MCS7840

USB-2.0 to Four Serial Ports

Features

- USB-2.0 Device Controller
- On-Chip USB-2.0 PHY
- On-Chip Voltage Regulators
- Four 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 & 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^2C 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 & Industrial PC

Application Note

- AN-7840

Evaluation Board

- MCS7840-EVB

Package

- 64-pin LQFP Package

Driver Support

- Windows (98SE / ME / 2000 / XP / 2003 Server)
- Linux Kernel 2.6.5 and above
- MAC 10.2 & above
- Windows CE5.0
- Windows Vista

Utility Support

- Windows based EEPROM Tool
- Mass Production Utility

General Description

The MCS7840 is a USB-2.0 to Quad-Serial Port device. It has been developed to connect a wide range of standard serial devices to a USB host.

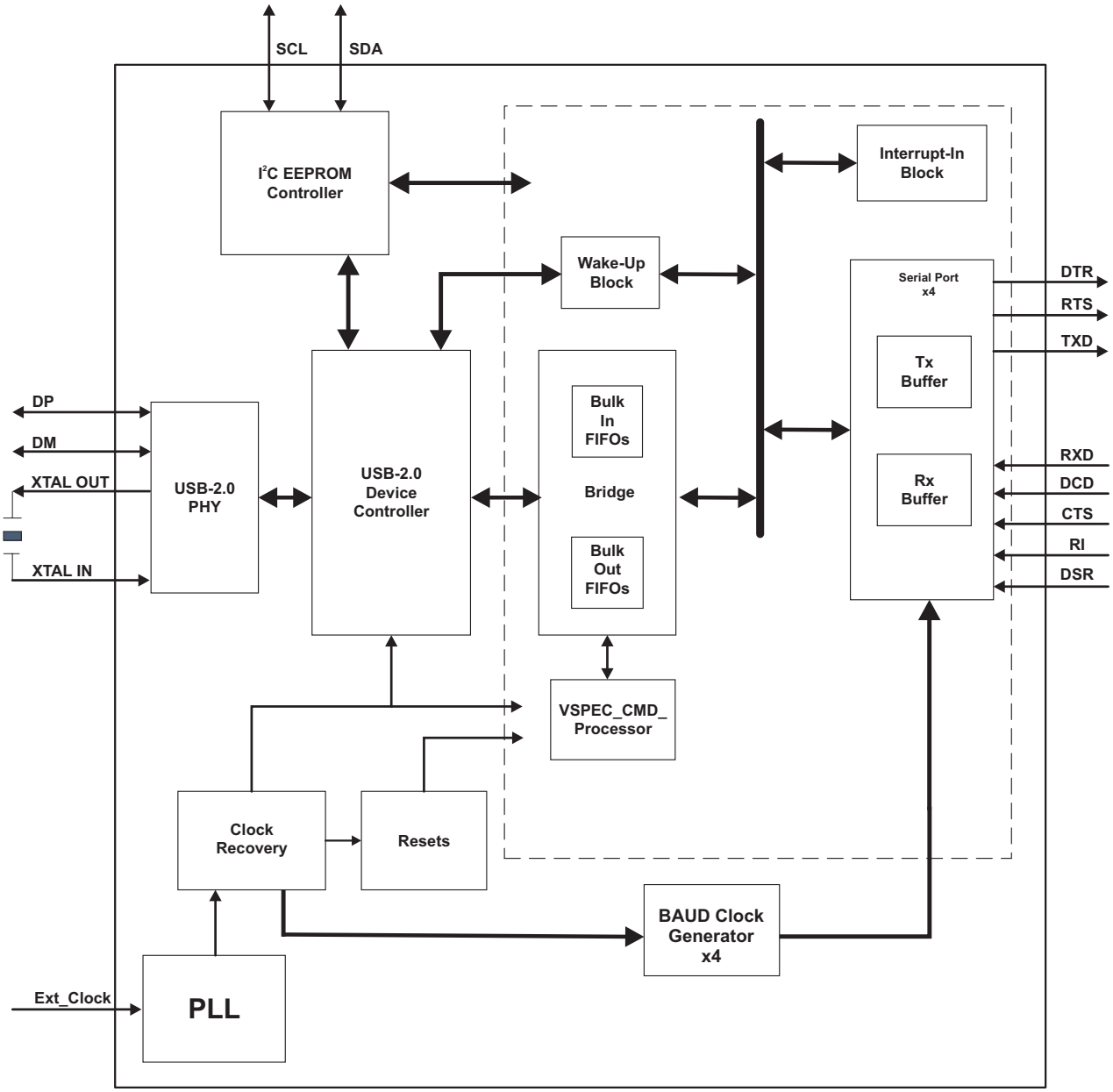
The MCS7840 has a USB Device Controller connected to four (4) individual UARTs.

