



**MCS7820**

## **USB 2.0 to Dual Serial Controller**

### **Features**

- USB-2.0 Device Controller
- On-Chip USB-2.0 PHY
- On-Chip Voltage Regulators
- Two 16c450/16c550 compatible UARTs
- Supports SIR IrDA Mode on any/all ports
- Supports RS-232, RS-485 and RS-422 Serial Ports
- 5, 6, 7 and 8-bit Serial Data support
- Hardware and Software Flow Control
- Serial Port speeds from 50 bps to 6 Mbps
- Custom BAUD Rates supported through external clock and/or by programming the internal PLL
- On-Chip 512-Byte FIFOs for upstream and downstream data transfers for each Serial Port
- Supports Remote Wakeup and Power Management features
- Serial Port Transceiver Shut-Down support
- Two-Wire I<sup>2</sup>C Interface for EEPROM
- EEPROM read/write through USB
- iSerial feature support with EEPROM
- One Bi-directional multi-function GPIO
- On-Chip buffers for Serial Port signals to operate without external Transceivers over short cable lengths
- Bus-Powered Device

### **Applications**

- Serial Attached Devices
- Modems, Serial Mouse, Generic Serial Devices
- Serial-Port Server
- Data Acquisition System
- POS Terminal and Industrial PC

### **Application Note**

- AN-7820

### **Evaluation Board**

- MCS7820-EVB

### **Package**

- 48-pin LQFP Package

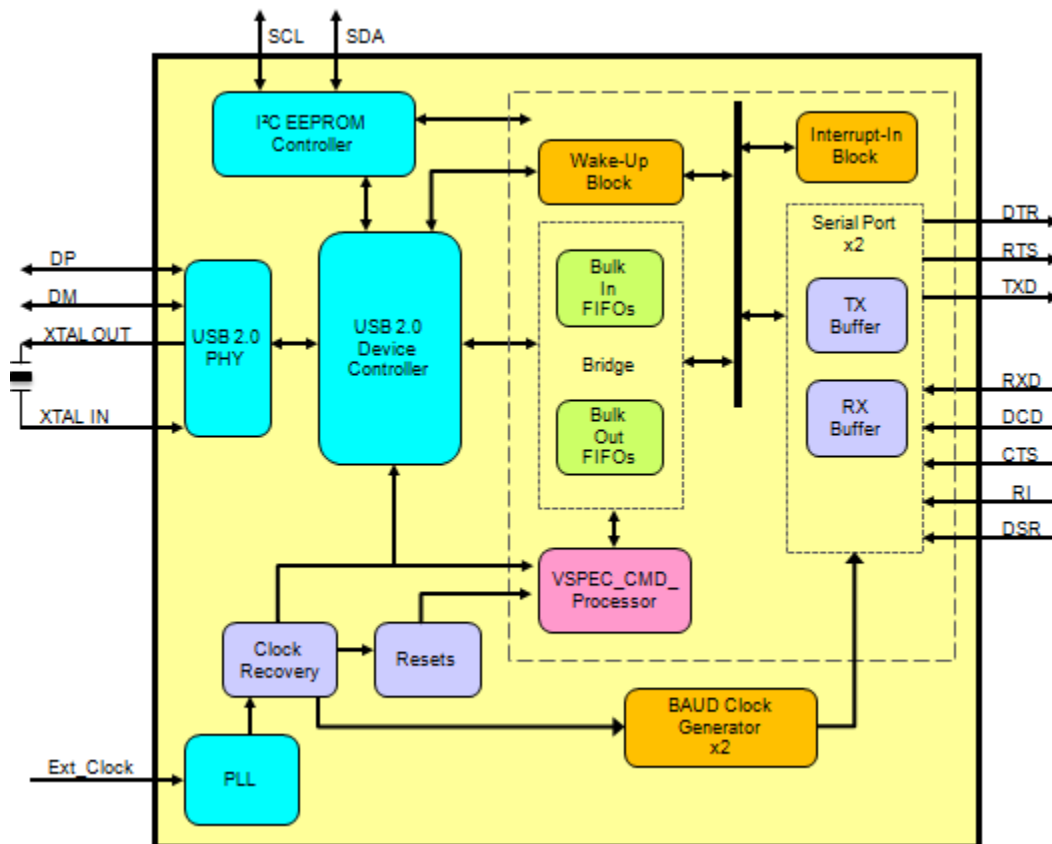
### **General Description**

The MCS7820 is a USB-2.0 to Dual-Serial Port device. It has been developed to connect a wide range of standard serial devices to a USB host.

The MCS7820 has a USB Device Controller connected to two (2) individual UARTs.

Support for the following serial communication programs is included:  
HyperTerminal, PComm, Windows direct connection, Windows dial-up connection through modem, Networking over IrDA and Windows direct connection over IrDA, Minicom.

<b>Ordering Information</b>		
Commercial Grade (0 °C to +70 °C)		
MCS7820CV-AA	48-LQFP	RoHS

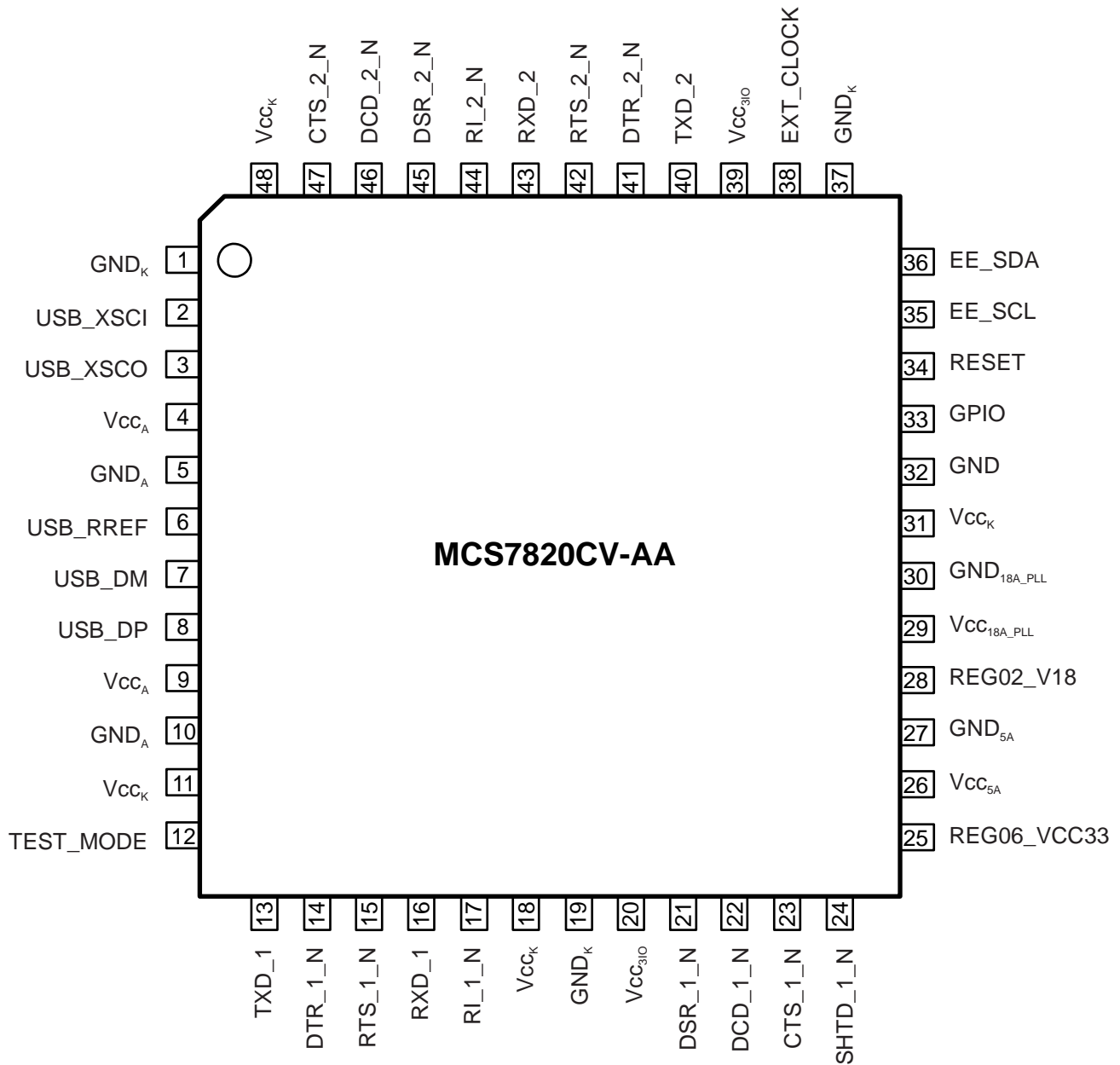
**Block Diagram**




**MCS7820**

**USB 2.0 to Dual Serial Controller**

**Pin-Out Diagram**





Pin Assignments

Pin	Name	Type	Functional Description
1	GND <sub>K</sub>	Power	Core Ground
2	USB_XSCI	Input	Crystal Oscillator Input
3	USB_XSCO	Output	Crystal Oscillator Output
4	Vcc <sub>A</sub>	Power	Power Pin (A3V3)
5	GND <sub>A</sub>	Power	Analog Ground
6	USB_RREF	Input	External Reference Resistor (12.1 KΩ, 1%) Connect resistor to Analog GND.
7	USB_DM	I/O	USB D- Signal
8	USB_DP	I/O	USB D+ Signal
9	Vcc <sub>A</sub>	Power	Power Pin (A3V3)
10	GND <sub>A</sub>	Power	Analog Ground
11	Vcc <sub>K</sub>	Power	Power Pin (1.8V)
12	TEST_MODE	Input	Test Mode Pin, (active high). Default = Low (0) When TEST_MODE = 1, PLL, Core, and SCAN/BIST/ Memory BIST testing can be performed. Set TEST_MODE = 0 for normal operation.
13	TXD_1	Output	Serial Port 1 Transmit Data out to transceiver or IrDA data out to IR LED
14	DTR_1_N	Output	Serial Port 1 Data Terminal Ready (in serial protocol), active low.
15	RTS_1_N	Output	Serial Port 1 Request To Send (in serial protocol), active low.
16	RXD_1	Input	Serial Port 1 Serial Receive Data in from transceiver or IrDA data in from IrDA detector.
17	RI_1_N	Input	Serial Port 1 Ring Indicator, active low
18	Vcc <sub>K</sub>	Power	Power Pin (1.8V)
19	GND <sub>K</sub>	Power	Core Ground
20	Vcc <sub>3IO</sub>	Power	Power Pin (D3V3)
21	DSR_1_N	Input	Serial Port 1 Data Set Ready (in serial protocol), active low
22	DCD_1_N	Input	Serial Port 1 Data Carrier Detect (in serial protocol), active low
23	CTS_1_N	Input	Serial Port 1 Clear To Send (in serial protocol), active low
24	SHTD_1_N	Output	Shut Down External Serial Transceiver during normal operation, active low by default, can be configured active high by using DCR setting.
25	REG06_VCC33	Power	Power Pin (3.3V OUTPUT)
26	Vcc <sub>5A</sub>	Power	Power Pin (5V INPUT)



