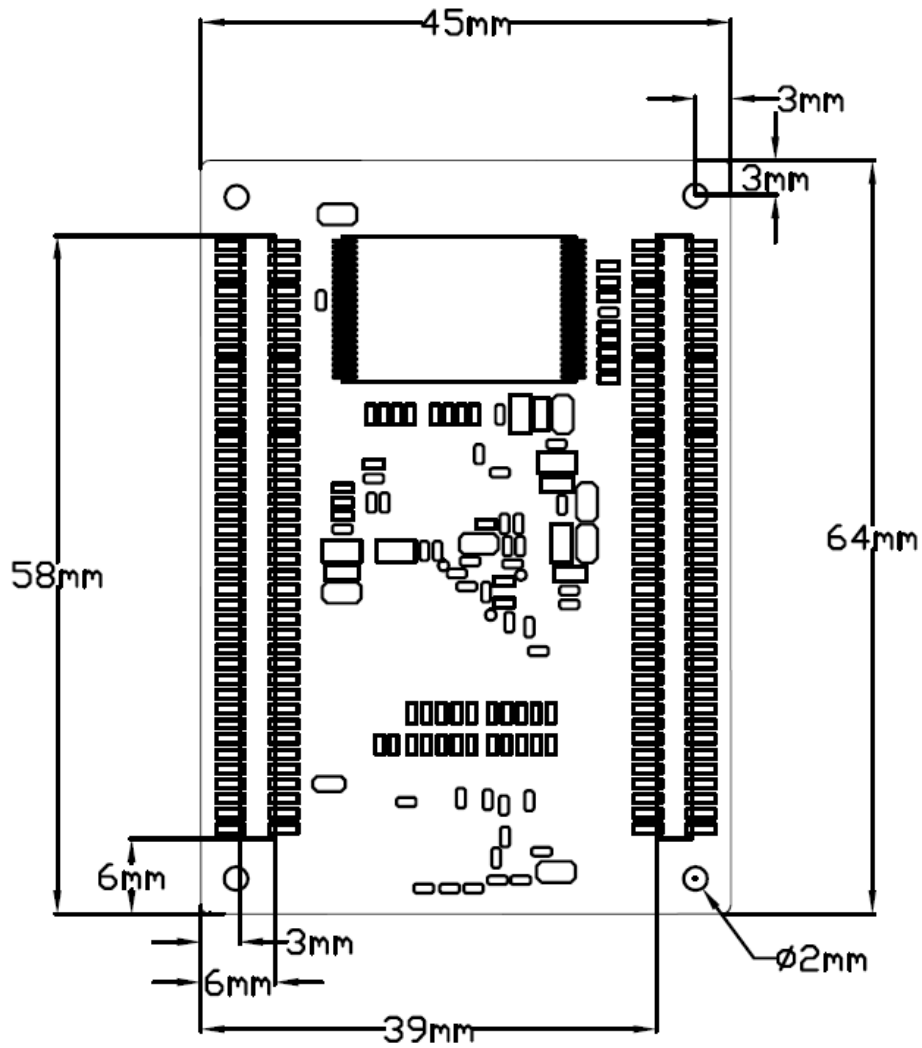
Figure 3: *Expansion Board Dimensions*

2 Hardware Features

2.1 Processor

2.1.1 Core

- Atmel AT91SAM9X35 32 bit processor running at up to 400MHz
- 16KB data cache, 16KB instruction cache, memory management unit

2.1.2 Memory

- 64KB internal ROM and 32KB internal SRAM
- High bandwidth multi-port DDR2 controller
- 32 bit external bus interface supporting 8-bank DDR2 memory and static memory
- MLC/SLC NAND controller, with up to 24-bit Programmable Multi-bit Error Correcting Code (PMECC)

2.1.3 Peripherals

- LCD controller supporting resolution of up to 800x600
- High speed USB device & host
- Full speed USB host with dedicated on-chip transceiver
- 10/100 Mbps Ethernet MAC controller
- Watchdog
- Two high speed memory card hosts
- Two CAN controllers
- Two SPI interfaces

- 6 channel 32 bit timers/counters

- SSC controller (I2S)

- 4 channel 16-bit PWM controller

- Three I2C interfaces

- Three USARTs, two UARTs

- 12 channel 10 bit ADC (for touchscreen)