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.

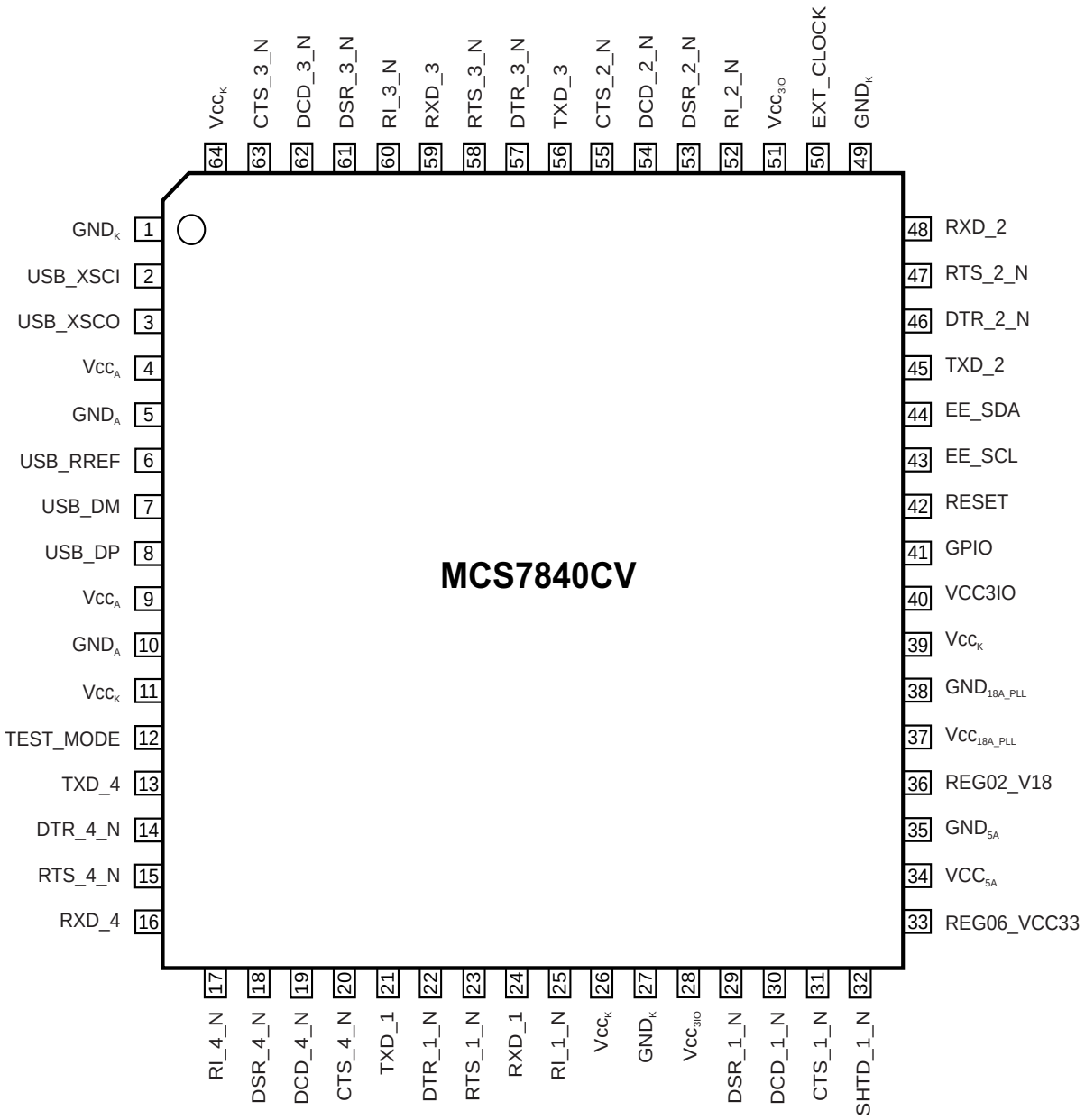
Ordering Information		
Commercial Grade (0 °C to +70 °C)		
MCS7840CV	64-LQFP	RoHS

