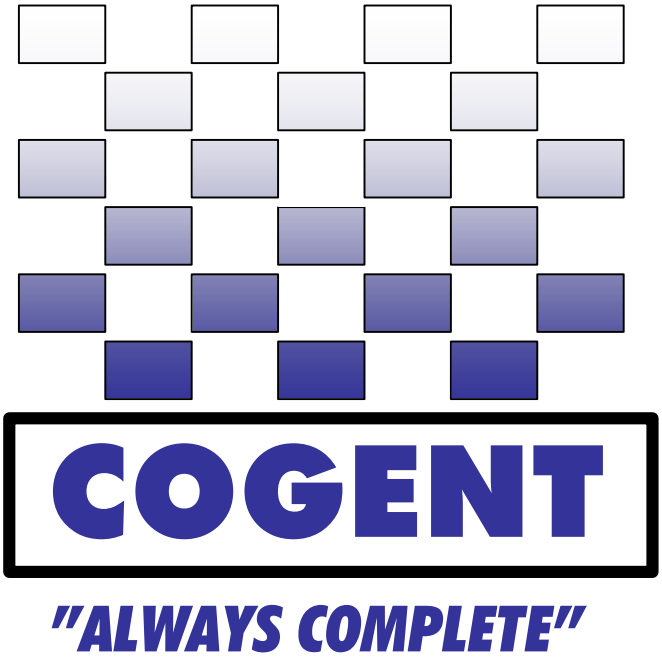


Cogent i.MX21 LiteKit for Freescale MC9328MX21

Hardware Reference Manual

Cogent Computer Systems, Inc.

Table of Contents

List of Tables

1 WARRANTY

The enclosed product ("the Product"), a part of the Cogent Modular Architecture or Cogent Single Board series, is warranted by Cogent Computer Systems, Inc. ("Cogent") for a period of six months for reasonable development testing and use, all as further described and defined below. This warranty runs solely to the individual or entity purchasing the Product and is not transferable or assignable in any respect. This warranty is valid only for so long as the product is used intact as shipped from Cogent. Any attempt or effort to alter the Product, including but not limited to any attempt to solder, desolder, unplug, replace, add or affix any part or component of or onto the Product, other than components specifically intended for the user to plug and unplug into appropriate sockets and/or connectors to facilitate user programming and development, all as specifically described and authorized in the Cogent Customer Product Users Manual, shall void this warranty in all respects. Coverage under this warranty requires that the Product be used and stored at all times in conditions with proper electrostatic protection necessary and appropriate for a complex electronic device. These conditions include proper temperature, humidity, radiation, atmosphere and voltage (standard commercial environment, 0C to +70C, <60%RH). Any Product that has been modified without the express, prior written consent of Cogent is not covered by this warranty. Cogent Single Board and Cogent Modular Architecture test and bus connectors are for use with Cogent adapters only. The use or connection of any test or bus connector, adapter or component with any device other than a Cogent connector or adapter shall void this warranty and the warranty of all other components, parts and modules connected to the rest of the system. Cogent shall not be responsible for any damage to the Product as a result of a customer's use or application of circuitry not developed or approved by Cogent for use on or in connection with the Product.

This warranty does not cover defects caused by electrical or temperature fluctuations or from stress resulting from or caused by abuse, misuse or misapplication of the Product. Any evidence of tampering with the serial number on the Product shall immediately void this warranty. This Product is not intended to be used on or embedded in or otherwise used in connection with any life sustaining or life saving product and this warranty is not applicable nor is Cogent liable in any respect if the Product is so used. Notwithstanding anything to the contrary herein, Cogent expressly disclaims any implied warranty of merchantability or implied warranty of fitness for a particular purpose in connection with the manufacture or use of the Product.

2 OVERVIEW

2.1 INTRODUCTION

The i.MX21 LiteLiteKit (CSB535FS CPU Module along with the companion CSB935FS Breakout Board) was designed and developed by Cogent Computer Systems, Inc. as a highly integrated Freescale MC9328MX21 Development LiteKit . The major features of the MC9328MX21 Development LiteKit are as follows:

- 200Mhz Freescale MC9328MX21 CPU with 16K I-Cache and 16K D-Cache
- 64Mbyte 32-Bit Wide SDRAM
- 8Mbyte 16-Bit Wide FLASH
- Ultra-Low Power CS8900a 10Mbit Ethernet Controller (on CSB935FS)
- 3.5" 240x320 QVGA TFT LCD with Integrated Touch Screen (on CSB935FS)
- RS-232 Buffer for Debug Serial Port (on CSB935FS)
- USB Device Interface (via USB Mini-B connector on CSB935FS)
- SD/MMC Controller (4-Bit) (socket on CSB935FS)
- Compact Flash Interface (socket and buffers on CSB935FS)
- Wolfson WM8731 Stereo Codec (on CSB935FS) with Line In, Line Out and Microphone In
- ADS7846E 4-Wire Touch Controller (on CSB935FS)
- On-Board Macraigor USBDemon JTAG Controller (via USB Mini-B on CSB535FS)
- Standard 20-Pin JTAG Header (on CSB935FS)

2.2 REFERENCE DOCUMENTS

Refer to the following documents for more detailed information regarding the major components of the i.MX21 LiteKit . In all cases, you should contact the manufacturer for the latest documentation (including errata) regarding these components.

1. *"Freescale® MC9328MX21 i.MX Integrated Portable System Processor"*, Reference Manual, MC9328MX21RM/D, Rev. 1.1 11/2004
2. *"3V Intel StrataFLASH Memory"* Datasheet, Order # 290667-006
3. Cirrus Logic "*CS8900a Product Data Sheet*", Order Number DS271PP3
4. Wolfson Microelectronics WM8731/WM8731L "*Portable Internet Audio Codec with Headphone Driver and Programmable Sample Rates*", Product Data Sheet, April 2004, Rev. 3.4
5. Texas Instruments ADS7846E "*Touch Screen Controller*", Datasheet, SBAS125G, June 2003

3 ON BOARD DEVICES

3.1 CSB535FS ADDRESS MAP

The following table describes the Address Map of the i.MX21 LiteKit . Refer to the MC9328MX21 documentation for information regarding on-chip peripheral addressing.