**MCS7820**

**USB 2.0 to Dual Serial Controller**

Pin	Name	Type	Functional Description
27	GND <sub>5A</sub>	Power	Ground Pin for 5V Input
28	REG02_V18	Power	Power Pin (1.8V OUTPUT)
29	Vcc <sub>18A_PLL</sub>	Power	PLL Power (1.8V)
30	GND <sub>18A_PLL</sub>	Power	PLL Ground
31	Vcc <sub>K</sub>	Power	Power Pin (1.8V)
32	Gnd	Power	Ground.
33	GPIO	I/O	GPIO_MODE - Bidirectional GPIO bit. The direction (Input or Output) is controlled by the DCR for Serial Port #1.
34	RESET	Input	Power-On Reset signal (active high).
35	EE_SCL	I/O	2-Wire EEPROM Clock. Default = High (1)
36	EE_SDA	I/O	2-Wire EEPROM Data in/out. Default = High (1)
37	GND <sub>K</sub>	Power	Core Ground.
38	EXT_CLOCK	Input	Input Clock from external world. In normal operation mode, clock can be supplied to serial ports and used for custom BAUD Rate of user's choice. In test mode, clock will be the test clock input from external world.
39	Vcc <sub>3IO</sub>	Power	Power Pin (D3V3).
40	TXD_2	Output	Serial Port 3 Transmit Data out to transceiver, or IrDA data out to IR LED.
41	DTR_2_N	Output	Serial Port 3 Data Terminal Ready (in serial protocol), active low.
42	RTS_2_N	Output	Serial Port 3 Request To Send (in serial protocol), active low.
43	RXD_2	Input	Serial Port 3 Serial Receive Data in from transceiver, or IrDA data in from IrDA detector.
44	RI_2_N	Input	Serial Port 3 Ring Indicator, active low.
45	DSR_2_N	Input	Serial Port 3 Data Set Ready (in serial protocol), active low.
46	DCD_2_N	Input	Serial Port 3 Data Carrier Detect (in serial protocol), active low.
47	CTS_2_N	Input	Serial Port 3 Clear To Send (in serial protocol), active low.
48	Vcc <sub>K</sub>	Power	Power Pin (1.8V)

**Functional Block Descriptions****Internal Regulators**

An internal DC-DC Regulator is provided to convert 5V to 1.8V for Core Logic. An additional regulator is provided to convert the 5V input to 3.3V for I/O functions. These regulators eliminate the need for external voltage sources.

**USB-2.0 PHY**

This is the physical layer of the USB interface. The USB-2.0 PHY communicates with the USB-2.0 Device Controller logic through a UTMI interface to send/receive data on the USB bus.

**USB-2.0 Device Controller**

The USB-2.0 Device Controller interfaces to the internal bridge and communicates with the serial ports through the bridge logic. The device controller logic is connected to a physical layer USB-2.0 PHY which provides the USB bus interface for the chip. The device controller responds to standard as well as vendor specific requests from USB-2.0 and USB-1.1 Hosts.

**Bridge**

The bridge logic controls traffic between the USB-2.0 Device Controller and the Serial Port Controllers. The bridge logic has synchronous RAM memories with ping-pong FIFO control logic to buffer data in either direction (Bulk-In and Bulk-Out) and send it to the other side without loss. Control logic prevents overflow or underflow conditions in the memory.

**UART / Serial Port Controllers**

The Serial Port Controllers are linked to the bridge and send/receive data from the bridge interface. Each serial port controller has register logic controlling BAUD rates (50 bps – 6 Mbps), stop-bits, and parity bit settings. Each serial port has synchronous RAM memories acting as transmit and receive FIFOs to buffer outgoing and incoming data. This block has registers for interrupts, line status, and line control features which can be accessed by software. The Serial Port Controllers can interface to external RS-232 / RS-422 / RS-485 transceivers.

**Vendor Specific Command Processor**

The bridge logic interfaces to a vendor specific command processor block containing commands/register settings (BAUD settings etc.) which are specific to this device.

**Interrupt-In Block**

The Interrupt-In controller block gives the status of the serial port interrupt registers to the USB-2.0 Device Controller. The USB host controller periodically polls the interrupt endpoint and reads the status of the interrupts.

**Wakeup Block**

The Wakeup block is used for remote wakeup control. The USB host can suspend operation of the device. The remote wakeup block checks for activity on the serial port pins, and if information is available, it issues a remote wakeup request to the USB-2.0 Device Controller. The Device Controller in turn requests a remote wakeup by the external host. The host issues the "Resume Signaling" command to the device, which then resumes normal operation.

**IC EEPROM Controller**

The I<sup>2</sup>C EEPROM Controller interfaces to an external EEPROM and retrieves information necessary for serial port settings, Product-IDs, Vendor-IDs and other control information. The EEPROM controller logic communicates with the USB-2.0 Device Controller block which uses the information from the external EEPROM.

**Clock Generation and Resets**

The Clock Generation logic is used to generate the clocks for the various BAUD rates supported by the device. The Resets block has logic for synchronous de-assertion and asynchronous assertion of Resets in the respective clock domains to various blocks.

**BAUD Clock Generators**

The BAUD Clock Generator block generates clocks for each of the Serial Port Controllers depending on the BAUD settings from the host. A source clock is generated from the Clock Recovery block which is further divided or used as is by the BAUD Clock Generator logic depending on the BAUD settings.

**PLL Clock Generator**

The PLL generates a master clock which the other blocks use to generate the various BAUD rates. The PLL supports a wide range of clock inputs to support industrial standard serial port bit rates, as well as custom BAUD rates.



**UART Functional Description**

**Overview**

The UARTs are high performance serial ports that comply with the 16c550 specification. All UARTs are similar in operation and function, and are described in this section. The function of a single UART is described below.

**Operation Modes**

The UARTs are backward compatible with 16c450 and 16c550 devices. The operation of the port depends upon the mode settings, which are described throughout the rest of this section. The modes, conditions and corresponding FIFO depth are tabulated below.

UART Mode	FIFO Size	FCR[0]
450	1	0
550	16	1

**450 Mode**

After the hardware reset, bit-0 of the FIFO Control Register (FCR) is cleared, and the UART is compatible with the 16c450 mode of operation.

The transmitter and receiver FIFOs (referred to as the “Transmitter Holding Register” and “Receiver Holding Register” respectively) have a depth of one.

This mode of operation is known as “Byte Mode”.

**550 Mode**

After the hardware reset, writing a 1 to FCR[0] will increase the FIFO size to 16, providing compatibility with 16c550 devices.

In 16c550 mode, the device has the following features:

- RTS/CTS hardware flow control or DSR/DTR hardware flow control
- Infrared IrDA format transmit and receive mode
- Deeper (16-Byte) FIFOs



**UART Register-Set and Register Descriptions**

The UART has 10 registers, but only three address lines to access those registers. The mapping of the registers is dependent upon the Line Control Register (LCR).

LCR[7] enables the Divider Latch Registers (DLL and DLM).

The following table gives the various UART registers and their offsets.

Register Name	Offset	R/W	Bit-7	Bit-6	Bit-5	Bit-4	Bit-3	Bit-2	Bit-1	Bit-0
THR	0	W	Data to be transmitted ( Transmitter Holding Register)							
RHR	0	R	Data to be received (Receiver Holding Register)							
IER	1	R/W	Reserved			Sleep Mode	Modem Int Mask	Rx Stat Int Mask	Tx Rdy Int Mask	Rx Rdy Int Mask
FCR	2	W	RHR Trigger Level		Reserved		Reserved	Flush THR	Flush RHR	FIFO Enable
ISR	2	R	FIFOs Enabled		Reserved		Interrupt Priority			Interrupt Pending
LCR	3	R/W	DLE	Tx Break	Force Parity	Odd/Even Parity	Parity Enable	Stop Bits	Data Length	
MCR	4	R/W	DTR – DSR/DCD Flow Control		RTS/CTS Flow Control	Loop	Unused		RTS	DTR
LSR	5	R	Data Error	Tx Empty	THR Empty	Rx Break	Framing Error	Parity Error	Overrun Error	Rx Rdy
MSR	6	R	DCD	RI	DSR	CTS	ΔDCD	Teri	ΔDSR	ΔCTS
SPR	7	R/W	Scratch Pad Register							

**Additional standard registers - these are accessed when LCR[7] = 1**

DLL	0	R/W	Divisor Latch bits[7:0]							
DLM	1	R/W	Divisor Latch bits[15:8]							





**Transmitter Holding Register and Receiver Holding Register (THR and RHR):**

Data is written into the bottom of the THR queue and read from the top of the RHR queue completely asynchronously to the operation of the transmitter and receiver. The size of the FIFOs is dependent upon the setting of the FCR register.

Data written to the THR when it is full, is lost. Data read from the RHR when it is empty, is invalid. The empty and full status of the FIFOs is indicated in the Line Status Register.

**Register:** THR  
**Description:** Data to be transmitted  
**Offset:** 0  
**Permissions:** Write Only  
**Access Condition:** LCR[7] = 0  
**Default Value:** (unknown) – based on memory

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Data to be transmitted							

**Register:** RHR  
**Description:** Data to be received  
**Offset:** 0  
**Permissions:** Read Only  
**Access Condition:** LCR[7] = 0  
**Default Value:** (unknown) – based on memory

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Data to be received							



**Interrupt Enable Register (IER):**

Serial channel interrupts are enabled using the Interrupt Enable Register (IER).