MosChip Semiconductor ♦ 3335 Kifer Rd, Santa Clara, CA 95051 ♦ Tel (408) 737-7141 ♦ Fax (408) 737-7708

Block Diagram



Pin-Out Diagram



Pin Assignments

Pin	Name	Type	Functional Description
1	GND_K	Power	Core Ground
2	USB_XSCI	Input	Crystal Oscillator Input
3	USB_XSCO	Output	Crystal Oscillator Output
4	Vcc_A	Power	Power Pin (A3V3)
5	GND_A	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_A	Power	Power Pin (A3V3)
10	GND_A	Power	Analog Ground
11	Vcc_K	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_4	Output	Serial Port 4 Transmit Data out to transceiver or IrDA data out to IR LED
14	DTR_4_N	Output	Serial Port 4 Data Terminal Ready (in serial protocol), active low.
15	RTS_4_N	Output	Serial Port 4 Request To Send (in serial protocol), active low.
16	RXD_4	Input	Serial Port 4 Serial Receive Data in from transceiver or IrDA data in from IrDA detector.
17	RI_4_N	Input	Serial Port 4 Ring Indicator, active low
18	DSR_4_N	Input	Serial Port 4 Data Set Ready (in serial protocol), active low
19	DCD_4_N	Input	Serial Port 4 Data Carrier Detect (in serial protocol), active low
20	CTS_4_N	Input	Serial Port 4 Clear To Send (in serial protocol), active low
21	TXD_1	Output	Serial Port 1 Transmit Data out to transceiver, or IrDA data out to IR LED
22	DTR_1_N	Output	Serial Port 1 Data Terminal Ready (in serial protocol), active low.

Pin	Name	Type	Functional Description
23	RTS_1_N	Output	Serial Port 1 Request To Send (in serial protocol), active low.
24	RXD_1	Input	Serial Port 1 Serial Receive Data in from transceiver, or IrDA data in from IrDA detector.
25	RI_1_N	Input	Serial Port 1 Ring Indicator, active low.
26	Vcc_K	Power	Power Pin (1.8V)
27	GND_K	Power	Core Ground
28	Vcc_{3IO}	Power	Power Pin (D3V3)
29	DSR_1_N	Input	Serial Port 1 Data Set Ready (in serial protocol), active low
30	DCD_1_N	Input	Serial Port 1 Data Carrier Detect (in serial protocol), active low
31	CTS_1_N	Input	Serial Port 1 Clear To Send (in serial protocol), active low
32	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.
33	REG06_VCC33	Power	Power Pin (3.3V OUTPUT)
34	Vcc_{5A}	Power	Power Pin (5V INPUT)
35	GND_{5A}	Power	Ground Pin for 5V Input
36	REG02_V18	Power	Power Pin (1.8V OUTPUT)
37	Vcc_{18A_PLL}	Power	PLL Power (1.8V)
38	GND_{18A_PLL}	Power	PLL Ground
39	Vcc_K	Power	Power Pin (1.8V)
40	VCC3IO	Power	Power pin D3V3.
41	GPIO	I/O	GPIO_MODE - Bidirectional GPIO bit. The direction (Input or Output) is controlled by the DCR for Serial Port #1.
42	RESET	I	Power-On Reset signal (active high).
43	EE_SCL	I/O	2-Wire EEPROM Clock. Default = High (1)
44	EE_SDA	I/O	2-Wire EEPROM Data in/out. Default = High (1)
45	TXD_2	Output	Serial Port 2 Transmit Data out to transceiver, or IrDA data out to IR LED
46	DTR_2_N	Output	Serial Port 2 Data Terminal Ready (in serial protocol), active low.