CPU Chip Select	Chip Select Width	Wait States	Address Start	Address End	Description
*SDCS0	32	N/A	0xC000.0000	0xC3FF.FFFF	64Mbyte SDRAM
*CS0	16	10	0xC800.0000	0xC8FF.FFFF	8Mbyte StrataFlash
*CS1	16	DTACK	0xCC00.0000	0xC1FF.FFFF	CS8900a Ethernet Controller
*CS2	-	-	-	-	Pin assigned to *SDCS0
*CS3	-	-	-	-	Not Available
*CS4	-	-	-	-	Not Available
*CS5	16	8	0x1400.0000	0x17FF.FFFF	Compact Flash Socket via CPLD

Table 1 – CSB535FS Address Map

3.2 8/16/32MBYTE STRATAFLASH

The i.MX21 LiteKit uses an Intel StrataFlash 28F640 device (or equivalent) for boot memory. CS0 must be set to 16-bits width (this is the default on reset using hardware strapping) and 10 wait states (the default is 64 wait states after reset).

3.3 64MBYTE SDRAM

The i.MX21 LiteKit uses two 16Mx16, PC100 or faster SDRAM devices for system memory. The specifications of these devices provides for 100Mhz operation. The maximum setting is 99.5Mhz allowing CAS Latency 2 and RAS to CAS 2 modes to be set. Refer to the MC9328MX21 User Manual for more information on programming the SDRAM Memory Controller. Note that the default (and only supported) setting by the boot monitor is 60Mhz.

3.4 CIRRUS LOGIC CS8900A ETHERNET CONTROLLER

The i.MX21 LiteKit uses the CS8900a to provide a 10Mbit Ethernet Interface. This device is mapped to CPU Chip Select 1. In addition, the interrupt output of the CS8900a is connected to CPU GPIO PE2.

CS8900a Interface Notes:

1. The CS8900a is connected to *CS2 as a 16-bit wide device with 10 wait states minimum and DTACK enabled.
2. GPIO PE2 is connected to the CS8900a Interrupt output 0 (*IRQ0). The CS8900a Interrupt is a low true, level output.

3.5 ADS7846E 4-WIRE TOUCH CONTROLLER

The ADS7846E provides the i.MX21 LiteKit with a 4-wire Touch Screen interface. The CPU communicates with the ADS7846E via the standard SPI bus.

ADS7846E Interface Notes:

1. The ADS7846E is connected the MC9328MX21 using the built in SPI port.
2. GPIO PD29 (CSPI_SS0) is used as SPI Chip Select.
3. The ADS7846E interrupt output is connected to GPIO PE1. This interrupt output is a low true, level output.
4. Software is responsible for assigning the associated GPIO signals to SPI use. They are PD28 to PD31.

3.6 WOLFSON MICROELECTRONICS WM8731 I2S CODEC

The Wolfson WM8731 provides the i.MX21 LiteKit with a 20-Bit Audio Codec. It supports Stereo Line in, Stereo Line out (which can also drive a headphone) and Microphone in

WM8731 Interface Notes:

1. GPIO PC20 to PC27 must be programmed for SSI Function, I2S Mode. SSI2 is used for the transmit (DAC) function, while SSI1 is used for the receive (ADC) function.
2. The WM8731 uses the I2C interface for control. GPIO PD18 (SDA) and PD17 (SCL) are used for this function. Note that they can be used as bit bang I2C or they may be programmed to the MC9328MX21 I2C Controller function.

3.7 GPIO LED'S AND SWITCHES

Two Yellow LED's are located on the CSB535FS CPU Module along with two pushbutton switches. The LED's are assigned to GPIO PC14 (LED0) and PC15 (LED1), while the switches are assigned to PA22 (USR_SW0) and PA23 (USR_SW1). A low to the LED will turn the LED on. The switches will drive the associated GPIO low when pressed. Note that there is no de-bouncing in hardware for the switches.

3.8 I2C LED'S AND SWITCHES

A Phillips PCA9554 I2C GPIO Expander is provided to interface to four red LED's and four pushbutton switches on the CSB935FS. The I2C address of the PCA9554 is 0x20. Refer to the schematic for the pin assignments. CPU GPIO PE0 will go low also whenever any one of the switches is pressed. As with the GPIO switches, there is no hardware de-bouncing circuitry.

3.9 3.5" QVGA TFT LCD WITH TOUCH

A 3.5" Portrait Mode QVGA LCD provides the i.MX21 LiteKit with a low power, transflective LCD display with touch overlay, similar to that used on commercial PDA's. This allows the user to develop graphical user interfaces for a wide variety of end applications. Refer to the Micromonitor source code (MC9328MX21_lcd.c) for detailed programming and setup examples. Additionally, the schematic will show the necessary interface to this display.

4 MC9328MX21 ON-CHIP I/O DEVICES

4.1 OVERVIEW

The MC9328MX21 has a number of on-chip peripheral devices as well as a number of user defined control lines. While it is beyond the scope of this document to provide detailed programming and interfacing information for the MC9328MX21 on-chip peripherals, the following section describes the assignments for these devices and control lines as implemented on the CSB535FS and on the CSB935FS breakout. Note that unused peripherals or GPIO are not made available on the CSB535FS connectors. They are simply unconnected.

4.2 MC9328MX21 CHIP SELECTS

As described in Section 3.1, the MC9328MX21 Chip Selects are used to enable the various peripheral devices on the i.MX21 LiteKit . As a cross-reference they are described again in the following table.

Chip Select	Attached Device(s)	Notes
*CS0	StrataFLASH	Boot Device
*CS1	CS8900a	Ethernet Controller
*CS2	Used as *SDCS0	SDRAM
*CS3	Not Available	
*CS4	Not Available	
*CS5	Compact Flash	Via CPLD

Table 2 – MC9328MX21 Chip Select Assignments

4.3 MC9328MX21 GENERAL PURPOSE I/O PORT PIN ASSIGNMENTS

The MC9328MX21 has six General Purpose I/O ports (A to F). The GPIO usage on the i.MX21 LiteKit is described in the following tables. Note that it is the responsibility of software to setup these bits for the correct direction and default state as well as the assignment of alternate functions.

