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Glueless Packet Transport from PowerQUICC Network Processors to MSC711x DSP Devices

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The MSC711x Fast Ethernet Controller (FEC) operating in 7-wire mode is a good way to achieve glueless packet transport between PowerQUICC network processors, such as the MPC8xx family, and MSC711x DSP devices. This mode of 10Mbps chip-to-chip data transport has several advantages:

- PowerQUICC processors use the serial communications controller (SCC), leaving the fast communications controllers (FCC) available for other uses such as a WAN or LAN interface.
- Only six signals are needed to connect the two devices, much fewer than those required for use of the parallel host port, MII, or RMII Ethernet.
- Full duplex communication is achieved.
- A large software base on PowerQUICC network processors already uses Ethernet as a packet transport mechanism. The modifications to Ethernet drivers are minimal.

The disadvantages of this approach are that 7-wire mode has a limit of 10Mbps and the number of DSP devices that can connect to the PowerQUICC is limited by the number of SCCs. For large farms of DSP devices, connecting to 100BaseT Ethernet or connecting over the bus to the HDI16 DSP bus interface is recommended. This application note focuses on the use of FEC 7-wire mode and explains the steps to configure an FEC to use 7-wire mode.

CONTENTS

1 MSC711x-PowerQUICC Connection

The MSC711x FEC supports 10/100 Mbps Ethernet as defined by **IEEE**® Std 802.3. It has two MAC-PHY interfaces, the media-independent interface (MII) and the reduced media-independent interface (RMII). For details on how to configure the MSC711x FEC for MII, RMII, and 7-wire modes, refer to the *MSC711x Reference Manual*. To set up communications between an MSC711x device (such as the MSC7113 or MSC7116) and an MPC860 device in 7-wire Ethernet mode, we connect the MSC711x FEC to the MPC860 SCC, as shown in **Figure 1**. Notice that only six wires are used to make this connection. The MSC711x COL pin and the MPC860 CLSN pin are grounded.

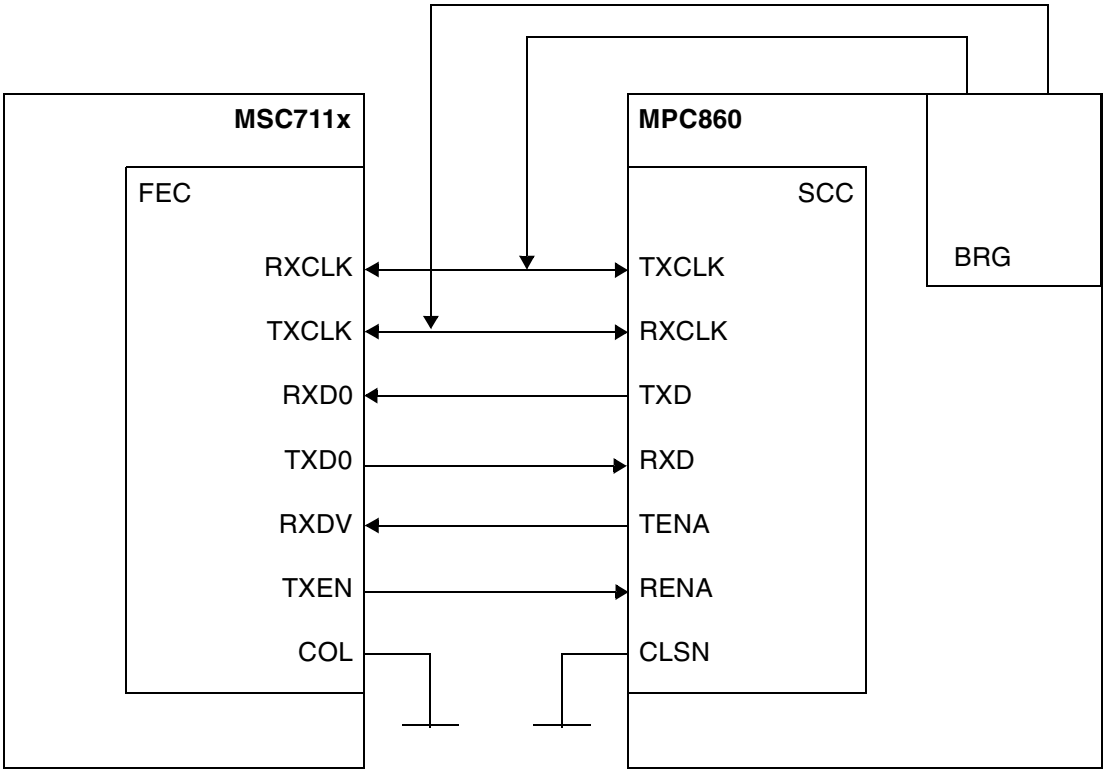

Figure 1. 7-wire Ethernet Connection Between MPC860 SCC and MSC711x FEC

The connection bypasses PHY, so the clock signals must be provided by generating the RX/TX clock signals via either the MSC711x or the MPC860 device. Alternatively, clock signals from an external source can be used. We use the MPC860 BRG to generate RX/TX clock signals. The clock rate is 10 MHz.

We developed two test programs to test the configuration shown in **Figure 1**. The MSC711x FEC is configured as specified in **Section 2**. The MPC860 SCC can be configured to support Ethernet, and its default mode is 10 MHz 7-wire mode. We installed two separate CodeWarrior tools on the desktop, one for StarCore and another for PowerPC. There may be problems when two CodeWarrior debuggers run from the same PC. We recommend the use of two separate PCs because it is more convenient to control how the test programs run from either side.