**Register:** IER  
**Description:** Interrupt Enable Register  
**Offset:** 1  
**Permissions:** Read/Write  
**Access Condition:** LCR[7] = 0  
**Default Value:** 0x0C

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved			Sleep Mode	Modem Int Mask	Rx Stat Int Mask	Tx Rdy Int Mask	Rx Rdy Int Mask

Bit	Description	Operation
0	Rx Rdy Interrupt Mask	Logic 0: Disable the Receiver Ready Interrupt Logic 1: Enable the Receiver Ready Interrupt
1	Tx Rdy Interrupt Mask	Logic 0: Disable the Transmitter Ready Interrupt Logic 1: Enable the Transmitter Ready Interrupt
2	Rx Stat Interrupt Mask	Logic 0: Disable the Receiver Status Interrupt (Normal Mode) Logic 1: Enable the Receiver Status Interrupt (Normal Mode)
3	Modem Interrupt Mask	Logic 0: Disable the Modem Status Interrupt Logic 1: Enable the Modem Status Interrupt
4	Sleep Mode	Logic 0: Disable Sleep Mode Logic 1: Enable Sleep Mode where by the internal clock of the channel is switched OFF
[7:5]	Reserved	Reserved



**FIFO Control Register (FCR):**

The FCR controls the UART behavior in various modes.

**Register:** FCR  
**Description:** FIFO Control Register  
**Offset:** 2  
**Permissions:** Write  
**Access Condition:**  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
RHR Trigger Level		Reserved		Reserved	Flush THR	Flush RHR	Enable FIFOs

Bit	Description	Operation
0	Enable FIFO Mode	Logic 0: Byte Mode Logic 1: FIFO Mode
1	Flush RHR	Logic 0: No change Logic 1: Flushes the contents of RHR, This is operative only in FIFO mode. The RHR is automatically flushed whenever changing between Byte Mode and FIFO Mode. The bit will return to zero after clearing the FIFO.
2	Flush THR	Logic 0: No change Logic 1: Flushes the content of the THR, in the same manner as FCR[1] does the RHR
3	Reserved	Reserved
[5:4]	Reserved	Reserved
[7:6]	RHR Trigger Level	See Table Below

In 550 Mode, the receiver FIFO trigger levels are defined by FCR[7:6].

The interrupt trigger level and flow control trigger level where appropriate are defined by L2 in the table.

L1 defines a lower flow control trigger level. The two trigger levels used together introduce a hysteresis element into the hardware RTS/CTS flow control.

In Byte Mode (450 Mode) trigger levels are all set to 1.

FCR[7:6]	550 Mode (FIFO = 16)	
	L1	L2
2'b00	1	1
2'b01	1	4
2'b10	1	8
2'b11	1	14



**Interrupt Status Register (ISR):**

The source of the highest priority pending interrupt is indicated by the contents of the Interrupt Status Register. There are five sources of interrupts and four levels of priority (1 is the highest) as tabulated below:

Register: ISR  
 Description: Interrupt Status Register  
 Offset: 2  
 Permissions: Read  
 Access Condition:  
 Default Value: 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
FIFOs Enabled		Interrupt Priority (Enhanced Mode)		Interrupt Priority (All Modes)			Interrupt Pending

***Interrupt Source and Priority Table***

Priority Level	Interrupt Source	ISR[5:0]
-	No interrupt pending	6'b000001
1	Receiver Status Error or address bit detected in 9-bit mode	6'b000110
2a	Receiver Data Available	6'b000100
2b	Receiver Time-Out	6'b001100
3	Transmitter THR Empty	6'b000010
4	Modem Status Change	6'b000000

**Note:** ISR[0] indicates whether any interrupt is pending



**Line Control Register (LCR):**

The LCR specifies the data format that is common to both transmitter and receiver.

**Register:** LCR  
**Description:** Line Control Register  
**Offset:** 3  
**Permissions:** Read/Write  
**Access Condition:**  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
DLE	TX Break	Force Parity	Odd/Even Parity	Parity Enable	Number of Stop-Bits		Data Length

LCR[1:0] Data Length of serial characters.

LCR[1:0]	Data Length
2'b00	5 bits
2'b01	6 bits
2'b10	7 bits
2'b11	8 bits

LCR[2] Number of Stop-Bits per serial character.

LCR[2]	Data Length	Number of Stop-Bits
0	5, 6, 7, 8	1
1	5	1.5
1	6, 7, 8	2

LCR[5:3] Parity Type  
 The selected parity type will be generated during transmission and checked by the receiver, which may produce a parity error as a result. In 9-bit mode parity is disabled and LCR[5:3] are ignored.

LCR[5:3]	Parity Type
3'bxx0	No Parity
3'b001	Odd Parity
3'b011	Even Parity
3'b101	Parity bit forced to 1
3'b111	Parity bit forced to 0

LCR[6] Transmission Break  
 Logic 0: Transmission Break Disabled.  
 Logic 1: Forces the transmitter data output SOUT low to alert the communications channel, or sends zeroes in IrDA mode.

LCR[7] Divisor Latch Enable  
 Logic 0: Accesses to DLL and DLM registers disabled.  
 Logic 1: Accesses to DLL and DLM registers enabled.



**Line Status Register (LSR):**

This register provides the status of the data transfer to CPU.

**Register:** LSR  
**Description:** Line Status Register  
**Offset:** 5  
**Permissions:** Read  
**Access Condition:**  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Data Error	Tx Empty	THR Empty	Rx Break	Framing Error	Parity Error	Overrun Error	Rx Rdy

Bit	Description	Operation
0	RHR Data Available	Logic 0: RHR is empty Logic 1: RHR is not empty. Data is available to be read
1	RHR Overrun	Logic 0: No overrun error Logic 1: Data was received when the RHR was full, An overrun has occurred. The error is flagged when the data would normally have been transferred to the RHR.
2	Received Data Parity Error	Logic 0: No parity error in normal mode or 9 <sup>th</sup> bit received data is "0" in 9-bit mode. Logic 1: Data has been received that did not have correct parity
3	Received Data Framing Error	Logic 0: No framing error Logic 1: Data has been received with an invalid stop-bit.
4	Receiver Break Error	Logic 0: No receiver break error Logic 1: The receiver received a break error
5	THR Empty	Logic 0: Transmitter FIFO is not empty Logic 1: Transmitter FIFO is empty
6	Transmitter and THR Empty	Logic 0: The transmitter is not idle Logic 1: THR is empty and the transmitter has completed the character in the shift register and is in the idle mode
7	Receiver Data Error	Logic 0: Either there is no receiver data error in the FIFO or it was cleared by an earlier read of LSR Logic 1: At least one parity error, framing error or break indication is present in the FIFO.



**Modem Control Register (MCR):**

This register controls the UART's flow control and self diagnostic features.

**Register:** MCR  
**Description:** Modem Control Register  
**Offset:** 4  
**Permissions:** Read/Write  
**Access Condition:**  
**Default Value:** 0x00

550 Mode							
Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
DTR-DSR/DCD Flow Control		CTS/RTS Flow Control	Internal Loop Back Enable	Reserved	Reserved	RTS	DTR

Bit	Description	Operation
0	DTR	Logic 0: Forces DTR# output to inactive (high) Logic 1: Forces DTR# output to active (low)
1	RTS	Logic 0: Forces RTS# output to inactive (high) Logic 1: Forces RTS# output to active (low)
2	Reserved	Reserved.
3	Reserved	Reserved.
4	Loop-Back Mode	Logic 0: Normal operating mode Logic 1: Enable local Loop-Back Mode
5	CTS/RTS Flow Control	Logic 0: CTS/RTS flow control disabled in 550 mode Logic 1: CTS/RTS flow control enabled in 550 mode
6	DTR/DSR Flow Control	Logic 0: DTR/DSR flow control disabled in 550 mode Logic 1: DTR/DSR flow control enabled in 550 mode
7	DCD Flow Control	Logic 0: DCD flow control disabled in 550 mode Logic 1: DCD flow control enabled in 550 mode



**Modem Status Register (MSR):**

This register provides the status of the modem control lines to CPU.

**Register:** MSR  
**Description:** Modem Status Register  
**Offset:** 6  
**Permissions:** Read  
**Access Condition:**  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
DCD	RI	DSR	CTS	ΔDCD	Teri	ΔDSR	ΔCTS

Bit	Description	Operation
0	Delta CTS	Logic 0: No change in the CTS signal Logic 1: Indicates that the CTS input has changed since the last time the MSR was read
1	Delta DSR	Logic 0: No change in the DSR signal Logic 1: Indicates that the DSR input has changed since the last time the MSR was read
2	Trailing Edge of RI	Logic 0: No change in the RI signal Logic 1: Indicates that the RI input has changed from low to high since the last time the MSR was read
3	Delta DCD	Logic 0: No change in the DCD signal Logic 1: Indicates that the DCD input has changed since the last time the MSR was read
4	CTS	Logic 0: CTS# line is 1 Logic 1: CTS# line is 0
5	DSR	Logic 0: DSR# line is 1 Logic 1: DSR# line is 0
6	RI	Logic 0: RI# line is 1 Logic 1: RI# line is 0
7	DCD	Logic 0: DCD# line is 1 Logic 1: DCD# line is 0





**Scratch Pad Register (SPR):**

The scratch pad register does not influence operation of the UART in RS-232 mode in any way, and is used for temporary data storage. When using RS-422/485 Mode, bit[6] and bit[7] of the Scratch Pad Register are used for mode setting and DTR active level settings.

**Register:** SPR  
**Description:** Scratch Pad Register  
**Offset:** 7  
**Permissions:** Read/Write  
**Access Condition:**  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Scratch Pad Register Data							



**Divisor Latch Registers (DLL and DLM):**

The Divisor Latch Registers are used to program the BAUD Rate divisor. This is a value between 1 and 65535 by which the input clock is divided in order to generate serial BAUD rates.

After the hardware reset, the BAUD Rate used by the transmitter and receiver is given by:

$$\text{BAUD Rate} = \text{Input Clock} / (16 * \text{Divisor})$$

where divisor is given by  $(256 * \text{DLM}) + \text{DLL}$ .

More flexible BAUD rate generation options are also available.