GPIO Port A			
Bit	DIR	Usage	Alternate Functions/Notes
PA1	-	-	Unavailable
PA2	-	-	Unavailable
PA3	-	-	Unavailable
PA4	-	-	Unavailable
PA5	Out	LCD_PCLK	LCD Pixel Clock
PA6	Out	LCD_B1	LCD Blue Bit 1 (LSB)
PA7	Out	LCD_B2	LCD Blue Bit 2
PA8	Out	LCD_B3	LCD Blue Bit 3
PA9	Out	LCD_B4	LCD Blue Bit 4
PA10	Out	LCD_B5	LCD Blue Bit 5 (MSB)
PA11	Out	LCD_G0	LCD Green Bit 0 (LSB)
PA12	Out	LCD_G1	LCD Green Bit 1
PA13	Out	LCD_G2	LCD Green Bit 2
PA14	Out	LCD_G3	LCD Green Bit 3
PA15	Out	LCD_G4	LCD Green Bit 4
PA16	Out	LCD_G5	LCD Green Bit 5 (MSB)
PA17	Out	LCD_R1	LCD Red Bit 1 (LSB)
PA18	Out	LCD_R2	LCD Red Bit 2
PA19	Out	LCD_R3	LCD Red Bit 3
PA20	Out	LCD_R4	LCD Red Bit 4
PA21	Out	LCD_R5	LCD Red Bit 5 (MSB)
PA22	In	USR_SW0	User Switch 0 (0 = switch pressed)
PA23	In	USR_SW1	User Switch 1 (0 = switch pressed)
PA24	In	*CF_CD	Compact Flash Card Detect (0 = Card in)
PA25	Out	CF_RST	Compact Flash Reset (1 = reset card)
PA26	In	CF_RDY	Compact Flash Ready/Busy (1 = ready)
PA27	Out	CF_VEN	Compact Flash Voltage Enable (1 = on)
PA28	Out	LCD_HSYNC	LCD Horizontal Sync

GPIO Port A			
Bit	DIR	Usage	Alternate Functions/Notes
PA29	Out	LCD_VSYNC	LCD Vertical Sync
PA30	Out	LCD_CONT	LCD Auxiliary Voltages Enable, 1 = on
PA31	Out	LCD_DOE	LCD Output Enable

Table 3 – MC9328MX21 GPIO Port A Pin Assignments

GPIO Port B			
Bit	DIR	Usage	Alternate Functions/Notes
PB4	-	-	Unavailable
PB5	-	-	Unavailable
PB6	-	-	Unavailable
PB7	-	-	Unavailable
PB8	-	-	Unavailable
PB9	-	-	Unavailable
PB10	-	-	Unavailable
PB11	-	-	Unavailable
PB12	-	-	Unavailable
PB13	-	-	Unavailable
PB14	-	-	Unavailable
PB15	-	-	Unavailable
PB16	-	-	Unavailable
PB17	-	-	Unavailable
PB18	-	-	Unavailable
PB19	-	-	Unavailable
PB20	-	-	Unavailable
PB21	-	-	Unavailable
PB22	Out	USBH_MOD	USB Host Transceiver Mode: 1 = Differential, 0 = Single Ended
PB23	Out	*USBH_PWR	USB Host Power Enable (unused)

GPIO Port B			
Bit	DIR	Usage	Alternate Functions/Notes
PB24	In	*USBH_OC	USB Host Over Current (unused)
PB25	Out	USBH_SUSP	Suspend to USB Host Transceiver
PB26	Out	USBH_SPD	USB Host Speed: 1 = 12Mbit, 0 = 1Mbit
PB27	Out	*USBH_OE	Transmit Output Enable to USB Host Transceiver
PB28	Out	USBH_VMO	Transmit Minus to USB Host Transceiver
PB29	Out	USBH_VPO	Transmit Plus to USB Host Transceiver
PB30	Out	USBH_VM	Receive Minus from USB Host Transceiver
PB31	Out	USBH_VP	Receive Plus from USB Host Transceiver

Table 4 – MC9328MX21 GPIO Port B Pin Assignments

GPIO Port C			
Bit	DIR	Usage	Alternate Functions/Notes
PC5	Out	USBD_EN	USB Device Transceiver Enable
PC6	Out	USBD_MOD	USB Device Transceiver Mode: 1 = Differential, 0 = Single Ended
PC7	Out	USBD_SUSP	Suspend to USB Device Transceiver
PC8	Out	USBD_SPD	USB Device Speed: 1 = 12Mbit, 0 = 1Mbit
PC9	Out	*USBD_OE	Transmit Output Enable to USB Device Transceiver
PC10	Out	USBD_VMO	Transmit Minus to USB Device Transceiver
PC11	Out	USBD_VPO	Transmit Plus to USB Device Transceiver
PC12	Out	USBD_VM	Receive Minus from USB Device Transceiver
PC13	Out	USBD_VP	Receive Plus from USB Device Transceiver
PC14	Out	*USR_LED0	User LED 0 (0 = on)
PC15	Out	*USR_LED1	User LED 1 (0 = on)
PC16	-	-	Unavailable
PC17	-	-	Unavailable

GPIO Port C			
Bit	DIR	Usage	Alternate Functions/Notes
PC18	-	-	Unavailable
PC19	-	-	Unavailable
PC20	Out	SSI1_FS	Receive Frame Sync to I2S Codec
PC21	In	SSI1_RXD	Receive Audio Data from I2S Codec
PC22	Out	SSI1_TXD	SSI1 Transmit Data (unused)
PC23	In	SSI1_CLK	Receive Data Clock from I2S Codec
PC24	Out	SSI2_FS	Transmit Frame Sync to I2S Codec
PC25	Out	SSI2_RXD	SSI2 Receive Data (unused)
PC26	Out	SSI2_TXD	Transmit Audio Data to I2S Codec
PC27	In	SSI2_CLK	Transmit Data Clock from I2S Codec
PC28	-	-	Unavailable
PC29	-	-	Unavailable
PC30	-	-	Unavailable
PC31	-	-	Unavailable

Table 5 – MC9328MX21 GPIO Port C Pin Assignments

GPIO Port D			
Bit	DIR	Usage	Alternate Functions/Notes
PD17	I/O	I2C_SDA	I2C Data
PD18	I/O	I2C_SCL	I2C Clock
PD19	-	-	Unavailable
PD20	-	-	Unavailable
PD21	-	-	Unavailable
PD22	-	-	Unavailable
PD23	-	-	Unavailable
PD24	-	-	Unavailable
PD25	In	*SD_CD	SD/MMC Card Detect (0 = Card in)
PD26	In	SD_WP	SD/MMC Write Protect (0 = Protected)

