i.MX31 SOM-LV Addendum to LogicLoader™ User's Manual
LogicLoader Documentation

Logic Product Development
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Abstract

This document contains information that addresses how LogicLoader runs specifically on the i.MX31 SOM-LV. As such, this document acts as a supplement to the *LogicLoader User's Manual*.

REVISION HISTORY

REV	EDITOR	REVISION DESCRIPTION	LogicLoader Version	APPROVAL	DATE
A	Peter Barada	Initial Release	2.3.1	MT	01/25/07
B	Jed Anderson	Figure 1.2 – added block numbers for the sections; corrected memory addresses Section 1.6 – added NAND flash memory block size information; updated commands required to create YAFFS partitions Added Section 2 Section 3.1 – changed SD/MMC support to "Y"; specified 399 MHz as the default clock frequency; added 64 MB to SDRAM support Section 4 – changed 'Fire Engine' to 'SOM'	2.4.0	SB	04/26/08
C	Jed Anderson	Figure 1.2 – corrected top LogicLoader address, was 0xA0004000 should be 0xA0040000; corrected top config block address, was 0xA0005000 should be 0xA0050000; Figure 1.3 – corrected top LogicLoader address, was 0xA0004000 should be 0xA0040000	2.4.0	EN	06/30/08

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1   i.MX31 SOM-LV Memory Map Diagrams

1.1   SDRAM Configuration

The i.MX31 SOM-LV is designed to accommodate SDRAM/DDRAM of different sizes. Under LogicLoader's default configuration, all memory installed is accessible. Please refer to Freescale's *MCIMX31 and MCIMX31L Multimedia Applications Processors Reference Manual* (document number: MCIMX31RM) for more information on the SDRAM controller.

1.2   MMU Remap: Physical Memory to Logical Memory

LogicLoader sets up the MMU to remap physical memory to logical memory. Type 'info cpu' at the losh prompt to see how LogicLoader remaps physical memory to logical memory. If you need to address a device outside of the default address map, use the 'remap' command to make additional address space accessible from within LogicLoader.

1.3   Physical Hardware Memory Map

i.MX31 SOM-LV Logical Memory Map during execution of LogicLoader for 128 MB of SDRAM

Address	Region
0xFFFFFFFF	Unused
0xB8005000	PCMCIA/CF
0xB8004000	Unused
0xB8001000	NAND Flash Controller
0xB8000000	Unused
0xB4200000	91C117 Ethernet Controller
0xB4100000	Unused
0xA0200000	NOR Flash (2 MB)
0xA0000000	Unused
0x88000000	SDRAM (128 MB)
0x80000000	Unused
0x53FC4000	LCD
0x53FC0000	Unused
0x43F94000	UART0
0x43F90000	Unused
0x20000000	SRAM
0x1FFFC000	Unused
0x00000000	

Figure 1.1: i.MX31 SOM-LV Hardware Memory Map

1.4   LogicLoader and the Configuration Block in Flash Memory

The i.MX31 SOM-LV comes with LogicLoader programmed into the SOM's resident NOR boot flash array (see Figure 1.2 below). LogicLoader resides in the first 4 blocks (0 to 3) of NOR flash. The optional Configuration Block may be added with the 'config CREATE' command; if added, the Configuration Block resides in block 4 of NOR flash.

TOP

Open for application, data, YAFFS, or operating system storage.

0xA0050000

Location of optional Configuration Block.
(This section consists of 1 block, numbered 4.)

0xA0040000

LogicLoader is resident in flash memory starting at address 0x0.
(This section consists of 4 blocks, numbered 0 to 3.)