- Software modem

2.1.4 Other

- I/O: Four 32-bit GPIOs, of which 105 programmable I/O lines are multiplexed with up to three peripheral I/Os
- Package: Surface-mount, 217 ball BGA with 0.8mm pitch

2.2 On-Board Memory

- 256MB NAND Flash

- 128MB SDRAM

- 4Kb EEPROM

- 4MB SPI Flash

2.3 On-Board Interfaces

- U63 Interface

- U64 Interface

- NAND Flash Interface (U43)

- SPI Flash Interface (MN7)

- EEPROM Interfaces (MN8)

2.4 Operational Parameters

- Operating Temperature: -10 °C ~ 70 °C

- Operating Humidity: 0% ~ 90% (Non-condensing)

- Power Supply: 3.3V, 1.25A

- Electrical Standards: CE, FCC and CCC

- PCB Layers: 6

- Product Dimensions: 64mmx45mm

3 Hardware Interfaces

3.1 U63 Interface

Pins	Names	Functions	Pins	Names	Functions
1	GND	GND	2	GND	GND
3	PB11	Touch Screen X+	4	PB12	Touch Screen X-
5	PB13	Touch Screen Y+	6	PB14	Touch Screen Y-
7	PB15	Isolate ISO_INPUT1	8	PB16	USB VBUS
9	PB17	BUZZER	10	PB18	GPIO for blue led
11	GND	GND	12	GND	GND
13	PC0	LCD B0	14	PC1	LCD B1
15	PC2	LCD B2	16	PC3	LCD B3
17	PC4	LCD B4	18	PC5	LCD B5
19	PC7	LCD B7	20	PC6	LCD B6
21	PC9	LCD G1	22	PC8	LCD G0
23	PC11	LCD G3	24	PC10	LCD G2
25	PC12	LCD G4	26	PC13	LCD G5
27	PC14	LCD G6	28	PC15	LCD G7
29	PC17	LCD R1	30	PC16	LCD R0
31	PC19	LCD R3	32	PC18	LCD R2
33	PC21	LCD R5	34	PC20	LCD R4
35	PC22	LCD R6	36	PC23	LCD R7
37	PC24	LCDDISP	38	PC25	PWR_EN
39	PC26	LCDPWM	40	PC27	VSYNC
41	PC29	LCDDEN	42	PC28	HSYNC
43	PC31	Audio XTI/MCLK	44	PC30	LCDPCK
45	GND	GND	46	GND	GND
47	PA0	TXD0	48	PA1	RXD0
49	PA2	RTS0	50	PA3	NULL
51	PA4	SW1 USER1	52	PA6	CANRX1
53	PA5	CANTX1	54	PA7	TXD2
55	PA8	RXD2	56	PA9	DRXD
57	PA10	DTXD	58	PA11	SPI0_MISO
59	PB0	ERX0	60	PA13	SPI0_SPCK
61	PB2	ERXER	62	PA14	SPI0_NPCS0
63	PB4	ETXCK	64	PA12	SPI0_MOSI
65	PB6	EMDC	66	PB1	ERX1
67	PB8	EMDINTR	68	PB3	ERXDV

Pins	Names	Functions	Pins	Names	Functions
69	PB9	ETX0	70	PB5	EMDIO
71	GND	GND	72	PB7	ETXEN
73	ETH0_TX-	DM9161 ETH0_TX-	74	PB10	ETX1
75	ETH0_TX+	DM9161 ETH0_TX+	76	AVDDT	DM9161 output voltage 1.8V
77	ETH0_RX-	DM9161 ETH0_RX-	78	ACT	DM9161 ACT
79	ETH0_RX+	DM9161 ETH0_RX+	80	ACT->LINK	DM9161 LINK