To run the test programs, download the MSC711x project and PowerPC project using CodeWarrior debuggers[1]. Use the debuggers to control the programs for both the MSC711x and PowerPC. Both the MSC711x and the PowerPC code sends data packets with changing patterns to the other side through the 7-wire Ethernet connection. For details on the data length and data pattern, refer to the sample code that accompanies this application note.

At any point, you can stop program execution by pressing the break button on the debugger interface. You can also open memory windows for sending/receiving data buffers to check the correctness of the data. You can run the programs step-by-step to verify that each individual packet is sent or received correctly, as follows:

1. Run the PowerPC code by clicking on the run button on the debugger interface.
2. Set a breakpoint on the MSC711x side so that one individual packet is sent.
3. Run the MSC711x project by clicking on the run button on the debugger interface.

   The MSC711x code pauses after each individual data packet is sent.
4. On the PowerPC side, open a memory window to monitor the received buffer content and verify that the correct packet is received.
5. Repeat this process to verify that each individual packet is correctly sent by the MSC711x and received by MPC860.
6. Use the same process to verify that the MPC8260 device sent the packet correctly and that the MSC711x received it.

2 MSC711x Configuration for 7-Wire Mode

To configure the MSC711x FEC for operation in 7-wire mode, you must configure port A and port D GPIO signal pins and GPIO registers. A total of nine pins are configured, but MDIO and MDC communicate with the PHY. When the PHY is not used, only 7 pins are used. For details on the GPIO registers, consult the chapter on GPIO in the *MSC711x Reference Manual*.

Table 1. GPIO Port Signal Pin Configuration

Port	Signal Pin Number	Function
Port A	20	TXD0
	22	RXD0
	23	TXCLK
	24	TXEN
	25	RXDV
Port D	0	COL
	2	MDC
	3	MDIO
	5	RXCLK

1. The Metrowerks CodeWarrior development tools are used for both MSC711x and MPC860 code development. They are CodeWarrior for StarCore 2.5.2 and CodeWarrior for PPC 8.1.

Table 2. GPIO Port Register Configuration

Register	Value
Port A Control Register (GPACTL)	0x03D00000
Port A Data Direction Register (GPADDR)	0x00000000
Port A Data Register (GPADR)	0x00000000
Port D Control Register (GPDCTL)	0x0000002D
Port D Data Direction Register (GPDDDR)	0x00000000
Port D Data Register (GPDDR)	0x00000000

Table 3 lists the FEC registers that must be configured for the MSC711x FEC to work in 7-wire mode.

Table 3. FEC Register Configuration

Register	Value	Description
MIIGSK Configuration Register (MIIGSKCFG)	= 0x00	No internal loopback, pass-through mode for MII
MIIGSK Enable Register (MIIGSKEN) MIIGSKEN[MIIEN] = 1	= 0x01	Enable transmission/reception of frames.
Receive Control Register (RCTL) RCTL[MIIM] = 0 RCTL[DRT] = 0 RCTL[LOOP] = 0	& = 0xFFFFFFF8	Full duplex 7-wire mode with internal loopback disabled.
Transmit Control Register (TCTL)	= 0x04	Full duplex mode and no heartbeat control.
Ethernet Control Register (ECTL): ECTL[EEN]	• ECTL = 0x000 • ECTL = 0x02	Clear the EEN bit. Reset DMA, BD, and FIFO logic. Reset the EEN bit to 1 to enable the FEC.

Configure other registers as required, such as the Physical Address Low/High Registers, Receive and Transmit Descriptor Ring Start Registers, and DMA Receive Buffer Size Register. Before enabling the FEC, initialize the receive/transmit descriptor rings. The configuration of these registers is not specific to 7-wire mode. Consult the *MSC711x Reference Manual* and other application notes for the correct settings of these registers. Also, see the sample code accompanying this application note.

3 Conclusion

Test programs running with the hardware configuration shown in **Figure 1**confirm that the MSC711x and MPC860 devices can exchange Ethernet packets correctly in 7-wire Ethernet mode. However, there is one minor constraint. If you enable the Ethernet controller, disable it, and then re-enable it, the first frame received by the MSC711x is dropped. Refer to the MSC711x errata for workaround and status updates. The MSC711x 7-wire Ethernet operating mode can also be verified through an external loopback mode. Our work demonstrates that the MSC711x 7-wire Ethernet mode can be used as an effective and convenient glueless packet transport mechanism.

4 Related Reading

The following Freescale documents are available on the web site listed on the back cover of this document.

[1] *MSC711x Reference Manual*, especially the FEC and GPIO chapters.

[2] *MPC860 PowerQUICC™ Family User's Manual*, especially the SCC chapter.

[3] *MSC711xADS User's Manual*.

[4] AN2289/D, *MPC8xx QMC Usage Advisory*.

[5] *MPC860FADSDBUM, MPC860DB and MPC860SARDB and MPC860TDB User's Manual*.

[6] AN2780, *Getting Started With the MSC711x Application Development System (MSC711xADS)*.

[7] AN2786, *MSC711x Design Checklist*.

[8] AN2781, *A Comparison of StarCore DSP Ethernet Controllers*.

NOTES:

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