Pin	Name	Type	Functional Description
47	RTS_2_N	Output	Serial Port 2 Request To Send (in serial protocol), active low.
48	RXD_2	Input	Serial Port 2 Serial Receive Data in from transceiver or IrDA data in from IrDA detector.
49	GND_K	Power	Core Ground.
50	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.
51	Vcc_{3IO}	Power	Power Pin (D3V3).
52	RI_2_N	Input	Serial Port 2 Ring Indicator, active low.
53	DSR_2_N	Input	Serial Port 2 Data Set Ready (in serial protocol), active low.
54	DCD_2_N	Input	Serial Port 2 Data Carrier Detect (in serial protocol), active low.
55	CTS_2_N	Input	Serial Port 2 Clear To Send (in serial protocol), active low.
56	TXD_3	Output	Serial Port 3 Transmit Data out to transceiver, or IrDA data out to IR LED.
57	DTR_3_N	Output	Serial Port 3 Data Terminal Ready (in serial protocol), active low.
58	RTS_3_N	Output	Serial Port 3 Request To Send (in serial protocol), active low.
59	RXD_3	Input	Serial Port 3 Serial Receive Data in from transceiver, or IrDA data in from IrDA detector.
60	RI_3_N	Input	Serial Port 3 Ring Indicator, active low.
61	DSR_3_N	Input	Serial Port 3 Data Set Ready (in serial protocol), active low.
62	DCD_3_N	Input	Serial Port 3 Data Carrier Detect (in serial protocol), active low.
63	CTS_3_N	Input	Serial Port 3 Clear To Send (in serial protocol), active low.
64	Vcc_K	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.

I^2C EEPROM Controller

The I^2C 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 & 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 & 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 & Receiver Holding Register (THR & RHR):
Data is written into the bottom of the THR queue & read from the top of the RHR queue completely asynchronously to the operation of the transmitter & 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 & 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[2] Number of Stop-Bits per serial character.

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[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.

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

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
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

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 9th 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 & THR Empty	Logic 0: The transmitter is not idle Logic 1: THR is empty & 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 & 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 & receiver is given by:

BAUD Rate = Input Clock / (16 * Divisor)

where divisor is given by (256 * DLM) + 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.

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.

RS-422

This is the full duplex mode.

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

Configuration Options
Four 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	Bulk-In	Serial Port – 3	64 / 512
6	Bulk-Out	Serial Port – 3	64 / 512
7	Bulk-In	Serial Port – 4	64 / 512
8	Bulk-Out	Serial Port – 4	64 / 512
9	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
- 0x02ww is the application number for Serial Port-2
- 0x03ww is the application number for Serial Port-3
- 0x04ww is the application number for Serial Port-4
- 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'h40
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'h51
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'h83
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'h04
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 & High Speed USB

Endpoint-5 Serial Port 3 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-6 Serial Port 3 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

Endpoint-7 Serial Port 4 Bulk-In

Configuration Descriptor	Index	Data
bLength	0	8'h07
bDescriptorType	1	8'h05
bEndpointAddress	2	8'h87
bmAttributes	3	8'h02
wMaxPacketSize(L)	4	8'h40/8'h00 *
wMaxPacketSize(M)	5	8'h00/8'h02 *
bInterval	6	8'hFF

Endpoint-8 Serial Port 4 Bulk-Out

Configuration Descriptor	Index	Data
bLength	0	8'h07
bDescriptorType	1	8'h05
bEndpointAddress	2	8'h08
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 & High Speed USB

Endpoint-9
Interrupt Endpoint

Configuration Descriptor	Index	Data
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

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)
11	1	SER2_DCR0	Device Configuration Registers (SER2_DCR0)
12	1	SER2_DCR1	Device Configuration Registers (SER2_DCR1)
13	1	SER2_DCR2	Device Configuration Registers (SER2_DCR2)
14	1	SER3_DCR0	Device Configuration Registers (SER3_DCR0)
15	1	SER3_DCR1	Device Configuration Registers (SER3_DCR1)
16	1	SER3_DCR2	Device Configuration Registers (SER3_DCR2)
17	1	SER4_DCR0	Device Configuration Registers (SER4_DCR0)
18	1	SER4_DCR1	Device Configuration Registers (SER4_DCR1)
19	1	SER4_DCR2	Device Configuration Registers (SER4_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 MCS7840 (Example Contents)