**Register:** DLL  
**Description:** Divisor Latch (Least Significant Byte)  
**Offset:** 0  
**Permissions:** Read/Write  
**Access Condition:** LCR[7] = 1  
**Default Value:** 0x01

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Least Significant Byte of divisor latch							

**Register:** DLM  
**Description:** Divisor Latch (Most Significant Byte)  
**Offset:** 1  
**Permissions:** Read/Write  
**Access Condition:** LCR[7] = 1  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Most Significant Byte of divisor latch							



**RS-422 / RS-485 Mode Support**

Two additional modes of serial port operation are supported, these are:

- RS-422 Mode – Full Duplex Serial Port for industrial applications
- RS-485 Mode – Half Duplex Serial Port for industrial applications

**RS-485**

The RS-485 mode can be set using the Scratch Pad Register bit[6] and bit[7] for each serial port.

This mode is a half duplex mode and the external transceiver is controlled for transmission or reception using the enable signal.

**RS-422**

This is the full duplex mode.

This mode will work without the use of the DTR signal for external transceiver control.

Scratch Pad Bit[7]	Scratch Pad Bit[6]	Operation Summary
0	X	RS-485 Mode Disabled
1	0	RS-485 Mode Enabled, DTR High = Rx DTR Low = Tx
1	1	RS-485 Mode Enabled DTR Low = Rx DTR High = Tx  This is the default selection when RS485 mode is selected through driver property sheets.



**Configuration Options**

Two serial ports can be configured for operation.

To program and access the serial ports via software, endpoint numbers have been assigned so that serial ports can be configured from the USB side.

Endpoint	Type	Function	Size (Bytes) (USB-1.1 / USB-2.0)
0	Control Endpoint	Default Functionality	8 / 64
1	Bulk-In	Serial Port – 1	64 / 512
2	Bulk-Out	Serial Port – 1	64 / 512
3	Bulk-In	Serial Port – 2	64 / 512
4	Bulk-Out	Serial Port – 2	64 / 512
5	Interrupt	Status Endpoint	5 or 13 *

\* Controlled by DCR1 bit-6

**Serial Port Set/Get Commands**

Vendor commands are the vendor specific USB setup commands. The purpose of the vendor commands is to set/get the contents of the application registers. The following table provides information on the various vendor specific commands.

Windex [7:0] is the register index from where data is to be read.

Brequest specifies whether to read or write.

- 0x0E = write to the application register
- 0x0D = read from the application register

Wvalue specifies the application number and data to be written (ww = data).

- 0x01ww is the application number for Serial Port-1
- 0x03ww is the application number for Serial Port-2
- 0x09ww is the application number for EEPROM Write/Read
- 0x00ww is the application number provided for accessing the Control Registers which control the UARTs. It is possible to enable higher BAUD rates, and features like auto hardware flow control using the Control Registers.

**Note:** "N" in Wvalue and Register Name columns indicate the corresponding serial port number.

Windex is the offset of the register to read/write.

Wlength is the length of the data to read/write.



**Get Application  
Vendor Specific  
Command  
(Serial Port -N)**

bmrequestType	Brequest	Wvalue	Windex	Wlength	Register Name
0xC0	0x0D	0x0N00	0x0000	0x0001	SPN_RHR
0xC0	0x0D	0x0N00	0x0001	0x0001	SPN_IER
0xC0	0x0D	0x0N00	0x0002	0x0001	SPN_IIR
0xC0	0x0D	0x0N00	0x0003	0x0001	SPN_LCR
0xC0	0x0D	0x0N00	0x0004	0x0001	SPN_MCR
0xC0	0x0D	0x0N00	0x0005	0x0001	SPN_LSR
0xC0	0x0D	0x0N00	0x0006	0x0001	SPN_MSR
0xC0	0x0D	0x0N00	0x0007	0x0001	SPN_SPR
0xC0	0x0D	0x0N00	0x0000	0x0001	SPN_DLL
0xC0	0x0D	0x0N00	0x0001	0x0001	SPN_DLM

**Set Application  
Vendor Specific  
Command  
(Serial Port -N)**

bmrequestType	Brequest	Wvalue	Windex	Wlength	Register Name
0x40	0x0E	0x0Nww	0x0000	0x0001	SPN_THR
0x40	0x0E	0x0Nww	0x0001	0x0001	SPN_IER
0x40	0x0E	0x0Nww	0x0002	0x0001	SPN_FCR
0x40	0x0E	0x0Nww	0x0003	0x0001	SPN_LCR
0x40	0x0E	0x0Nww	0x0004	0x0001	SPN_MCR
0x40	0x0E	0x0Nww	0x0005	0x0001	SPN_LSR
0x40	0x0E	0x0Nww	0x0006	0x0001	SPN_MSR
0x40	0x0E	0x0Nww	0x0007	0x0001	SPN_SPR
0x40	0x0E	0x0Nww	0x0000	0x0001	SPN_DLL
0x40	0x0E	0x0Nww	0x0001	0x0001	SPN_DLM



USB Device Descriptors

Device Descriptor	Location	Data
BLength	0	8'h12
BDescriptorType	1	8'h01
BcdUSB	2	8'h00
BcdUSB	3	8'h02
BDeviceClass	4	8'hFF
BDeviceSubClass	5	8'h00
BDeviceProtocol	6	8'hFF
bMaxPacketSize0	7	8'h40
IdVendor	8	8'h10
IdVendor	9	8'h97
IdProduct	10	8'h20
IdProduct	11	8'h78
BcdDevice	12	8'h01
BcdDevice	13	8'h00
iManufacturer	14	8'h00 / 02 *
iProduct	15	8'h00 / 03 *
iSerialNumber	16	8'h00 / 01 *
BNumConfigurations	17	8'h01

\* Values returned Without / With the Serial EEPROM present.



**USB  
Configuration  
Descriptors**

Configuration Descriptor	Index	Data
BLength	0	8'h09
BDescriptorType	1	8'h02
WtotalLength(L)	2	8'h35
WtotalLength(M)	3	8'h00
BNumInterfaces	4	8'h01
BConfigurationValue	5	8'h01
IConfiguration	6	8'h00
BmAttributes	7	8'hA0
BMaxPower	8	8'h32 (100 mA)

**USB  
Interface  
Descriptors**

Configuration Descriptor	Index	Data
BLength	0	8'h09
BDescriptorType	1	8'h04
BInterfaceNumber	2	8'h00
BAlternateSetting	3	8'h00
BNumEndpoints	4	8'h09
BInterfaceClass	5	8'hFF
BInterfaceSubClass	6	8'h00
BInterfaceProtocol	7	8'hFF
IInterface	8	8'h00



**Endpoint-1  
Serial Port 1  
Bulk-In**

Configuration Descriptor	Index	Data
bLength	0	8'h07
bDescriptorType	1	8'h05
bEndpointAddress	2	8'h81
bmAttributes	3	8'h02
wMaxPacketSize(L)	4	8'h40/8'h00 *
wMaxPacketSize(M)	5	8'h00/8'h02 *
bInterval	6	8'hFF

**Endpoint-2  
Serial Port 1  
Bulk-Out**

Configuration Descriptor	Index	Data
bLength	0	8'h07
bDescriptorType	1	8'h05
bEndpointAddress	2	8'h02
bmAttributes	3	8'h02
WmaxPacketSize(L)	4	8'h40/8'h00 *
WmaxPacketSize(M)	5	8'h00/8'h02 *
bInterval	6	8'hFF

**Endpoint-3  
Serial Port 2  
Bulk-In**

Configuration Descriptor	Index	Data
bLength	0	8'h07
bDescriptorType	1	8'h05
bEndpointAddress	2	8'h85
bmAttributes	3	8'h02
wMaxPacketSize(L)	4	8'h40/8'h00 *
wMaxPacketSize(M)	5	8'h00/8'h02 *
bInterval	6	8'hFF

**Endpoint-4  
Serial Port 2  
Bulk-Out**

Configuration Descriptor	Index	Data
bLength	0	8'h07
bDescriptorType	1	8'h05
bEndpointAddress	2	8'h06
bmAttributes	3	8'h02
wMaxPacketSize(L)	4	8'h40/8'h00 *
wMaxPacketSize(M)	5	8'h00/8'h02 *
bInterval	6	8'hFF

\* Values for Full Speed and High Speed USB





**Endpoint-5  
Interrupt Endpoint**

<b>Configuration Descriptor</b>	<b>Index</b>	<b>Data</b>
bLength	0	8'h07
bDescriptorType	1	8'h05
bEndpointAddress	2	8'h89
bmAttributes	3	8'h03
wMaxPacketSize(L)	4	8'h0A
wMaxPacketSize(M)	5	8'h00
bInterval	6	* 8'h01 / 8'h05 (default FS/HS)

\* programmable using intr\_pg\_fs ,  
intr\_pg\_hs



**Vendor Specific Command Registers**

There are a total of 28 registers, out of which 10 Vendor Specific Registers can be used to tune the behavior and performance of each serial port. The remaining registers are EEPROM registers. These registers are listed below.

**VSPEC Control Registers Description Table**

The vspec control registers are accessed through Vendor Specific Commands, with Application\_ Number = 0.

Register	Offset	App #
sp1_reg	0	0
control_reg1	1	0
ping_pong_high	2	0
ping_pong_low	3	0
eeprom_reg	4, 5, 6	0
eeprom_reg	22-30	0
sp2_reg	10	0
control_reg2	11	0
pll_m_reg	14	0
pll_n_reg	16	0
clk_mux_reg	18	0
clk_select_reg1	19	0
clk_select_reg2	20	0
mode_reg*	43	0
sp1_ICG_reg	44	0
sp2_ICG_reg	46	0
RX_sampling_reg1	48	0
bi_fifo_stat1*	50	0
bo_fifo_stat1*	51	0
bi_fifo_stat2*	54	0
bo_fifo_stat2*	55	0
zero_len_reg1	58	0
zero_len_reg2	60	0
zero_len_flag_en	62	0
thr_value1_sp1	63	0
thr_value2_sp1	64	0
thr_value1_sp2	67	0
thr_value2_sp2	68	0

\* indicates a read-only register



**sp1 (2) reg**

This register is used to configure Endpoint-1 (3). This enables the designer to pin point the problem in the design. There is a register bit which resets the UART. There are register bits which control the input clock fed to the UART, thereby providing options for higher BAUD rates.