GPIO Port D			
Bit	DIR	Usage	Alternate Functions/Notes
PD27	Out	SD_VEN	SD/MMC Voltage Enable (1 = on)
PD28	Out	SPI_CS	SPI Chip Select (low true) to ADS7846E
PD29	Out	SPI_CLK	SPI Clock to ADS7846E
PD30	In	SPI_DIN	SPI Data In from ADS7846E
PD31	Out	SPI_DOUT	SPI Data Out to ADS7846E

Table 6 – MC9328MX21 GPIO Port D Pin Assignments

GPIO Port E			
Bit	DIR	Usage	Alternate Functions/Notes
PE0	-	-	Unavailable
PE1	-	-	Unavailable
PE2	-	-	Unavailable
PE3	-	-	Unavailable
PE4	-	-	Unavailable
PE5	-	-	Unavailable
PE6	-	-	Unavailable
PE7	-	-	Unavailable
PE8	-	-	Unavailable
PE9	-	-	Unavailable
PE10	-	-	Unavailable
PE11	-	-	Unavailable
PE12	Out	USB_SCON	1 = Enable USB Device for 12Mbit
PE13	In	*USB_CD	1 = USB Device Cable Detected
PE14	In	U1_RXD	Debug UART Receive
PE15	In	U1_TXD	Debug UART Transmit
PE16	-	-	Unavailable
PE17	Out	*RST_OUT	MX21 Reset Output
PE18	I/O	SD_D0	SD/MMC Interface Data Bit 0

GPIO Port E			
Bit	DIR	Usage	Alternate Functions/Notes
PE19	I/O	SD_D1	SD/MMC Interface Data Bit 1
PE20	I/O	SD_D2	SD/MMC Interface Data Bit 2
PE21	I/O	SD_D3	SD/MMC Interface Data Bit 3
PE22	Out	SD_CMD	SD/MMC Interface Command Bit
PE23	Out	SD_CLK	SD/MMC Interface Clock Bit

Table 7 – MC9328MX21 GPIO Port E Pin Assignments

GPIO Port F			
Bit	DIR	Usage	Alternate Functions/Notes
PF0	-	-	Unavailable
PF1	-	-	Unavailable
PF2	-	-	Unavailable
PF3	-	-	Unavailable
PF4	-	-	Unavailable
PF5	-	-	Unavailable
PF6	-	-	Unavailable
PF7	-	-	Unavailable
PF8	-	-	Unavailable
PF9	-	-	Unavailable
PF10	-	-	Unavailable
PF11	-	-	Unavailable
PF12	-	-	Unavailable
PF13	-	-	Unavailable
PF14	-	-	Unavailable
PF15	Out	CLK_OUT	Bus Clock Out (~60Mhz)
PF16	-	-	Unavailable
PF17	-	-	Unavailable
PF18	-	-	Unavailable

GPIO Port F			
Bit	DIR	Usage	Alternate Functions/Notes
PF19	-	-	Unavailable
PF20	-	-	Unavailable
PF21	In	*DTACK	Data Acknowledge from CS8900a and Compact Flash (0 = data ready)
PF22	Out	*CS4	Chip Select 5 (Compact Flash via CPLD)
PF23	-	-	Unavailable

Table 8 – MC9328MX21 GPIO Port F Pin Assignments

4.4 MC9328MX21 INTERRUPT PIN ASSIGNMENTS

The MC9328MX21 has a number of GPIO's that are, or can be used as interrupt inputs to the ARM9 Interrupt Controller. The following table describes the GPIO that are used as interrupts on the i.MX21 LiteKit . User software is required to enable the interrupt function for any signal.

GPIO Bit	Source	Notes
PA22	*USR_SW0	User Pushbutton Switch 0
PA23	*USR_SW1	User Pushbutton Switch 1
PA24	*CF_CD	CF Card Detect (0 = card in)
PA26	CF_RDY	CF Ready/Busy – Polarity depends upon the mode the CF card is in.
PD25	*SD_CD	SD/MMC Card Detect (0 = card in)
PE0	*I2C_INT	PCA9554 GPIO Expander Interrupt, 0 = active
PE1	*PIRQ	ADS7846E Touch Controller Interrupt, 0 = active
PE2	*E_INT	CS8900a Interrupt, 0 = active
PE13	*USB_CD	USB Cable Detect (1 = USB Device Cable In and powered)

Table 9 – CSB535FS/CSB925 Interrupt Pin Assignments

4.5 MC9328MX21 DEBUG UART

The MC9328MX21 UART 1 is used as the debug UART on the i.MX21 LiteKit . This UART is buffered with an RS-232 Transceiver (TXD and RXD only) and brought to the DB-9. Software must assign the appropriate GPIO pins (PE12 = TXD, PE13 = RXD) to the UART 1 function. Refer to the MC9328MX21 Users Manual for more information about the MC9328MX21 UARTS.

4.6 MC9328MX21 SPI CONTROLLER

The MC9328MX21 provides a high-speed, Serial Peripheral Interface (SPI) controller. This port is used to interface with the ADS7846E Touch Controller. Refer to the MC9328MX21 Users Manual for detailed programming information.

4.7 MC9328MX21 I2C INTERFACE

The MC9328MX21 has a full speed (100Khz/400Khz), master/slave I2C Serial Controller. The controller is fully compatible with the industry standard I2C and SMBus Interfaces. For simplicity, the I2C pins may also be programmed as GPIO (PD18 = SDA, PD17 = SCL). This allows simple “Bit Banging” control of I2C peripherals without setting up the MC9328MX21 I2C Controller

4.8 MC9328MX21 4-BIT SD/MMC CONTROLLER

The MC9328MX21 has a high-speed 4-Bit Secure Digital (SD/MMC) controller. This controller can interface with MMC, SD and SDIO Cards with minimal host intervention. The internal MC9328MX21 DMA controller can be used to transfer data between the SD/MMC Socket on the i.MX21 LiteKit and system memory for very high data rates. The SD/MMC clock can be programmed up to 20Mhz. On the i.MX21 LiteKit two GPIO’s are used to indicate SD Card Detect (GPIO PD25, 0 = card inserted) and SD Write Protect (GPIO PD26, 0 = Write Protected). Additionally, GPIO PD27 controls power to the socket. When 1, power is driven to the SD/MMC socket. A 0 disables the socket. Refer to the MC9328MX21 Users Manual for detailed programming information on the SD/MMC Controller.