0xA0000000
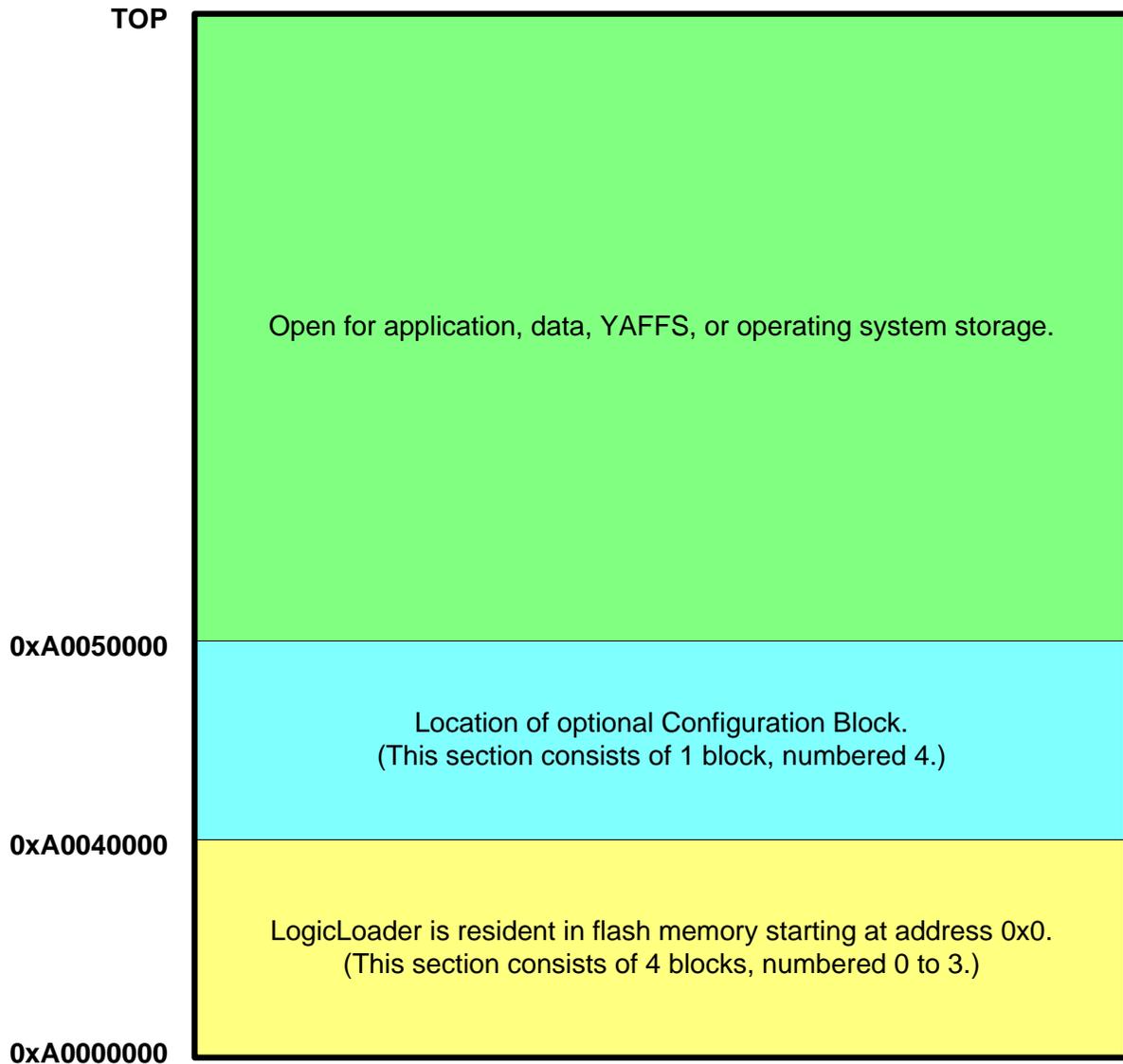
Figure 1.2: NOR Boot Flash Memory Layout

NAND memory (64 MB) can be used for YAFFS file systems, etc. However, the NAND device is only accessible through the NAND controller.