**Register:** SP1 (2)\_REG  
**Description:** Serial Port 1 (2) Register  
**Register Index:** 0 (10)  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
UART_Reset	clk_UART_select			sp_bi_clear	sp_bo_clear	ser_line_err_ctl_en	udc_loop

Bit	Description
udc_loop	When enabled, loops the data from Bulk-Out FIFO to the Bulk-In FIFO.
ser_line_err_ctl_en	When enabled, will not allow data from the UART to be written into the Bulk-In FIFO if there are any errors in the received data.
sp_bo_clear	Reset the Bulk-Out FIFO
sp_bi_clear	Reset the Bulk-In FIFO
clk_UART_sel	Changes the clock fed to the UART as shown in table below
UART1_reset	Resets the UART

**clk\_UART\_sel**

These bits are used by the BAUD clock generators when generating clocks for higher BAUD rates. The clock frequency and maximum BAUD rates achieved are shown in the table.

Option	Input Clock Frequency	Max BAUD Rate
3'b000	1.8432 MHz	115200 bps
3'b001	1.8432 x 2 = 3.6864 MHz	230400 bps
3'b010	1.8432 x 3.5 = 6.4512 MHz	403200 bps
3'b011	1.8432 x 4 = 7.3728 MHz	460800 bps
3'b100	1.8432 x 7 = 12.9024 MHz	806400 bps
3'b101	1.8432 x 8 = 14.7456 MHz	921600 bps
3'b110	24 MHz	1.5 Mbps
3'b111	48 MHz	3 Mbps



**control\_reg1 (2)**

The Control register is used for controlling the flow control, driver done bit setting after setting all serial port controls and IrDA related register bits of Serial Port 1.

**Register:** control\_reg1 (2)  
**Description:** Control Register1 (2)  
**Register Index:** 1 (11)  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved	fsm_control	rx_disable	rx_negate	drv_done	sp_bit	Reserved	sp_autoflow_pwrdown_en

Bit	Description
sp_autoflow_pwrdown_en	This bit is used for enabling the hardware flow control.
Reserved	Reserved (Unused)
sp_bit	when set, CTS change is reflected in Modem Status Register, else the delta CTS is not set.
drv_done (used only in control_reg1)	0: UART RAMS are used for string descriptor. 1: UART RAMS are used for sending/receiving the data. This bit is to be set after USB enumeration, and before setting all serial port controls for transmission/reception.
rx_negate	The input from the transmitter is inverted when this bit is enabled. This bit is valid only in the IrDA mode.
rx_disable	When this bit is enabled, and IrDA bit is not set, the Serial Port will not receive any data.
fsm_control	fsm_control doesn't receive data while the UART is transmitting, this bit is valid only in IrDA mode
Reserved	Reserved (Unused)

Bit 3 is used only in control\_reg1 as drv\_done. For the other control\_reg (2) bit-3 is reserved.



**ping\_pong\_high and ping\_pong\_low**

Each serial port has a 512-Byte Bulk-In FIFO. The FIFO actually has two 512-Byte banks. The two banks use a ping-pong mechanism, so that only one is active at a time. In some situations, these registers can increase receiver performance by enabling a timeout mechanism in the serial ports to control when the FIFO switches banks. The current software Driver does not enable this feature.

Each UART transfers the data it receives to its Bulk-In FIFO. When the host controller initiates a Bulk-In transfer to that endpoint and reads the data, the other bank of the FIFO is activated. This allows the UART to continue receiving data asynchronously, while the host reads the data received prior to the Bulk-In request. If the host controller tries to read the FIFO when it is empty, it gets a NAK response.

These registers can reduce the number of NAKs by controlling the time at which the FIFO switches banks. They are combined into a 15-bit value using this formula:

$$(128 * \text{ping\_pong\_high}) + \text{ping\_pong\_low}$$

The “correct” settings for these registers are very application and data rate specific. Improper settings can actually reduce performance. In most cases, it will not be necessary to change these values. This feature affects all serial ports equally; it is not possible to set different values for each port.

**Register:** ping\_pong\_high  
**Description:** MSB of 15-bit Memory Switching Threshold Value  
**Register Index:** 2  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
ping_pong_high							

**Register:** ping\_pong\_low  
**Description:** LSB of 15-bit Memory Switching Threshold Value  
**Register Index:** 3  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
0	ping_pong_low						



**PLL Dividers**

The PLL has two programmable dividers. The “Pre-Divider” (M) divides the Input clock before it goes to the phase comparator. The “Loop-Divider” (N) divides the Output clock signal before it goes to the phase comparator. Together, these two registers are used to set the ratio of the Output clock to Input clock frequencies.

Because they are used as divisors, neither M nor N should be set to zero.

The formula used to set the Output frequency is:

$$F_{Out} = (N/M) * F_{In}$$

The default Input clock is 12 MHz.

To obtain a 30 MHz Output from the PLL, the values M=2 and N=5 could be used ( (5/2) \* 12 = 30 ).

In order to maintain a stable Output clock frequency, this important relationship must be maintained:

$$5 \text{ MHz} \leq (F_{In} / M) \leq 100 \text{ MHz}$$

**pll\_m\_reg**

Register writes/reads are possible for lower 6 bits of the register.

**Register:** pll\_m\_reg  
**Description:** PLL Divider Register – “Pre” Divisor  
**Register Index:** 14  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x01; (Reset value = 0x03)

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved		M					

**pll\_n\_reg**

Register writes/reads are possible for lower 6 bits of the register.

**Register:** pll\_n\_reg  
**Description:** PLL Divider Register – “Loop” Divisor  
**Register Index:** 16  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x08

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved		N					



**clk\_mux\_reg**

Register writes are possible only for bit[3:0] of the register. Internally the register is configured as an 8-bit register and clk\_mux\_reg[7:4] are reserved for future use.

Register: clk\_mux\_reg  
 Description: clk\_mux\_reg  
 Register Index: 18  
 Permissions: Read/Write  
 Application Number: 0  
 Default Value: 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved				FIFO Status Enable	FRANGE Setting	Clock Input to PLL	

Bit	Description
[1:0]	<p><b>Selects the Input Clock for the PLL</b></p> 0: 12 MHz 1: External Clock Input (EXT_CLK) 2: Reserved 3: Reserved
2	<p><b>PLL Output Frequency Range</b></p> 0: 20 MHz – 100 MHz 1: 100 MHz – 300 MHz
3	<p><b>Enable additional Status Information</b></p> 0: Endpoint-5 returns 5 Bytes of data. 1: Endpoint-5 returns 5 Bytes of data, plus 8 Bytes of FIFO Status.
[7:4]	Reserved



**clk\_select\_reg1**

Input Clock Selector for Serial Port 1.  
Register writes are possible for bit[5:0] of the register.

**Register:** clk\_select\_reg1  
**Description:** clk\_select\_reg1  
**Register Index:** 19  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved		Reserved			Serial Port 1 Clock Input		

**clk\_select\_reg2**

Input Clock Selector for Serial Port 2  
Register writes are possible for bit[5:0] of the register.

**Register:** clk\_select\_reg2  
**Description:** clk\_select\_reg2  
**Register Index:** 20  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved		Reserved			Serial Port 2 Clock Input		

Each Serial Port can be configured independently.

The input clock for each Port can be selected from one of the following:

Selector Value	Description
0	Standard BAUD Rates (Derived from 96 MHz)
1	30 MHz
2	96 MHz
3	120 MHz
4	PLL Output
5	External Clock Input
6	Reserved
7	Reserved





**Mode Register**

A separate 8-bit Mode Register is defined to indicate the mode of operation. The contents of this Mode Register are tabulated below. Bits in the Mode Register are set by bonding options available on the die and can only be read by software during normal operation.

**Register:** Mode Register  
**Description:** Mode Register  
**Register Index:** 43  
**Permissions:** Read Only  
**Application Number:** 0  
**Default Value:** 0xC4

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
irda_en_i	ee_wr_en_i	Reserved	bypass_por	PLL_bypass	ser_prsnt	reset_sel	Reserved

Bit	Name	Definition	Default Value
0	Reserved	Reserved.	0
1	reset_sel	0: RESET = Active High 1: Reserved	0
2	ser_prsnt	0: Reserved 1: Do not use hard coded values	1
3	pll_bypass	1: PLL clock output is bypassed	0
4	bypass_por	1: Internal Power-On Reset is bypassed	0
5	Reserved	Reserved.	0
6	ee_wr_en_i	1: EEPROM write access is enabled	1
7	irda_en_i	1: IrDA mode is activated	1



**SP1 (2) ICG Register (Inter Character Gap Register)**

The Inter Character Gap Register controls the amount of time the serial port transmitter will wait before transmitting the next character.

Each serial port has an 8-bit ICG\_reg which can be programmed by software. The decimal value of the register times the BAUD clock period for that serial port gives the amount of time that the transmitter will wait between successive character transmissions.

**Register:** Sp1 (2)\_ICG\_reg  
**Description:** Inter Character Gap Register  
**Register Index:** 44 (46)  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x24

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Inter Character Gap value (to be multiplied by BAUD clock period)							



**Rx Sampling Register 1**

All UARTs have an internal clock signal that runs sixteen times as fast as the currently selected BAUD Clock.

The RX Sampling Controller register is used to select the sampling time for the UART receiver logic. The default value (7) samples the data at the middle of the bit time. This register allows sampling the data more towards the beginning or end of the bit time if desired.

There is a 4-bit register value for each serial port.

**Register:** Rx\_sampling\_reg1  
**Description:** RX Sampling Register  
**Register Index:** 48  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x77

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Serial Port #2				Serial Port #1			

The table shows the configuration for the Rx\_sampling\_reg1 register.

Register	Bits	Serial Port
Rx_sampling_reg1	[3:0]	1
Rx_sampling_reg1	[7:4]	2



**zero\_len\_reg1 (2)**

Zero-Length packets are generated if there is no data to send. Zero-Length packet generation only occurs when the Bulk-In FIFO is empty after completion of all the requests coming from the host. This value indicates the number of Bulk-In requests coming from the host, before a Zero-Length packet is generated.

**Register:** zero\_len\_reg1 (2)  
**Description:** This value indicates the number of Bulk-In requests from the host.  
**Register Index:** 58 (60)  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x14

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Number of Bulk-Ins sent from the host controller before Zero-Length Packet is Generated							

**zero\_len\_flag\_en**

Enable/Disable the generation of Zero-Length packets by programming this register for all serial ports.