4.9 MC9328MX21 COMPACT FLASH

The MC9328MX21 supports the Compact Flash using a CPLD to generate the proper timing signals. On the i.MX21 LiteKit , several GPIO’s are used to support the Compact Flash. They are shown in the following table.

GPIO	Source	Notes
PA26	CSB925 - CF RDY/BSY	Polarity depends upon the mode the Compact Flash card is in

GPIO	Source	Notes
PA27	CSB925 – CF Power Enable	1 = On
PA24	CSB925 - CF Card Detect	0 = Card Present
PA25	CSB925 – CF Reset	High True

Table 10 – Compact Flash GPIO Assignments

4.10 MC9328MX21 USB DEVICE PORT

The MC9328MX21 has a single, USB1.1 compliant Device Port. An on-board USB Transceiver provides the physical interface. In addition, two GPIO's are used for host notification and host detect. GPIO PC10 drives the USB D+ line via a 1.5K-ohm resistor. When the USB device port is connected to a USB host, software can indicate to the host that a device is present by driving GPIO PE15 high. This indicates to the host both the presence of a USB device and that the device is 12Mbit capable. This also allows the MC9328MX21 USB Device software to delay recognition by the Host until it is ready. Also, GPIO PE14 goes high when the USB device port is connected to, and powered from, a USB Host. This allows the USB device software to recognize when it is actually connected to a host. Refer to the MC9328MX21 Users Manual for detailed programming information.

4.11 TFT LCD CONTROLLER

The MC9328MX21 contains a built in LCD controller. On the i.MX21 LiteKit , this is connected to the 3.5" 240x320 LCD. It is beyond the scope of this document to provide complete programming information. Please refer to the Micromonitor source code for an example of how to initialize and setup the LCD controller for the 3.5" LCD. Refer to the MC9328MX21 Users Manual for more detailed information.

There are 3 GPIO's used in the interface to the 3.5" (or other) LCD. GPIO PA2 is used as the backlight control. A 1 will enable the LED backlight contained in the LCD, while a 0 will shut it off. Note that the alternate function of GPIO PE5 is PWM0 (Pulse Width Modulator 0). This allows the LED backlight intensity to be varied from full on to full off. GPIO PA30 controls the auxiliary voltages (+12V and –6.5V), if any. Again, a one will enable them while a 0 will turn them off. The control for the auxiliary voltages is separate from the main voltages due the power-sequencing requirement of the LCD panel. Again, refer to the Micromonitor source code for an example of this.

5 POWER AND JTAG

5.1 OVERVIEW

The i.MX21 LiteKit has a high efficiency 3.3V-switching regulator located on the CPU Module (CSB5365FS. Additionally the module can be powered in stand-alone mode via the USBDemon connector on the CPU Module.

5.2 3.3V SWITCHING REGULATOR

On board the CSB535FS is a high efficiency (90%+), high power, switching regulator. It is designed to accept a wide input voltage range of +5V to +15V. It produces 4.5 Amps of current, of which a minimum of 3 Amps is available to the CSB935FS breakout board.

3.3V Regulator Notes:

1. The optimal input voltage range for the regulator is 12V +/- 2V, which achieves an efficiency of 90%+. Otherwise the efficiency drops to approximately 80%.
2. When powered in stand-alone mode from the USBDemon connector, the regulator is provided with 5V +/- 10%. In this mode the maximum output current is limited by the input power of ~2.4W x 80% = 3.3V @ 580ma.
3. Power in stand-alone or in LiteKit mode is provided via the 1.3mm power jack on the CPU Module. Input voltage should be limited to +5V to +15V. Although the input can be unregulated it must be DC.
4. The USBDemon circuitry uses a low drop out (LDO) regulator to power from the input voltage. The current draw is ~50ma. At the maximum voltage (15V), the LDO dissipates 500mw which is it's maximum.

5.3 MACRAIGOR USBDEMON

On board the CPU Module is the Macraigor USBDemon JTAG interface. A USB Mini-B type connector is used to interface the USBDemon to the Host computer. Refer to the USBDemon Users Manual for detailed information on using the USBDemon JTAG interface.

Note that the i.MX21 LiteKit contains a standard 20-pin JTAG header on the breakout board as well. This may be used instead of the USBDemon interface. In that case, DO NOT CONNECT the USBDemon cable and an external JTAG controller to the 20-Pin header simultaneously.

6 CSB535FS SOFTWARE

6.1 OVERVIEW

Due to the various resources contained on the CSB535FS (and CSB925), both on and off the MC9328MX21, it is necessary to initialize a large number of MC9328MX21 registers and external devices before correct operation can begin. These values and their proper sequencing are beyond the scope of this document. The Micromonitor source code should be referred to as the best guide.