EE_Check,
VID,
PID,
RN,
SER1_DRC0, SER1_DRC1, SER1_DRC2,
SER2_DRC0, SER2_DRC1, SER2_DRC2,
SER3_DRC0, SER3_DRC1, SER3_DRC2,
SER4_DRC0, SER4_DRC1, SER4_DRC2,
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
0	10	
1	97	
2	10	
3	97	
4	40	
5	78	
6	01	
7	00	
8	01	
9	85	
10	24	
11	01	
12	80	
13	24	
14	01	
15	80	
16	24	
17	01	
18	80	
19	24	
20	01	
21	05	
22	09	
23	04	
24	4D	M
25	00	
26	6F	o
27	00	
28	73	s
29	00	
30	43	C
31	00	
32	68	h
33	00	
34	69	i
35	00	
36	70	p
37	00	
38	20	Space
39	00	
40	53	S
41	00	
42	65	e
43	00	

Location	HEX	ASCII
44	6D	m
45	00	
46	69	i
47	00	
48	63	c
49	00	
50	6F	o
51	00	
52	6E	n
53	00	
54	64	d
55	00	
56	75	u
57	00	
58	63	c
59	00	
60	74	t
61	00	
62	6F	o
63	00	
64	72	r
65	00	
66	20	Space
67	00	
68	20	Space
69	00	
70	20	Space
71	00	
72	55	U
73	00	
74	53	S
75	00	
76	42	B
77	00	
78	2D	-
79	00	
80	53	S
81	00	
82	65	e
83	00	
84	72	r
85	00	
86	69	i
87	00	

Location	HEX	ASCII
88	61	a
89	00	
90	6C	l
91	00	
92	20	Space
93	00	
94	43	C
95	00	
96	6F	o
97	00	
98	6E	n
99	00	
100	74	t
101	00	
102	72	r
103	00	
104	6F	o
105	00	
106	6C	l
107	00	
108	6C	l
109	00	
110	65	e
111	00	
112	72	r
113	00	
114	4D	M
115	00	
116	6F	o
117	00	
118	73	s
119	00	
120	43	C
121	00	
122	68	h
123	00	
124	69	i
125	00	
126	70	p
127	00	
128	20	Space
129	00	

Device Configuration Bit Fields and Descriptions

Bytes 4, 5, 6 and 22-30 form twenty-four 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
11	SER2_DCR[7:0]	SER2_DCR0	0	22	0x01
12	SER2_DCR[15:8]	SER2_DCR1	0	23	0x84
13	SER2_DCR[23:16]	SER2_DCR2	0	24	0x24
14	SER3_DCR[7:0]	SER3_DCR0	0	25	0x01
15	SER3_DCR[15:8]	SER3_DCR1	0	26	0x84
16	SER3_DCR[23:16]	SER3_DCR2	0	27	0x24
17	SER4_DCR[7:0]	SER4_DCR0	0	28	0x01
18	SER4_DCR[15:8]	SER4_DCR1	0	29	0x84
19	SER4_DCR[23:16]	SER4_DCR2	0	30	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	***RS-232 / RS-422 / RS-485 Transceiver Shut-Down Mode:*** 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	***RTSM RTS Control Method:*** 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	***These two bits set the output current of the GPIO lines:*** 00: 6 mA 01: 8 mA (Default) 10: 10 mA 11: 12 mA	01
[3:2]	Tx_I_ PMG	***These two bits set the output current of Serial output signals TxD, DTR_n and RTS_n:*** 00: 6 mA 01: 8 mA (Default) 10: 10 mA 11: 12 mA	01
4	RW_ INHB	***RW_INH Remote Wake Inhibit:*** 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	***Enable Wake Up Trigger on CTS:*** 0: Disabled 1: Enable Wake Up Trigger on CTS State Changes.	0
1	EWU_ DCD	***Enable Wake Up Trigger on DCD:*** 0: Disabled 1: Enable Wake Up Trigger on DCD State Changes.	0
2	EWU_ RI	***Enable Wake Up Trigger on RI:*** 0: Disabled 1: Enable Wake Up Trigger on RI State Changes.	1
3	EWU_ DSR	***Enable Wake Up Trigger on DSR:*** 0: Disabled 1: Enable Wake Up Trigger on DSR State Changes.	0
4	EWU_ Rx	***Enable Wake Up Trigger on RXD:*** 0: Disabled 1: Enable Wake Up Trigger on RXD State Changes.	0
5	RWU_ Mode	***Remote Wakeup Mode:*** 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	***SHDN Polarity:*** 0: Pin 12 Active Low Shut-Down Signal. 1: Pin 12 Active High Shut-Down Signal.	0