**Register:** zero\_len\_flag\_en  
**Description:** Enable/Disable the generation of Zero-Length packets.  
**Register Index:** 62  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x0F

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved				Reserved	Enable Zero Length Packet for SP2	Reserved	Enable Zero Length Packet for SP1



**thr\_value1\_sp1 (2) Register**

**Register:** thr\_value 1\_sp1 (2)  
**Description:** Host can program the size of the Bulk-In packet for the Serial Port.  
**Register Index:** 63 (67)  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x0F

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Least Significant bits of Threshold Value							

**thr\_value2\_sp1 (2) Register**

**Register:** thr\_value 2\_sp1 (2)  
**Description:** Host can program the size of the Bulk-In packet . The value can be from 1 Byte to 512 Bytes.  
**Register Index:** 64 (68)  
**Permissions:** Read/Write  
**Application Number:** 0  
**Default Value:** 0x80

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Threshold Value Enable Bit	Reserved						Most Significant bit of Threshold Value

Bits	Description
0	Most Significant bit of Threshold Value
[6:1]	Reserved
7	Threshold Value Enable Bit Programmed values of thr_value1_sp1, thr_value2_sp1, thr_value1_sp2, thr_value2_sp2 registers are valid only when this bit is enabled.



**EEPROM Write Commands**

<b>bmrequestType</b>	<b>Brequest</b>	<b>Wvalue</b>	<b>Windex</b>	<b>Wlength</b>	<b>Register Name</b>
0x40	0x0E	0x09ww	0x00rr	0x0000	EEPROM Register

Wvalue [15:8] is the Application Number. (0x09 is for EEPROM access)

Wvalue [7:0] is the data to be written.

Windex [7:0] is the Register Index where the data is to be written.

**EEPROM Read Commands**

<b>bmrequestType</b>	<b>Brequest</b>	<b>Wvalue</b>	<b>Windex</b>	<b>Wlength</b>	<b>Register name</b>
0xC0	0x0D	0x0900	0x00rr	0x0001	EEPROM Register



**Status Endpoint**

The Status Endpoint returns the interrupt status each time it is polled by the host.. These Bytes are the status information of all the Serial Ports.

Byte	Function	Port
1	Interrupt Identification Register	1
2	Reserved	
3	Interrupt Identification Register	2
4	Reserved	
5	FIFO Status	All

**FIFO Status – Additional Bytes**

If the DCR1[6] bit is set, the Interrupt Endpoint will return eight additional Bytes after the five Bytes described earlier. The additional eight Bytes provide information about the number of Bytes currently present in the Bulk-In and Bulk-Out FIFOs for each endpoint.

These Bytes are:

Byte	Bytes in FIFO	Endpoint
6	Bulk-In for SP1	1
7	Bulk-Out for SP1	2
8	Reserved	
9	Reserved	
10	Bulk-In for SP2	3
11	Bulk-Out for SP2	4
12	Reserved	
13	Reserved	

**Status Endpoint Byte-5**

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved	Reserved	InFIFO Status_ Sp2	OutFIFO Status_ Sp2	Reserved	Reserved	InFIFO Status_ Sp1	OutFIFO Status_ Sp1

Bit	Description
0	0: Indicates the Bulk-Out FIFO is filled with Tx data. (Serial Port-1) 1: Indicates the Bulk-Out FIFO is empty.
1	0: Indicates the Bulk-In FIFO is empty. (Serial Port-1) 1: Indicates the Bulk-In FIFO is filled with Rx data.
2	Reserved.
3	Reserved.
4	0: Indicates the Bulk-Out FIFO is filled with Tx data. (Serial Port-2) 1: Indicates the Bulk-Out FIFO is empty.
5	0: Indicates the Bulk-In FIFO is empty. (Serial Port-2) 1: Indicates the Bulk-In FIFO is filled with Rx data.
6	Reserved.
7	Reserved.



Alternatively, the software has the provision of disabling the DCR1[6] bit and receiving only the first 5 Bytes from the Status Endpoint. In this case, the software can still read the status of the Bulk-In and Bulk-Out FIFOs for each endpoint through a Vendor Specific read to the internal registers described below.

**bi\_fifo\_stat1 (2) Register**

**Register:** bi\_fifo\_stat1 (2)  
**Description:** Bulk-In FIFO Status Register for SP1 (2)  
**Register Index:** 50 (54)  
**Permissions:** Read  
**Application Number:** 0  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Number of Bytes available in Bulk-In FIFO for Endpoint 1 (3)							

**bo\_fifo\_stat1 (2) Register**

**Register:** bo\_fifo\_stat1 (2)  
**Description:** Bulk-Out FIFO Status Register for SP1 (2)  
**Register Index:** 51 (55)  
**Permissions:** Read  
**Application Number:** 0  
**Default Value:** 0x00

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Number of Bytes available in Bulk-Out FIFO for Endpoint 2 (4)							

**Note:** These registers are provided for diagnostic purposes. Each register is 8-bits wide and can support up to 256 bytes.

Register Name	Index	# of Bytes in
bi_fifo_stat1	50	Bulk-In FIFO 1
bo_fifo_stat1	51	Bulk-Out FIFO 1
bi_fifo_stat2	54	Bulk-In FIFO 2
bo_fifo_stat2	55	Bulk-Out FIFO 2





**EEPROM Content Layout**

Bytes	# of Bytes	Name	Description
[1:0]	2	EE Check	EEPROM Present Check value = 0x9710
[3:2]	2	VID	Vendor ID = 0x9710
[5:4]	2	PID	Product ID = 0x7840
[7:6]	2	RN	Release Number in BCD format = 0x0001
8	1	SER1_DCR0	Device Configuration Registers (SER1_DCR0)
9	1	SER1_DCR1	Device Configuration Registers (SER1_DCR1)
10	1	SER1_DCR2	Device Configuration Registers (SER1_DCR2)
14	1	SER2_DCR0	Device Configuration Registers (SER2_DCR0)
15	1	SER2_DCR1	Device Configuration Registers (SER2_DCR1)
16	1	SER2_DCR2	Device Configuration Registers (SER2_DCR2)
20	1	intr_pg_fs	Binterval value for Full Speed
21	1	intr_pg_hs	Binterval value for High Speed
[23:22]	2	Language ID	Language ID in HEX Format (0x0409 default)
[71:24]	48	Manufacture ID	"MosChip Semiconductor" in UNICODE
[113:72]	42	Product Name	"USB-Serial Controller" in UNICODE
[129:114]	16	Serial Number	"X7X6X5X4X3X2X1X0" in UNICODE



**EEPROM Contents for MCS7820  
(Example Contents)**

EE\_Check,  
VID,  
PID,  
RN,  
SER1\_DRC0, SER1\_DRC1, SER1\_DRC2,  
Reserved (3),  
SER2\_DRC0, SER2\_DRC1, SER2\_DRC2,  
Reserved (3),  
INTR\_PG\_FS,  
INTR\_PG\_HS,  
Language ID,  
Manufacture ID,

M	o	s	C	h	i	p
4D	6F	73	43	68	69	70

S	e	m	i	c	o	n	d	u	c	t	o	r	
20	53	65	6D	69	63	6F	6E	64	75	63	74	6F	72

Product Name,

U	S	B	-	S	e	r	i	a	l
55	53	42	2D	53	65	72	69	61	6C

C	o	n	t	r	o	l	l	e	r	
20	43	6F	6E	74	72	6F	6C	6C	65	72

Serial Number

Location	HEX	ASCII	Location	HEX	ASCII	Location	HEX	ASCII
0	10		44	6D	m	88	61	a
1	97		45	00		89	00	
2	10		46	69	i	90	6C	l
3	97		47	00		91	00	
4	40		48	63	c	92	20	Space
5	78		49	00		93	00	
6	01		50	6F	o	94	43	C
7	00		51	00		95	00	
8	01		52	6E	n	96	6F	o
9	85		53	00		97	00	
10	24		54	64	d	98	6E	n
11	01		55	00		99	00	
12	80		56	75	u	100	74	t
13	24		57	00		101	00	
14	01		58	63	c	102	72	r
15	80		59	00		103	00	
16	24		60	74	t	104	6F	o
17	01		61	00		105	00	
18	80		62	6F	o	106	6C	l
19	24		63	00		107	00	
20	01		64	72	r	108	6C	l
21	05		65	00		109	00	
22	09		66	20	Space	110	65	e
23	04		67	00		111	00	
24	4D	M	68	20	Space	112	72	r
25	00		69	00		113	00	
26	6F	o	70	20	Space	114	4D	M
27	00		71	00		115	00	
28	73	s	72	55	U	116	6F	o
29	00		73	00		117	00	
30	43	C	74	53	S	118	73	s
31	00		75	00		119	00	
32	68	h	76	42	B	120	43	C
33	00		77	00		121	00	
34	69	i	78	2D	-	122	68	h
35	00		79	00		123	00	
36	70	p	80	53	S	124	69	i
37	00		81	00		125	00	
38	20	Space	82	65	e	126	70	p
39	00		83	00		127	00	
40	53	S	84	72	r	128	20	Space
41	00		85	00		129	00	
42	65	e	86	69	i			
43	00		87	00				

**Device Configuration Bit Fields and Descriptions**

Bytes 8, 9, 10, 14, 15 and 16 form six 8-bit DCR Registers. These Bytes are read from the EEPROM, and loaded into the Global Device Configuration Registers after Power-On Reset. They can be programmed by software using the following application number and register indexes as shown in the table.

EEPROM Location	DCR Bit	DCR Name	Application Number	Register Index	Default Value
8	SER1_DCR[7:0]	SER1_DCR0	0	4	0x01
9	SER1_DCR[15:8]	SER1_DCR1	0	5	0x85
10	SER1_DCR[23:16]	SER1_DCR2	0	6	0x24
14	SER2_DCR[7:0]	SER2_DCR0	0	25	0x01
15	SER2_DCR[15:8]	SER2_DCR1	0	26	0x84
16	SER2_DCR[23:16]	SER2_DCR2	0	27	0x24

The following tables describe the function of each bit in the DCR registers. There are three DCR registers for each Serial Port (IrDA). In the absence of an EEPROM, the default values are taken from the Device Configuration Registers.