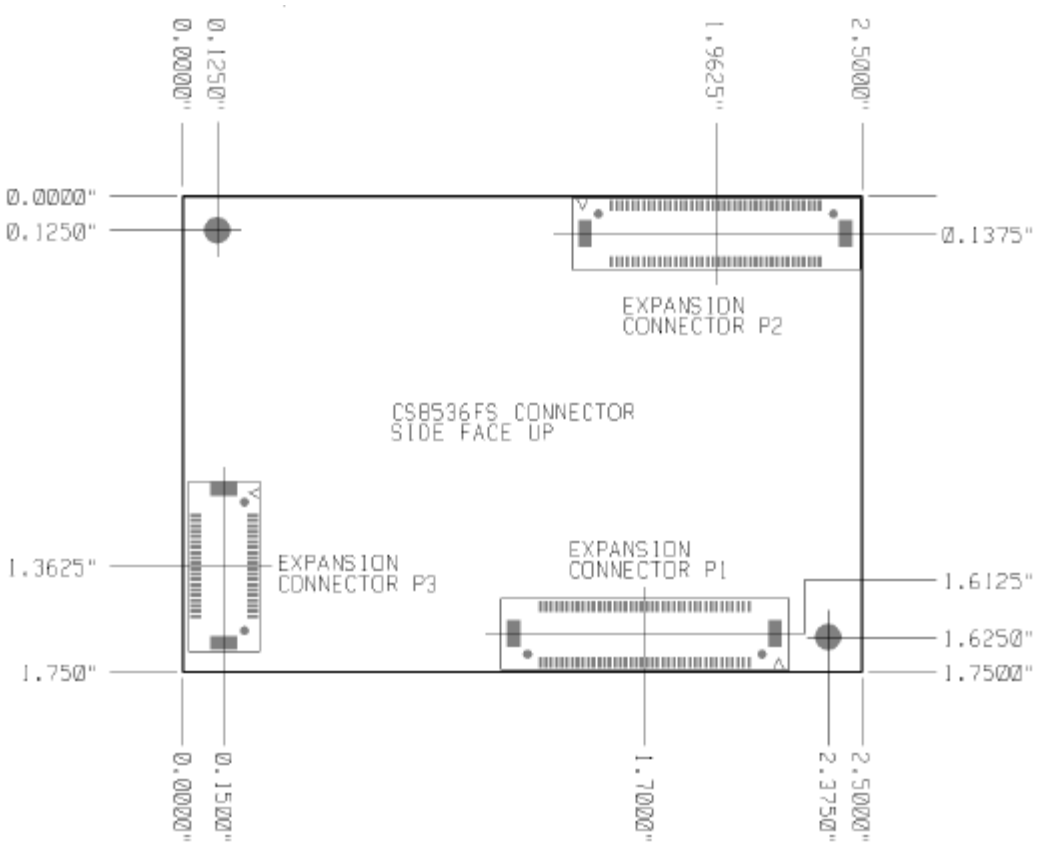
7 CSB535FS CPU MODULE CONNECTORS, LED'S AND SWITCHES

7.1 OVERVIEW

This section provides the locations and pinouts of the various connectors on the i.MX21 LiteKit CPU Module.

7.2 CSB535FS EXPANSION CONNECTOR

The following diagram shows the location of the Expansion Connectors and the mounting holes on the CSB535FS. The mounting holes are .100" in diameter.



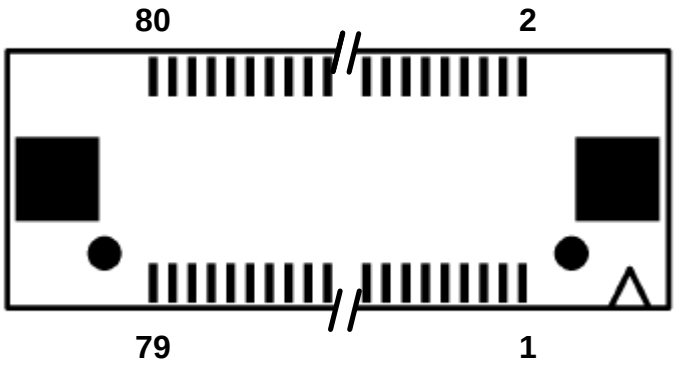
7.3 CSB535FS EXPANSION CONNECTORS

P1 and P2 are 80-Pin, low profile, SMT connectors, Hirose part number DF17(3.0)-80DS-0.5V. P3 is 40-Pin, low profile, SMT connector, Hirose part number DF17(3.0)-40DS-0.5V. There are two mating connector heights that can be placed on the target board. They result in the following board-to-board and overall heights (the CSB935FS uses the 4.0):

Mating Connector (xx = 40 or 80)	Board-Board Height	Overall Height	Component Clearance
DF17(2.0)-xxDP-0.5V	5.0mm	9.0mm	1.0mm
DF17(4.0)-xxDP-0.5V	7.0mm	11.0mm	3.0mm

Table 11 - Expansion Connector Mating Height Table

The orientation of the Target board connectors is shown in the following drawing. The "V" in the silkscreen indicates Pin 1. 80-Pin size is shown.



7.4 CSB535FS EXPANSION CONNECTOR PINOUTS

The following tables describe the pinouts of the four expansion connectors. The signal name shown is the MC9328MX21 signal name unless otherwise indicated.

Expansion Connector P1			
Pin	Signal	Pin	Signal
1	Ground	2	Ground
3	Ground	4	Ground
5	Ground	6	Ground
7	Ground	8	Ground
9	USB Device D-	10	USB Host D-
11	USB Device D+	12	USB Host D+

Expansion Connector P1			
Pin	Signal	Pin	Signal
13	Ground	14	Ground
15	Ground	16	I2C_SCL
17	SPI_DIN	18	SSI2_TXD
19	SD_VEN	20	I2C_SDA
21	-	22	Ground
23	Ground	24	SSI1_CLK
25	SSI2_CLK	26	Ground
27	Ground	28	SSI2_FS
29	SSI1_RXD	30	*SD_CD
31	SSI1_TXD	32	LCD_DOE
33	SSI1_FS	34	LCD_CONT
35	Ground	36	LCD_HSYNC
37	SPI_CLK	38	CF_RDY
39	Ground	40	*CF_CD
41	UART1_RXD	42	LCD_R4
43	*USBH_PWR	44	LCD_R1
45	*USBH_OC	46	LCD_R2
47	LCD_VSYNC	48	LCD_G0
49	LCD_G5	50	LCD_G4
51	LCD_G1	52	LCD_G2
53	LCD_R3	54	LCD_B2
55	CF_RST	56	LCD_B4
57	LCD_R5	58	LCD_B3
59	CF_VEN	60	LCD_B1
61	Ground	62	LCD_G3
63	LCD_PCLK	64	LCD_B5
65	Ground	66	CPU ADDRESS 20
67	CPU ADDRESS 19	68	CPU ADDRESS 18

Expansion Connector P1			
Pin	Signal	Pin	Signal
69	CPU ADDRESS 17	70	CPU ADDRESS 16
71	CPU ADDRESS 14	72	CPU ADDRESS 15
73	+3.3V	74	+3.3V
75	+3.3V	76	+3.3V
77	+3.3V	78	+3.3V
79	+3.3V	80	+3.3V

Table 12 – P1, Expansion Connector 1 Pinout

Expansion Connector P2			
Pin	Signal	Pin	Signal
1	Ground	2	Ground
3	Ground	4	Ground
5	Ground	6	Ground
7	Ground	8	Ground
9	CPU CLKOUT	10	-
11	Ground	12	CPU ADDRESS 9
13	CPU ADDRESS 13	14	CPU ADDRESS 10
15	CPU ADDRESS 11	16	CPU ADDRESS 7
17	CPU ADDRESS 12	18	CPU ADDRESS 8
19	CPU DATA 15	20	CPU ADDRESS 5
21	CPU DATA 14	22	CPU ADDRESS 6
23	CPU DATA 13	24	CPU DATA 11
25	CPU ADDRESS 3	26	*EB1
27	CPU ADDRESS 4	28	CPU ADDRESS 2
29	CPU DATA 12	30	*EB0
31	*EB3	32	CPU DATA 7
33	*EB2	34	CPU DATA 9
35	*OE	36	CPU ADDRESS 1

