

Enabling Dual SIM Phones

Interprocessor Communication Using the iCE40 Ultra Low Density FPGA

Dual SIM Phones

A dual SIM phone is one which holds two SIM cards. Both can be active at the same time or one at a time. A phone that allows both SIMs to be active simultaneously and allows calls to be received on either number at any given time is also known as “Active dual-SIM phone”.

■ **There are two different types of “Active dual-SIM phones”**

- Single call / dual standby – dual SIM phone with one baseband processor
- Dual call / dual standby – dual SIM phone with two independent baseband processors

Lattice enables dual SIM phones with dual call / dual standby capability with a solution for bridging two baseband processors.

Interprocessor Communication

Interprocessor communication often relies on external hardware devices due to the processor lacking common communication ports. For example, almost every processor comes with a SPI port, however one must be the master and the other the slave. Processors are offered with SPI or I²C masters only, making communication impossible. Also, different interface voltage levels prevent direct connection even when the right communication ports are presented. Therefore, interprocessor communication heavily relies on external bridging devices.

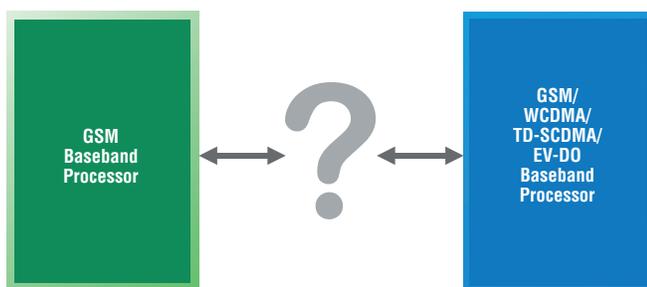


Figure 1: Processors can't communicate directly.

“ Dual SIM handsets are among the fastest growing segments in the handset market. This is reflected in the number of companies that sell dual SIM handsets, which has rapidly increased. 18 months ago, there were only three companies selling dual SIM phones. Now there are about 40 brands in the market. ”

KPMG Research

Interprocessor Communication Solutions

- **There are many ways to make interprocessor communication bridging solutions.**
 - Communicate through a mailbox (Figure 3)
 - Direct communication through a common interface port (Figure 4)

The flexible iCE40™ FPGA offers designers the choice of any processor interface (Figure 2). In addition, extra functions can be added to the design as long as it fits in the density of the designer's choice. Designers can also define the internal functions and mailbox configuration based on their software implementation.

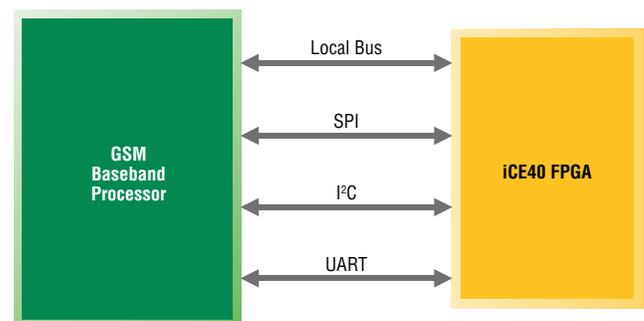


Figure 2: Examples of processor interfaces that can be used for interprocessor communication using the iCE40 FPGA.

Solutions Using the iCE40 FPGA

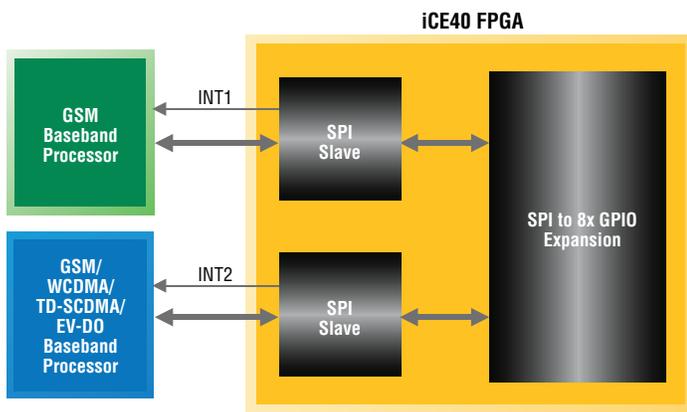


Figure 3: Interprocessor communication using a SPI bridge with shared mailbox registers.

Lattice Solution 2

The Qualcomm 6085 only offers two UART ports and they are used for Bluetooth and SIM interfaces needing an additional UART port to communicate to the NXP 4902 processor. Lattice has implemented a Local Bus to UART bridging function along with a voltage level shifter to make the connection from the 6085 to the UART of the 4902. In addition, the SPI to GPIOs x8 expansion design and SIM card switching logic have been implemented to further reduce the component counts. One of the benefits of using an iCE40 FPGA is that it offers flexibility by adding additional functions and logic at no extra cost as long as there is space left. Designers always want more GPIOs in their design. GPIO expansion is just one of the basic functions offered by the iCE40. Additional functions such as additional UART, SPI, I²C, SD/SDIO, memory controller and more can be implemented as well.

Lattice Solution 1

The example shown in Figure 3 utilizes the processor's SPI port. Two SPI slaves are implemented inside the iCE40 FPGA along with a shared mailbox structure made of built-in block RAM (BRAM) with independent read and write operations. As compared to the dual-port RAM structure, this tremendously reduces the number of signals which further simplifies PCB layout and software implementation. iCE40 FPGAs can be customized specifically to help simplify software implementation.

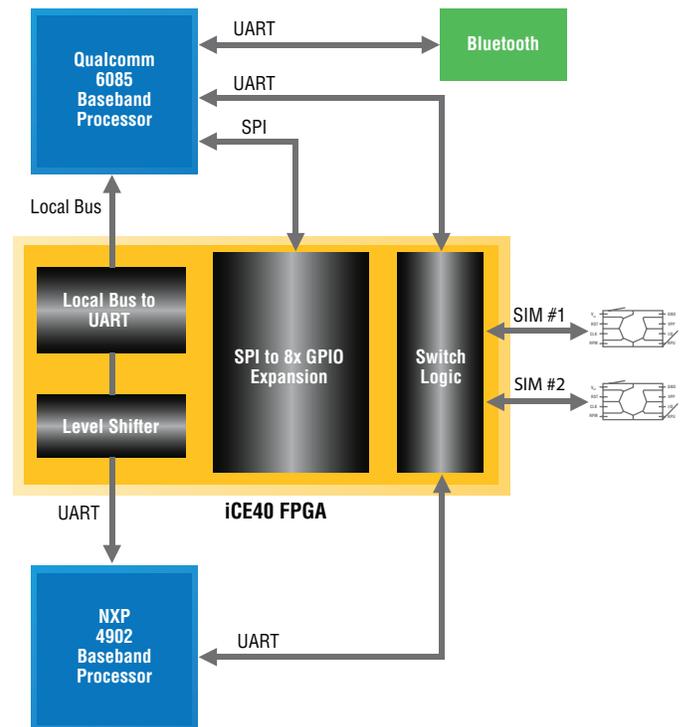


Figure 4: Interprocessor Communication Solution for Qualcomm 6085 and NXP 4902 Using the iCE40 FPGA.

Applications Support

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