1.5   LogicLoader's Location in RAM

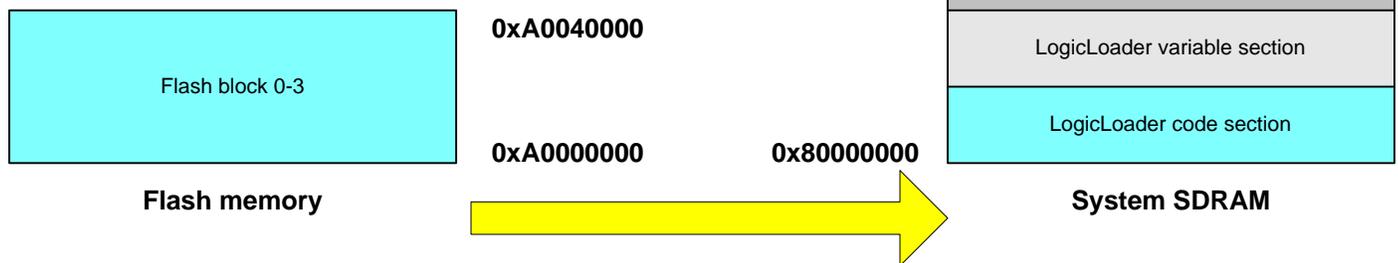Logic's LogicLoader bootloader executes out of SDRAM. The diagram below (see Figure 1.3) depicts the run-time location of LogicLoader. Refer to the Zoom *i.MX LITEKIT QuickStart Guide* for steps required to start LogicLoader.

Run-time location of LogicLoader:

At reset, LogicLoader relocates itself from flash memory to system SDRAM. LogicLoader then spends the remainder of its run-time executing out of system SDRAM.

Note: The size of LogicLoader's code and variable sections are estimates. This size depends on the exact features built into the LogicLoader image and may change with new releases. The location of LogicLoader's stack is dynamically determined at run-time based on the size of the code and variable section. Therefore, the location of the stack is provided as an estimate in this diagram.

0x87FFFFFF	Free RAM
0x800C0000	Heap and stack for use by LogicLoader
	LogicLoader variable section
0x80000000	LogicLoader code section

0xA0040000

Flash block 0-3

0xA0000000

Flash memory

System SDRAM

Figure 1.3: LogicLoader RAM Execution Environment

1.6 NAND Flash Support

The i.MX31 SOM-LV supports two types of flash memory: NOR and NAND. NOR flash is a contiguous memory device that is typically used for boot time code. NAND flash is a block device commonly used for bulk storage. Since NAND flash is a block device, a program typically cannot be executed directly out of NAND. Also, reading and writing to the device is more complicated than to a NOR flash device since the NAND memory is only accessible via the NAND controller. This is where LogicLoader's implementation of YAFFS is most useful.

On a standard configuration i.MX31 SOM-LV, the 64 MB of NAND flash contains 4,096 blocks, where each block is 16kB.

1.6.1 YAFFS Support of NAND Flash

YAFFS will manage where data is stored and read from within the NAND device, while also managing the bad block areas of the device. Most manufacturers of NAND devices only guarantee about 98% of the blocks to be free of bad bits. YAFFS will keep track of the bad blocks and replace them with blocks marked good. Also, bad blocks can develop over the lifetime of the device; YAFFS will detect and relocate those blocks as well.

1.6.2 Creating a YAFFS Partition in NAND Flash

LogicLoader uses two commands to configure the NAND device with YAFFS: 'part-add' and 'mount'. See *LogicLoader User's Manual* for more detailed information on creating YAFFS partitions in NAND flash. When using the 'part-add' command for a NAND device, the <start> and <length> fields refer to the start block and block length of the YAFFS partition. To determine the total number of blocks in the NAND device, type 'info mem' at the LogicLoader command prompt.

2   i.MX31 SOM-LV Core Frequency and Voltage

The release of LogicLoader 2.4.0 includes an important change in how Logic's software initializes the i.MX31 processor's core frequency and voltage. LogicLoader 2.4.0 reduces the default frequency from 532 MHz to 399 MHz and the default voltage from 1.6V to 1.45V; these reductions were made to avoid shortening the processor's life span as specified by Freescale. Logic chose to operate the core at 399 MHz and 1.45V since they represent the highest operating conditions that will not reduce the life of the processor.

2.1   Overdriving the Processor

If speed is more important to an application than product life, you can use LogicLoader's new command 'cpu-freq' to overdrive the processor by adjusting the frequency and voltage to higher settings.