Expansion Connector P2			
Pin	Signal	Pin	Signal
37	CPU DATA 10	38	CPU DATA 8
39	*DTACK	40	*CS5
41	*CS3	42	CPU ADDRESS 0
43	CPU DATA 6	44	CPU DATA 5
45	*CS1	46	CPU DATA 4
47	CPU DATA 3	48	*CS0
49	CPU DATA 0	50	CPU DATA 2
51	CPU DATA 1	52	R/*W
53	Ground	54	Ground
55	SD_CMD	56	SD_CLK
57	Ground	58	Ground
59	SD _D2	60	SD_D3
61	SD_D0	62	SD_D1
63	USB_CD	64	USB_SCON
65	UART1 TXD	66	*PIRQ (ADS7846E)
67	E_INT (CS8900a)	68	PWM0 (LED_BKL)
69	SPI_DOUT	70	SPI_CS
71	*I2C_INT (PCA9554)	72	SD_WP
73	+3.3V	74	+3.3V
75	+3.3V	76	+3.3V
77	+3.3V	78	+3.3V
79	+3.3V	80	+3.3V

Table 13 – P2, Expansion Connector 2 Pinout

Expansion Connector P3			
Pin	Signal	Pin	Signal
1	Ground	2	VIN
3	Ground	4	VIN

Expansion Connector P3			
Pin	Signal	Pin	Signal
5	Ground	6	VIN
7	Ground	8	VIN
9	*RST_IN	10	VIN
11	*TSRT	12	VIN
13	-	14	VIN
15	TCK	16	Ground
17	TMS	18	Ground
19	TDI	20	Ground
21	TDO	22	Ground
23	*RST_OUT	24	Ground
25	BSEL0	26	Ground
27	BSEL1	28	VMAIN
29	BSEL2	30	VMAIN
31	BSEL3	32	VMAIN
33	Ground	34	VMAIN
35	Ground	36	VMAIN
37	Ground	38	VMAIN
39	Ground	40	VMAIN

Table 14 – P3, Expansion Connector 3 Pinout

7.5 CSB535FS TOPSIDE CONNECTORS, LED'S AND SWITCHES

The following diagram shows the location of the connectors, LED's and Switches on the CSB535FS CPU Module.

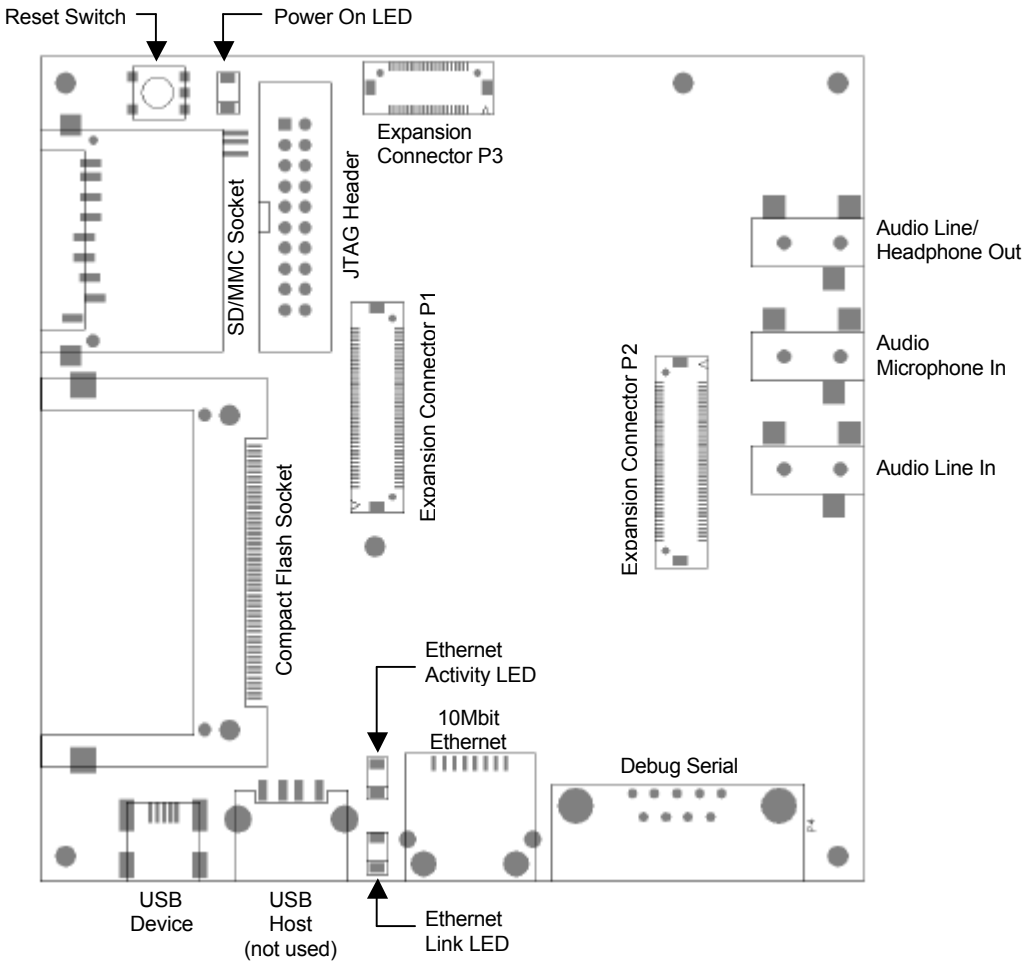
8 CSB935FS BREAKOUT BOARD CONNECTORS, LED'S AND SWITCHES

8.1 OVERVIEW

This section provides the locations and pinouts of the various connectors on the i.MX21 LiteKit CPU Module.