Serial Port 1 – Device Configuration Register 0

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved	IrDA_ Mode	RTS_ CM		GPIO_ Mode		Reserved	RS_ SDM

DCR0 Bit	Name	Definition	Default Value
0	RS_ SDM	<p align="center"><b>RS-232 / RS-422 / RS-485 Transceiver Shut-Down Mode:</b></p> 0: Do not shut down the transceiver Even when USB SUSPEND is engaged  1: Shut down the transceiver when USB SUSPEND is engaged	1
1	Reserved	Reserved.	0
[3:2]	GPIO_ Mode	00: GPIO = Input  10: GPIO = Output	00
[5:4]	RTS_ CM	<p align="center"><b>RTSM RTS Control Method:</b></p> 00: RTS is controlled by Control Bit Map. Signal is active low;  01: RTS is controlled by Control Bit Map. Signal is active high;  10: Drive RTS active when Downstream Data Buffer is NOT EMPTY; Otherwise Drive RTS inactive.  11: Drive RTS inactive when Downstream Data Buffer is NOT EMPTY; Otherwise Drive RTS active.	00
6	IrDA_ Mode	0: RS-232 / RS-422 / RS-485 Serial Port Mode. 1: IrDA Mode.	0
7	Reserved	Reserved	0



Serial Port 1 – Device Configuration Register 1

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved	Interrupt IN Endpoint Status	PLL_ Power-Down Bypass Control	RW_ INHB	Tx_I_ PMG		GPIO_I_ PMG	

DCR1 Bit	Name	Definition	Default Value
[1:0]	GPIO_I_ PMG	<p><i>These two bits set the output current of the GPIO lines:</i></p> 00: 6 mA 01: 8 mA (Default) 10: 10 mA 11: 12 mA	01
[3:2]	Tx_I_ PMG	<p><i>These two bits set the output current of Serial output signals TxD, DTR_n and RTS_n:</i></p> 00: 6 mA 01: 8 mA (Default) 10: 10 mA 11: 12 mA	01
4	RW_ INHB	<p><i>RW_ INH Remote Wake Inhibit:</i></p> 0: Enable the USB Remote Wakeup function 1: Inhibit the USB Remote Wakeup function	0
5	PLL_ Power-Down Bypass Control	0: Enables PLL Power-Down 1: Disables PLL Power-Down	0
6	Interrupt IN Endpoint Status	0: Interrupt Endpoint returns 5 Bytes of data. 1: Interrupt Endpoint returns 5 Bytes + 8 Bytes of the Bulk-In/Out memory controller status	0
7	Reserved	Reserved.	1



Serial Port 1 – Device Configuration Register 2

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
SHDN_ POL	Reserved	RWU_ Mode	EWU_ Rx	EWU_ DSR	EWU_ RI	EWU_ DCD	EWU_ CTS

DCR2 Bit	Name	Definition	Default Value
0	EWU_ CTS	<b>Enable Wake Up Trigger on CTS:</b> 0: Disabled 1: Enable Wake Up Trigger on CTS State Changes.	0
1	EWU_ DCD	<b>Enable Wake Up Trigger on DCD:</b> 0: Disabled 1: Enable Wake Up Trigger on DCD State Changes.	0
2	EWU_ RI	<b>Enable Wake Up Trigger on RI:</b> 0: Disabled 1: Enable Wake Up Trigger on RI State Changes.	1
3	EWU_ DSR	<b>Enable Wake Up Trigger on DSR:</b> 0: Disabled 1: Enable Wake Up Trigger on DSR State Changes.	0
4	EWU_ Rx	<b>Enable Wake Up Trigger on RXD:</b> 0: Disabled 1: Enable Wake Up Trigger on RXD State Changes.	0
5	RWU_ Mode	<b>Remote Wakeup Mode:</b> 0: Engages Remote Wakeup, The device issues Disconnect Signal. 1: Engages Remote Wakeup, The device issues Resume Signal.	1
6	Reserved	Reserved.	0
7	SHDN_ POL	<b>SHDN Polarity:</b> 0: Pin 12 Active Low Shut-Down Signal. 1: Pin 12 Active High Shut-Down Signal.	0

Note: Wake up defined above only works when DCR0[6] = 0 and DCR1[4] = 0.



**Serial Port 2 – Device Configuration Register 0**

The Configuration Registers for this Serial Port are very similar to Serial Port 1, but have a few less configuration options.

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved	IrDA_ Mode	RTS_ CM		Reserved		Reserved	RS_ SDM

DCR0 Bit	Name	Definition	Default Value
0	RS_ SDM	<p><b>RS-232 / RS-422 / RS-485 Transceiver Shut-Down Mode:</b></p> <p>0: Do not shut down the transceiver Even when USB SUSPEND is engaged</p> <p>1: Shut down the transceiver when USB SUSPEND is engaged</p>	1
[3:1]	Reserved	Reserved	000
[5:4]	RTS_ CM	<p><b>RTSM RTS Control Method:</b></p> <p>00: RTS is controlled by Control Bit Map. Signal is active low;</p> <p>01: RTS is controlled by Control Bit Map. Signal is active high;</p> <p>10: Drive RTS active when Downstream Data Buffer is NOT EMPTY; Otherwise Drive RTS inactive.</p> <p>11: Drive RTS inactive when Downstream Data Buffer is NOT EMPTY; Otherwise Drive RTS active.</p>	00
6	IrDA_ Mode	<p>0: RS-232 / RS-422 / RS-485 Serial Port Mode.</p> <p>1: IrDA Mode.</p>	0
7	Reserved	Reserved	0



**Serial Port 2 – Device Configuration Register 1**

The Configuration Registers for this Serial Port are very similar to Serial Port 1, but have a few less configuration options.

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved	Reserved	Reserved	RW_ INHB		Tx_I_ PMG		Reserved

DCR1 Bit	Name	Definition	Default Value
[1:0]	Reserved	Reserved	00
[3:2]	Tx_I_ PMG	<p><i>These two bits set the output current of Serial output signals TxD, DTR_n and RTS_n:</i></p> 00: 6 mA 01: 8 mA (Default) 10: 10 mA 11: 12 mA	01
4	RW_ INHB	<p><i>RW_INH Remote Wake Inhibit:</i></p> 0: Enable the USB Remote Wakeup function 1: Inhibit the USB Remote Wakeup function	0
[7:5]	Reserved	Reserved	0





**Serial Port 2 – Device Configuration Register 2**

The Configuration Registers for this Serial Port are very similar to Serial Port 1, but have a few less configuration options.

Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]
Reserved	Reserved	RWU_ Mode	EWU_ Rx	EWU_ DSR	EWU_ RI	EWU_ DCD	EWU_ CTS

DCR2 Bit	Name	Definition	Default Value
0	EWU_ CTS	<b>Enable Wake Up Trigger on CTS:</b> 0: Disabled 1: Enable Wake Up Trigger on CTS State Changes.	0
1	EWU_ DCD	<b>Enable Wake Up Trigger on DCD:</b> 0: Disabled 1: Enable Wake Up Trigger on DCD State Changes.	0
2	EWU_ RI	<b>Enable Wake Up Trigger on RI:</b> 0: Disabled 1: Enable Wake Up Trigger on RI State Changes.	1
3	EWU_ DSR	<b>Enable Wake Up Trigger on DSR:</b> 0: Disabled 1: Enable Wake Up Trigger on DSR State Changes.	0
4	EWU_ Rx	<b>Enable Wake Up Trigger on RXD:</b> 0: Disabled 1: Enable Wake Up Trigger on RXD State Changes.	0
5	RWU_ Mode	<b>Remote Wakeup Mode:</b> 0: Engages Remote Wakeup, The device issues Disconnect Signal. 1: Engages remote wakeup, the Device issues resume signal.	1
[7:6]	Reserved	Reserved.	0

Note: Wake up defined above only works when DCR0[6] = 0 and DCR1[4] = 0.



USB Software Access For Control Endpoint Registers

Register Write Access

Register Name	BmRequestType	brequest	wValue	wIndex	wLength
sp1_reg	8'h40	8'h0E	16'h0000_8'hxx	16'h0000	16'h0000
sp2_reg	8'h40	8'h0E	16'h0000_8'hxx	16'h000A	16'h0000
control_reg1	8'h40	8'h0E	16'h0000_8'hxx	16'h0001	16'h0000
control_reg2	8'h40	8'h0E	16'h0000_8'hxx	16'h000B	16'h0000
ping_pong_high	8'h40	8'h0E	16'h0000_8'hxx	16'h0002	16'h0000
ping_pong_low*	8'h40	8'h0E	16'h0000_8'hxx	16'h0003	16'h0000
pll_m_reg	8'h40	8'h0E	16'h0000_8'hxx	16'h000E	16'h0000
pll_n_reg	8'h40	8'h0E	16'h0000_8'hxx	16'h0010	16'h0000
clk_mux_reg*	8'h40	8'h0E	16'h0000_8'hxx	16'h0012	16'h0000
clk_select_reg1*	8'h40	8'h0E	16'h0000_8'hxx	16'h0013	16'h0000
clk_select_reg2	8'h40	8'h0E	16'h0000_8'hxx	16'h0014	16'h0000
sp1_ICG_reg	8'h40	8'h0E	16'h0000_8'hxx	16'h002C	16'h0000
sp2_ICG_reg	8'h40	8'h0E	16'h0000_8'hxx	16'h002E	16'h0000
Rx_sampling_reg1	8'h40	8'h0E	16'h0000_8'hxx	16'h0030	16'h0000
zero_len_reg1	8'h40	8'h0E	16'h0000_8'hxx	16'h003A	16'h0000
zero_len_reg2	8'h40	8'h0E	16'h0000_8'hxx	16'h003C	16'h0000
zero_len_flag_en	8'h40	8'h0E	16'h0000_8'hxx	16'h003E	16'h0000

Note: \*

- pll\_m\_reg, pll\_n\_reg: Only bits [5:0] can be written.
- clk\_mux\_reg: Only bits [3:0] can be written.
- clk\_select\_reg1, clk\_select\_reg2: Only bits [5:0] can be written.
- ping\_pong\_low: Only bits [6:0] can be written.