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

Serial Port (2, 3, & 4) – Device Configuration Register 0

The Configuration Registers for these three Serial Ports are all identical.
They 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	***RS-232 / RS-422 / RS-485 Transceiver Shut-Down Mode:*** 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]	Reserved	Reserved	00
[5:4]	RTS_ CM	***RTSM RTS Control Method:*** 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 (2, 3, & 4) – Device Configuration Register 1

The Configuration Registers for these three Serial Ports are all identical.
They 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	***These two bits set the output current of Serial output signals TxD, DTR_n and RTS_n:*** 00: 6 mA 01: 8 mA (Default) 10: 10 mA 11: 12 mA	01
4	RW_ INHB	***RW_INH Remote Wake Inhibit:*** 0: Enable the USB Remote Wakeup function 1: Inhibit the USB Remote Wakeup function	0
5	Reserved	Reserved	0
6	Reserved	Reserved	0
7	Reserved	Reserved	1

Serial Port (2, 3, & 4) – Device Configuration Register 2

The Configuration Registers for these three Serial Ports are all identical.
They 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	***Enable Wake Up Trigger on CTS:*** 0: Disabled 1: Enable Wake Up Trigger on CTS State Changes.	0
1	EWU_ DCD	***Enable Wake Up Trigger on DCD:*** 0: Disabled 1: Enable Wake Up Trigger on DCD State Changes.	0
2	EWU_ RI	***Enable Wake Up Trigger on RI:*** 0: Disabled 1: Enable Wake Up Trigger on RI State Changes.	1
3	EWU_ DSR	***Enable Wake Up Trigger on DSR:*** 0: Disabled 1: Enable Wake Up Trigger on DSR State Changes.	0
4	EWU_ Rx	***Enable Wake Up Trigger on RXD:*** 0: Disabled 1: Enable Wake Up Trigger on RXD State Changes.	0
5	RWU_ Mode	***Remote Wakeup Mode:*** 0: Engages Remote Wakeup, The device issues Disconnect Signal. 1: engages remote wakeup, the Device issues resume signal.	1
6	Reserved	Reserved	0
7	Reserved	Reserved	0

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

Electrical Specifications

Absolute Maximum Ratings:

Core Power Supply (Vcc_K)	-0.3 to 2.16 V
Power Supply of 3.3V I/O (Vcc_{3IO})	-0.3 to 4.0 V
Input Voltage of 3.3V I/O (Vin_3)	-0.3 to 4.0 V
Input Voltage of 5V Tolerant I/O (Vin_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 (Tj)	115 °C
Thermal Resistance of Junction to Ambient (Still Air)	65 °C/W

Operating Conditions:

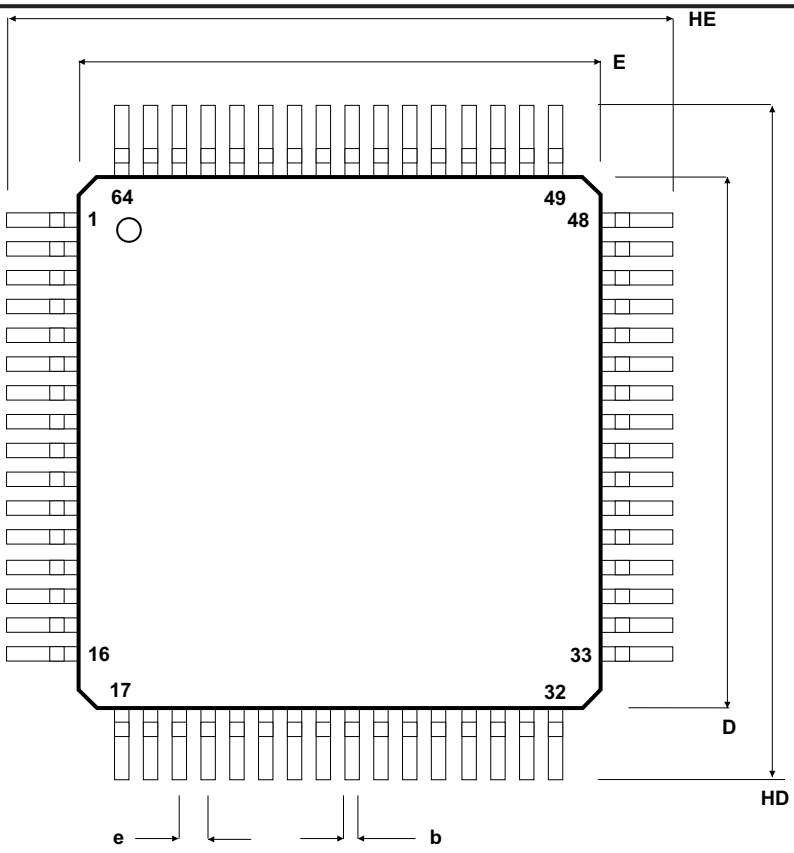
Symbol	Parameter	Min	Typ	Max	Units
Vcc_{5A}	5V Power Supply Input	4.5	5.0	5.5	V
Vcc_K	Core Power Supply	1.62	1.8	1.98	V
Vcc_{3IO}	Power Supply of 3.3V I/O	2.97	3.3	3.63	V
REG02_V18	1.8V Regulator Output	1.71	1.8	1.89	V
I_{REG02_V18}	1.8V Regulator Current			70	mA
REG06_VCC33	3.3V Regulator Output	3.14	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