3.2 U64 Interface

Pins	Names	Functions	Pins	Names	Functions
1	GND	GND	2	GND	GND
3			4		
5			6		
7			8	VDDBU	VDDBU
9			10	JTAGSEL	NULL
11			12	WKUP	NULL
13			14	SHDN	NULL
15	PD14	SD WP Active	16		
17	PD16	Isolate ISO_INPUT2	18	PD17	Isolate ISO_INPUT3
19	PD18	Isolate IO_OUT1	20	PD19	Isolate IO_OUT2
21	PD20	Isolate IO_OUT3	22	PD21	Isolate IO_OUT4
23			24	GND	GND
25	GND	GND	26	GND	GND
27	HHSDMA	HHSDMA	28	HHSDMB	HHSDMB
29	HHSDPA	HHSDPA	30	HHSDPM	HHSDPM
31	GND	GND	32	GND	GND
33	GND	GND	34	GND	GND
35	DIBN	NULL	36	HHSDPC	NULL
37	DIBP	NULL	38	HHSDMC	NULL
39	GND	GND	40	GND	GND
41	GND	GND	42	NRST	NRST
43	TMS	NULL	44	NTRST	NULL
45	TDO	NULL	46	TDI	NULL
47	RTCK	NULL	48	TCK	NULL
49			50		
51	GND	GND	52	GND	GND

Pins	Names	Functions	Pins	Names	Functions
53	PA21	NULL (SPI1_MISO)	54	PA23	NULL(SPI1_MOSI)
55	PA22	NULL (SPI1_SPCK)	56	PA24	AUDIO BCLK
57	PA25	AUDIO DACLRC	58	PA26	AUDIO DACDAT
59	PA27	AUDIO ADCDAT	60	PA28	AUDIO BCLK
61	PA29	AUDIO ADCLRC	62	PA30	AUDIO SDIN
63	PA31	AUDIO SCLK	64	GND	GND
65	GND	GND	66	PA15	SD TF_DAT0
67	PA16	SD DCMD	68	PA17	SD CLK
69	PA18	SD TF_DAT1	70	PA19	SD TF_DAT2
71	PA20	SD CD/DAT3	72	PD15	SD Detect Active
73	GND	GND	74	GND	GND
75	GND	GND	76	GND	GND
77	VDD33_IN	VDD33V input	78	VDD33_IN	VDD33V input
79	VDD33_IN	VDD33V input	80	VDD33_IN	VDD33V input

3.3 NAND Flash Interface (U43)

Pins	Names	Functions
7	PD5	RD/BY
8	PD0	RE
9	PD4	CE
12	VDD33V	+3.3V power
13	GND	GND
16	PD3	CLE
17	PD2	ALE
18	PD1	WE
29	NADN_D0	D0
30	NADN_D1	D1
31	NADN_D2	D2
32	NADN_D3	D3
36	GND	GND
37	VDD33V	+3.3V power
38	GND	GND
41	NADN_D4	D4
42	NADN_D5	D5
43	NADN_D6	D6
44	NADN_D7	D7

3.4 SPI Flash Interface (MN7)

Pins	Names	Functions
1	PA14	Slave Select for SSP0
2	PA11	Master In Slave Out for SSP0
3	VDDIOP0	+3.3V power
4	GND	GND
5	PA12	Master Out Slave In for SSP0
6	PA13	Serial clock for SSP0
7	VDDIOP0	+3.3V power
8	VDDIOP0	+3.3V power

3.5 EEPROM Interfaces (MN8)

Pins	Names	Functions
1	VDDIOP0	+3.3V power
2	GND	GND
3	GND	GND
4	GND	GND
5	PA30	SDA
6	PA31	SCL
7	GND	GND
8	VDDIOP0	+3.3V power

4 Software Features

4.1 System Features

- Supports Linux 6.39

- Supports Linux QT GUI

- Supports multiple file systems including: ROM, CRAM, EXT2, EXT3, FAT, NFS, JFFS2, YAFFS2, and UBIFS

This chapter will briefly introduce the BSP package on the included CD-ROM.