**Register Read Access**

Register Name	BmRequestType	brequest	wValue	wIndex	wLength
sp1_reg	8'hC0	8'h0D	16'h0000_8'h00	16'h0000	16'h0001
sp2_reg	8'hC0	8'h0D	16'h0000_8'h00	16'h000A	16'h0001
control_reg1	8'hC0	8'h0D	16'h0000_8'h00	16'h0001	16'h0001
control_reg2	8'hC0	8'h0D	16'h0000_8'h00	16'h000B	16'h0001
ping_pong_high	8'hC0	8'h0D	16'h0000_8'h00	16'h0002	16'h0001
ping_pong_low	8'hC0	8'h0D	16'h0000_8'h00	16'h0003	16'h0001
pll_m_reg	8'hC0	8'h0D	16'h0000_8'h00	16'h000E	16'h0001
pll_n_reg	8'hC0	8'h0D	16'h0000_8'h00	16'h0010	16'h0001
clk_mux_reg	8'hC0	8'h0D	16'h0000_8'h00	16'h0012	16'h0001
clk_select_reg1	8'hC0	8'h0D	16'h0000_8'h00	16'h0013	16'h0001
clk_select_reg2	8'hC0	8'h0D	16'h0000_8'h00	16'h0014	16'h0001
sp1_ICG_reg	8'hC0	8'h0D	16'h0000_8'h00	16'h002C	16'h0001
sp2_ICG_reg	8'hC0	8'h0D	16'h0000_8'h00	16'h002E	16'h0001
mode_reg*	8'hC0	8'h0D	16'h0000_8'h00	16'h002B	16'h0001
Rx_sampling_reg1	8'hC0	8'h0D	16'h0000_8'h00	16'h0030	16'h0001
bi_fifo_stat1*	8'hC0	8'h0D	16'h0000_8'h00	16'h0032	16'h0001
bo_fifo_stat1*	8'hC0	8'h0D	16'h0000_8'h00	16'h0033	16'h0001
bi_fifo_stat2*	8'hC0	8'h0D	16'h0000_8'h00	16'h0036	16'h0001
bo_fifo_stat2*	8'hC0	8'h0D	16'h0000_8'h00	16'h0037	16'h0001
zero_len_reg1	8'hC0	8'h0D	16'h0000_8'h00	16'h003A	16'h0001
zero_len_reg2	8'hC0	8'h0D	16'h0000_8'h00	16'h003C	16'h0001
zero_len_flag_en_reg	8'hC0	8'h0D	16'h0000_8'h00	16'h003E	16'h0001

**Note:** \*

- mode\_reg : Read-Only Register
- bi\_fifo\_stat1, bi\_fifo\_stat2: Read-Only Register
- bo\_fifo\_stat1, bo\_fifo\_stat2: Read-Only Register



**Electrical Specifications**

**Absolute Maximum Ratings:**

Core Power Supply ( $V_{CC_K}$ )	-0.3 to 2.16 V
Power Supply of 3.3V I/O ( $V_{CC_{3IO}}$ )	-0.3 to 4.0 V
Input Voltage of 3.3V I/O ( $V_{in_3}$ )	-0.3 to 4.0 V
Input Voltage of 5V Tolerant I/O ( $V_{in_5}$ )	-0.3 to 5.8 V
Operating Temperature	0 to +70 °C
Storage Temperature	-40 to +150 °C
ESD HBM (MIL-STD 883E Method 3015-7 Class 2)	2000 V
ESD MM (JEDEC EIA/JESD22 A115-A)	200 V
CDM (JEDEC/JESD22 C101-A)	500 V
Latch-up (JESD No. 78, March 1997)	200 mA, 1.5 x VCC
Junction Temperature ( $T_j$ )	115 °C
Thermal Resistance of Junction to Ambient (Still Air)	80 °C/W

**Operating Conditions:**

Symbol	Parameter	Min	Typ	Max	Units
$V_{CC_{5A}}$	5V Power Supply Input	4.5	5.0	5.5	V
$V_{CC_K}$	Core Power Supply	1.62	1.8	1.98	V
$V_{CC_{3IO}}$	Power Supply of 3.3V I/O	2.97	3.3	3.63	V
REG02_V18	1.8V Regulator Output	1.71	1.8	1.89	V
$I_{REG02\_V18}$	1.8V Regulator Current			70	mA
REG06_VCC33	3.3V Regulator Output	3.14	3.3	3.46	V
$I_{REG06\_VCC33}$	3.3V Regulator Current			250	mA
$I_{5V}$	Operating current of 5V when 3.3V and 1.8V internal regulators are used. No serial load.		70		mA
$I_{3.3V}$	Operating current of 3.3V. No serial load.		45		mA
$I_{1.8V}$	Operating current of 1.8V. No serial load.		25		mA

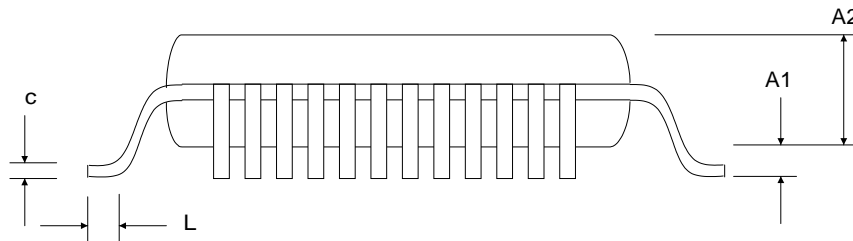
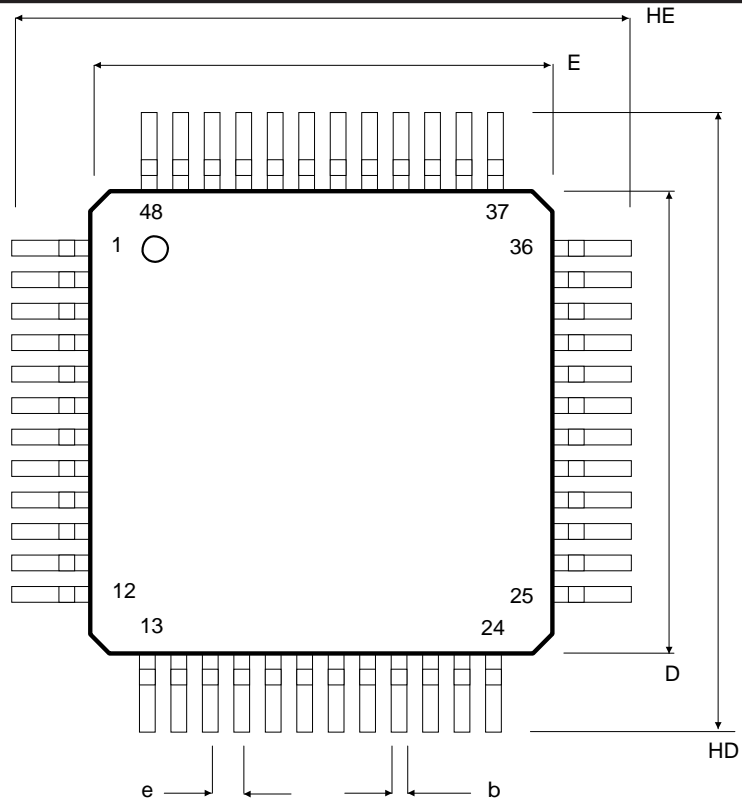


DC Characteristics of 3.3V I/O Cells

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{CC_K}$	Core Power Supply	Core Area	1.62	1.8	1.98	V
$V_{CC_{3IO}}$	Power Supply	3.3V I/O	2.97	3.3	3.63	V
$V_{i_L}$	Input Low Voltage	LVTTL			0.8	V
$V_{i_H}$	Input High Voltage	LVTTL	2.0			V
$V_t$	Switching Threshold	LVTTL		1.5		V
$V_{t-}$ $V_{t+}$	Schmitt Trigger Threshold Voltage	LVTTL	0.8	1.1 1.6	2.0	V
$V_{o_L}$	Output Low Voltage	$I_{O_L} = 2$ to 24mA			0.4	V
$V_{o_H}$	Output High Voltage	$I_{O_H} = -2$ to -24mA	2.4			V

DC Characteristics of 5V Tolerant I/O Cells

Symbol	Parameter	Condition	Min	Typ	Max	Units
$V_{CC_{5A}}$	5V Power Supply	5V I/O	4.5	5.0	5.5	V
$V_{i_L}$	Input Low Voltage	LVTTL			0.8	V
$V_{i_H}$	Input High Voltage	LVTTL	2.0			V
$V_t$	Switching Threshold	LVTTL		1.5		V
$V_{t-}$ $V_{t+}$	Schmitt Trigger Threshold Voltage	LVTTL	0.8	1.1 1.6	2.0	V
$V_{o_L}$	Output Low Voltage	$I_{O_L} = 2$ to 24 mA			0.4	V
$V_{o_H}$	Output High Voltage	$I_{O_H} = -2$ to -24 mA	2.4			V



**48-Pin "CV" LQFP  
Package Dimensions**

SYMBOL	MILLIMETERS		
	MIN	TYPICAL	MAX
A1	0.05		0.15
A2	1.35		1.45
b	0.17		0.27
c	0.09		0.20
e		0.50	
L	0.45		0.75
HD	8.80		9.20
D	6.80		7.20
HE	8.80		9.20
E	6.80		7.20



**MCS7820**

## **USB 2.0 to Dual Serial Controller**

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### Revision History

Revision	Date	Comment
0.1	19-May-2006	Preliminary Release.
0.2	30-May-2006	Switched to new Page-1 Layout.
0.3	31-May-2006	Corrected MaxPacketSize, Endpoint Numbers, Package dimensions.
0.4	05-Jun-2006	Corrected Wlength fields in "Set Application Vendor Specific Command".
1.0	28-Aug-2006	Removed Preliminary Notice. Made change throughout to reflect one GPIO port instead of two. Added Driver Support entries on page 1. Made bits 2 and 3 of the MCR register reserved. Made bit 5 of the Mode register reserved. Replaced Raid_reg1 with Rx_sampling_reg1 throughout document. Modified product ID value in EEPROM Content Layout table. Modified description of bits 3, 2, and 1 of Device Configuration register 0. Made bit 6 of Device Configuration register 2 reserved and added note.
1.1	16-Sept-2006	Clarified Linux Kernel support in Features. Deleted Windows CE5.0 and Vista release dates. Verified state of all Reserved field default values.
1.2	5-August-2007	Updated Absolute Maximum Rating table Deleted Leakage Current table Updated Operating Conditions table Updated 3.3V DC Characteristics table Updated 5V DC Characteristics table Removed dimensions in Inches from Package Dimensions table Removed 'Confidential' notice from all pages
2.00	2011/08/05	<ol style="list-style-type: none"><li>1. Changed to ASIX Electronics Corp. logo, strings and contact information.</li><li>2. Added ASIX copyright legal header information.</li><li>3. Modified the Revision History table format.</li><li>4. Updated the block diagram.</li><li>5. Modified some descriptions in the Feature page.</li></ol>





**MCS7820**

**USB 2.0 to Dual Serial Controller**



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