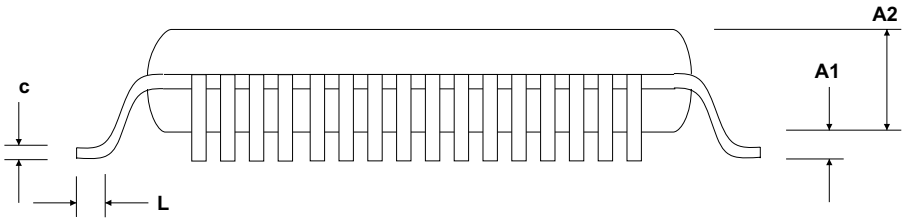
DC Characteristics of 3.3V I/O Cells

Symbol	Parameter	Condition	Min	Typ	Max	Units
Vcc_K	Core Power Supply	Core Area	1.62	1.8	1.98	V
Vcc_{3IO}	Power Supply	3.3V I/O	2.97	3.3	3.63	V
Vi_L	Input Low Voltage	LVTTL			0.8	V
Vi_H	Input High Voltage	LVTTL	2.0			V
Vt	Switching Threshold	LVTTL		1.5		V
Vt- Vt+	Schmitt Trigger Threshold Voltage	LVTTL	0.8	1.1 1.6	2.0	V
Vo_L	Output Low Voltage	Io_L= 2 to 24mA			0.4	V
Vo_H	Output High Voltage	Io_H= -2 to -24mA	2.4			V

DC Characteristics of 5V Tolerant I/O Cells

Symbol	Parameter	Condition	Min	Typ	Max	Units
Vcc_{5A}	5V Power Supply	5V I/O	4.5	5.0	5.5	V
Vi_L	Input Low Voltage	LVTTL			0.8	V
Vi_H	Input High Voltage	LVTTL	2.0			V
Vt	Switching Threshold	LVTTL		1.5		V
Vt- Vt+	Schmitt Trigger Threshold Voltage	LVTTL	0.8	1.1 1.6	2.0	V
Vo_H	Output Low Voltage	Io_L= 2 to 24 mA			0.4	V
Vo_H	Output High Voltage	Io_H= -2 to -24 mA	2.4			V





64-Pin "CV" LQFP
Package Dimensions

Symbol	Millimeters		
	MIN	TYP	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	11.75		12.25
D	9.90		10.10
HE	11.75		12.25
E	9.90		10.10

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Revision History

Revision	Changes	Date
0.9	Preliminary Release	30-May-2006
0.91	Corrected MaxPacketSize values (FS/HS)	01-Jun-2006
0.92	Corrected Wlength field in “Set Application Vendor Specific Command”	05-Jun-2006
1.0	Removed Preliminary Notice. Made change to reflect one GPIO port instead of two. Added Driver Support entries on page 1. Made bits 2 and 1 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. Made bit 1 of Device Configuration register 0 reserved and added note. Modified description of bit 1 of Device Configuration register 0. Made bit 6 of Device Configuration register 0 reserved and added note.	28-Aug-2006
1.1	Clarified Linux Kernel support in Features Deleted Windows CE5.0 and Vista release dates	16-Sept-2006
1.2	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	6-August-2007