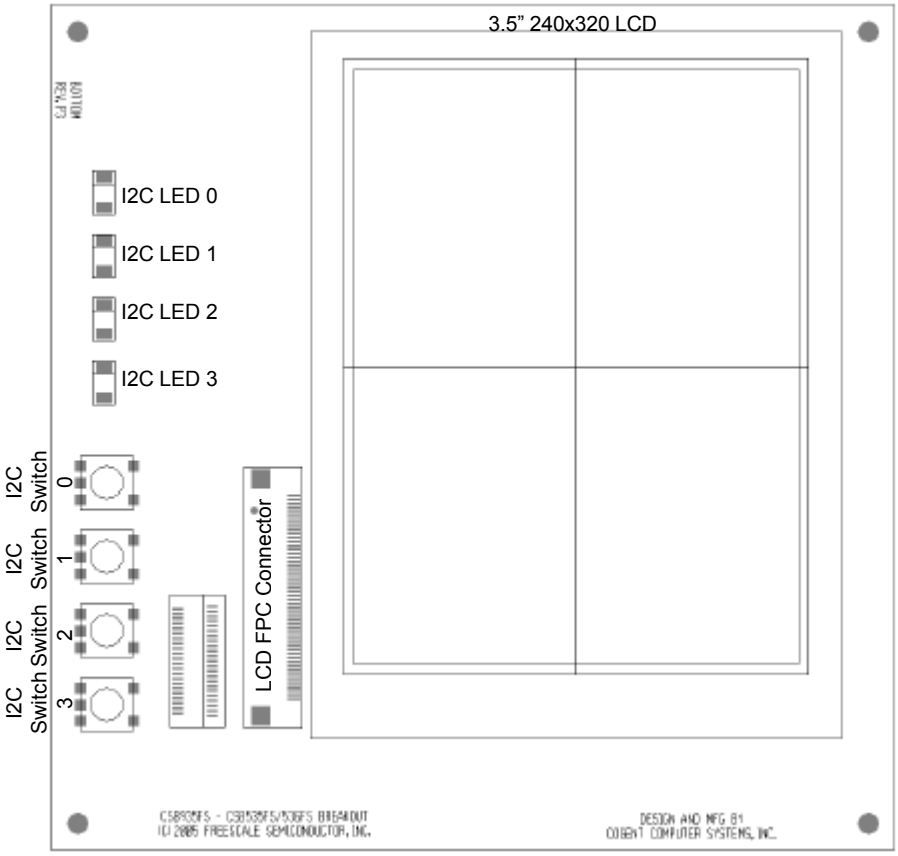
8.2 CSB935FS CONNECTORS, LED'S AND SWITCHES - TOPSIDE

The following diagram shows the location of the Connectors, LED's and Switches on the CSB935FS topside.



8.3 CSB935FS CONNECTORS, LED'S AND SWITCHES – BACKSIDE

The following diagram shows the location of the Connectors, LED's and Switches on the CSB935FS backside.



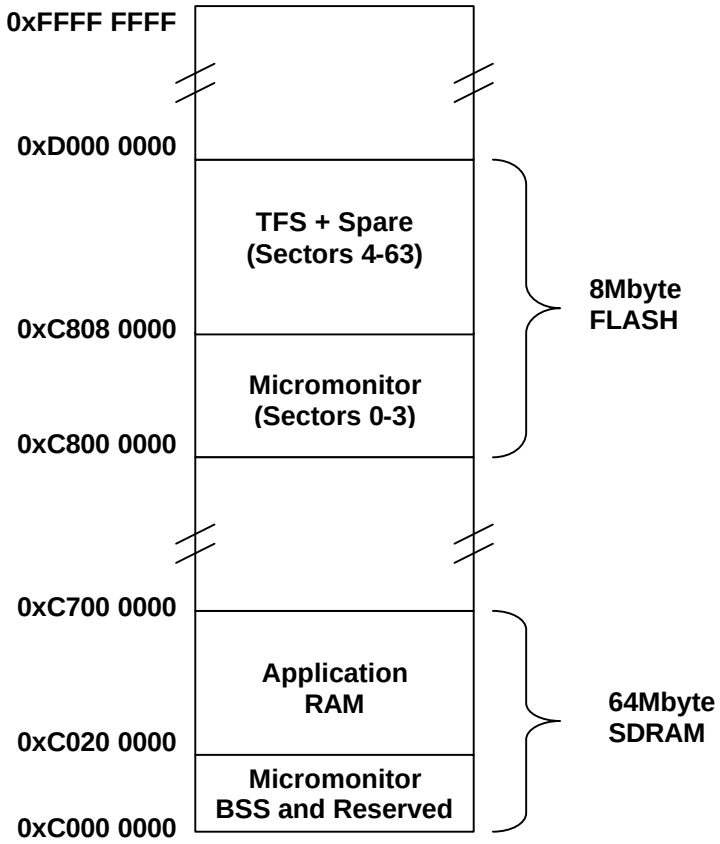
9 MICROMONITOR

9.1 INTRODUCTION TO MICROMONITOR

The i.MX21 LiteKit is delivered standard with the Micromonitor boot monitor in FLASH. Micromonitor was developed and is maintained by Ed Sutter of Lucent Technologies. Micromonitor is an open source product and may be copied, modified and re-used without restriction. However, neither Cogent nor Lucent is liable for any problems that may arise during the use of Micromonitor including its use with this board.

9.2 MICROMONITOR SOFTWARE MEMORY MAP

The memory usage by Micromonitor is shown in the following block diagram:



Note: All addresses shown are physical addresses.

9.3 CONNECTING TO MICROMONITOR

As delivered from Cogent, Micromonitor is configured to use the Debug UART (MC9328MX21 UART 1). The default connection is 38,400 baud, 8-N-1, with no handshaking. A null modem cable is provided with the i.MX21 LiteKit that will connect

the CSB535FS to another DTE port such as found on a PC.

Micromonitor also uses the Ethernet port to listen for connections via UDP.

9.4 MICROMONITOR COMMANDS

Micromonitor supports a wide variety of commands that allow the user to modify and/or read memory, download programs from Ethernet, Serial or on-board Flash File System (TFS) and many others. Refer to the Micromonitor Users Manual for a complete listing. Note that not all commands are available on all targets. Type the following command (assuming you are connected using a standard terminal program) at the Micromonitor command prompt to get a list of the commands currently enabled on your target:

```
umon> help
```

The terminal window will then display the commands installed on your target. Additional help for each command can be displayed by typing “help xxx” where “xxx is the specific command you are seeking help on.

You can also type the following to get information regarding the build date, memory usage, default application load address (APPRAMBASE) and other useful information regarding Micromonitor as installed on your i.MX21 LiteKit :

```
uMon> mstat
```

9.5 GETTING MORE INFORMATION ABOUT MICROMONITOR

Micromonitor reference information and a more advanced Micromonitor training guide are available from Microcross, Inc. (www.microcross.com).

10 I.MX21 LITEKIT SCHEMATICS