4.2 BSP Packages

Types	Names	Descriptions
BIOS	Bootstrap	Serial Flash
	U-Boot	Serial Flash
		Supports kernel and file system programming through SAM-BA or USB flash drive (USB flash drive is recommended)
Kernel	Linux-2.6.39	ROM/CRAM/EXT2/EXT3/FAT/NFS/JFFS2/YAFFS2/UBIFS file systems
Device Drivers	RTC	Internal RTC of AT91SAM9X35
	Ethernet	10/100M Ethernet driver
	Flash	NAND Flash and DataFlash driver
	LCD	LCD driver, 800x480 resolution
	Touch Screen	Touchscreen controller on CPU
	USB Host	USB Host driver
	Watchdog	Built-in watchdog driver
	SD Card	SD card driver
	CAN Bus	1 CAN bus
	LED	1 system status LED
	Button	1 custom user button driver
	GPIO	GPIO driver, 3 input channels, 4 output channels
Root File System	UBIFS	Readable and writeable file system, supporting compression storage

4.3 Development Environment

The CD provided with the board contains an ARM Linux cross compiler:

"**arm-2007q1-10-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz 2**" under **\02 Linux2.6 kit\02 tools**. Please follow the steps below to install the cross compiler

1） The Ubuntu system should automatically mount the CD under **/media/cdrom**. Please execute the following commands to begin installation:

✎ `mkdir /usr/local/arm`

✎ `tar -jxvf`
`arm-2007q1-10-arm-none-linux-gnueabi-i686-pc-linux-gnu.tar.bz2`
`-C/usr/local/arm`

2） Execute the following instructions to add an environment variable which specifies the path to the cross-compiler in the system and check if it has been added successfully;

✎ `export PATH=/usr/local/arm/arm-2007q1/bin/:$PATH`

✎ `arm-none-linux-gnueabi-gcc -v`

The system prints feedback as shown below;

```
Using built-in specs.
Target: arm-none-linux-gnueabi
...
gcc version 4.2.0 20070413 (prerelease) (CodeSourcery Sourcery G++ Lite 2007q1-10)
```

If the version information contained in the last line is consistent, this indicates the installation has been completed successfully.

Note:

📖 The instruction adding environment variables can be put into the file .bashrc under user directory to allow the system load the variable automatically each time on boot up.

4.4 Kernel Customization

By default, the kernel source code provides a configuration file
"**at91sam9x5ek_defconfig"** saved under **arch/arm/configs/**. Please
execute the following instructions to enter the configuration menu and then
select the drivers you need according to the entries shown in the table
below.

- 🖉 `root@LINUXSERVER:~/embest/linux-2.6.30# make at91sam9x5ek_defconfig`

- 🖉 `root@LINUXSERVER:~/embest/linux-2.6.30# make menuconfig`

Drivers	Paths
Serial Interface	Device drivers > Character devices > Serial drivers > AT91 / AT32 on-chip serial port support
Buttons	Device drivers > Input device support > Keyboards > GPIO Buttons
GPIO	Device drivers > Misc devices > Device driver for Atmel GPIO devices
LED	Device drivers > LED Support > LED Class Support > LED Support for GPIO connected LEDs
SD/MMC	Device drivers > MMC/SD/SDIO card support > MMC block device driver > Atmel SD/MMC Driver (Atmel Multimedia Card Interface support)
USB	Device drivers > USB support > Support for Host-side USB > EHCI HCD (USB 2.0) support > OHCI HCD support > USB Mass Storage supportHCD support > USB Mass Storage support
RTC	Device drivers > Real Time Clock > AT91RM9200 or some AT91SAM9 RTC
Watchdog	Device drivers > Watchdog Timer Support > AT91SAM9 watchdog
CAN Bus	Networking support > CAN bus subsystem support > CAN Device Drivers > Atmel AT91 onchip CAN controller
MACB	Device drivers > Network device support > Ethernet(10 or 100Mbit) > Atmel MACB support
Graphics	Device drivers > Graphics support > Support for frame buffer devices > AT91/AT32 LCD Controller support
Touch-Screen	Input device support > Touchscreens > Atmel Touchscreen Interface

Save the changes and execute the instruction below to compile the
customized kernel

4.5 File System Customization

Configuration List	Paths	Notes
Driver Modules	/lib/modules/2.6.39/	Store driver module ko
Driver Module Mounting	/etc/init.d/S50modules	
Network Address	/etc/network/interfaces.eth0	
Command Line Prompt Name	/etc/hostname	
User Program Auto Running	/etc/init.d/S60evnset	Add it to the end of file
Environment Variables	/etc/profile	
Touch-Screen Coordinate Files	/etc/pointercal	
udev Rules	/etc/udev	
LCD Backlight Brightness	/etc/bl_adjust.conf	
User Testing Applications	/home/app	

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