Kits and modules built with i.MX31 processors using silicon revisions prior to 2.0 required the core voltage be set to 1.6V so that the USB high-speed ULPI interface could meet its required setup-time. This issue has been addressed in Freescale errata MSIIs20595 and Logic's *Product Change Notification PCN 351*. LogicLoader software will query the i.MX31's revision register and automatically overdrive the core voltage on pre-2.0 revision silicon to address the above erratum. If you intend to use the USB interface, take care in attempting to use the new 'cpu-freq' command so as not to inadvertently place the processor into a voltage mode that will conflict with the discussed erratum. In summary, modules built with pre-2.0 i.MX31 processors must remain in overdrive mode to address the USB ULPI setup-time issue. LogicLoader should properly recognize and address this situation automatically. However, please recognize that if you use the 'cpu-freq' command to change the core voltage and frequency on these early processors, ULPI timing issues may be introduced. SOMs built with pre-2.0 silicon have model number MIMX31CSOM.

2.2   Additional Information

For more information about how core operating frequency and voltage affects the life of the part, please see Freescale's "i.MX31 Data Sheet" document. To obtain this document, visit Freescale's main web page (http://www.freescale.com/), search for keywords "MCIMX31 Data Sheet", and the top return should be the PDF document. Most of the relevant information can be found in Table 8 "Operating Ranges" located in Section 4.1 "Chip-Level Conditions" (this location correlates to document Rev 3.4 10/2007).

3   i.MX31 SOM-LV LogicLoader Functionality

3.1   Supported Hardware Peripherals

The table below lists i.MX31 SOM-LV-specific peripherals supported by LogicLoader.

Hardware Peripheral	Support (Y/N)	Details
Audio	N	--
Display:	Y	LogicLoader supports 16 bits per pixel; custom displays can be supported by using the configuration block
LCD-3.5-QVGA-10	Y	Display kit with LCD part number LQ035Q7DB02
LCD-3.5-QVGA-20	Y	Display kit with LCD part number LQ035Q7DB02
LCD-3.6-QVGA-10	Y	Display kit with LCD part number LQ036Q1DA01
LCD-5.7-QVGA-10	Y	Display kit with LCD part number LQ057Q3DC02
LCD-6.4-VGA-10	Y	Display kit with LCD part number LQ64D343
LCD-10.4-VGA-10	Y	Display kit with LCD part number LQ10D368
LCD-12.1-SVGA-10	Y	Display kit with LCD part number LQ121S1DG41
Ethernet	Y	10/100MBit support; MAC address stored in the configuration block and 917C117 EEPROM
NOR Flash Memory	Y	--
NAND Flash Memory	Y	Using YAFFS
IrDA	N	--
Memory Card Expansion:	Y	CompactFlash memory cards are only supported. 16 -> 256 MB CompactFlash memory cards have been verified.
IO Mode PCMCIA/ CF	N	--
Memory Mode CF	Y	Recommended: SanDisk, Toshiba, PNY
SD/MMC	Y	Recommended: SanDisk (memory-mode only)
Smart Card	N	--
Processor:		
Cache	Y	16kB Instruction & Data cache
Clock	Y	399 MHz CPU (default frequency; see Section 2) / 133 MHz External Bus
Power Management	N	--
MMU	Y	--
PS/2	N	--
RTC	N	--
SDRAM	Y	64 and 128 MB DDR mode (automatically detected by LogicLoader)
SSP	N	--
Serial Port:		
UARTA	Y	115200 baud standard, RTS flow only; 2400 to 460800 baud can be supported by using the configuration block
UARTB	N	--
UARTC	N	--
CAN	N	--
Touch Screen	N	--
USB Host	N	--
USB OTG	N	--
Misc:		
GPIO	Y	Use 'w' and 'x' commands to access data direction and data registers to control GPIO lines per register description in Hardware Specification document.
Status	Y	Toggles to show system "heartbeat"

Note: If a peripheral is not mentioned on this list, it should be assumed there is no native support for it in LogicLoader besides the ability to read and write from registers.

4 Disclaimer

Logic strives to provide the most up to date information. However, the list of supported features in this document is partial and subject to change.

The "Supported Hardware Peripherals" list was created to describe the supported features for fully populated standard SOM builds. If the SOM in use is a custom build or has some hardware feature omitted, the commands related to those hardware features may not function.

If you need software support on demand, please contact Logic Product Development sales at: product.sales@logicpd.com.