Replacing the MC68HC24 Port Replacement Unit

Motorola has decided to discontinue the 68HC24 PRU, which we've widely used in our board designs. We have until September of this year ('99) to place final orders for the 68HC24. After those orders are filled, we will not have a source for 68HC24's anymore, and therefore, will not be able to supply them to you.

This letter is intended to inform you of the situation, present some thought we have on how to deal with the situation and also survey your desires and thoughts on the best solutions.

Background

The F68HC11 was designed to be either a single chip, or an expanded computer. When the single chip was put in an expanded mode, pins that would have other wise been available as ports, were lost to the user as lines used to create the address and data bus. Inside the 68HC11, the registers associated with the lost ports, Port B and Port C, were turned off and did not appear in the memory map. To allow seamless development of single chip projects, the lost ports had to be replicated on an external device. The 68HC24 was designed to perfirm exactly that function. Putting additional registers into the 68HC11's register set, externally, allowed the 68HC24 to capture any writes to the missing ports on its own pins. Likewise, reads to the missing internal ports were provided by the external 68HC24. The 68HC24 Port Replacement Unit thereby fulfilled its mission of replacing the missing ports.

Our use of the 68HC24 Port Replacement Unit dates back to aproximately 1987, with our first F68HC11 board design. Although other parallel port parts could have been used, and were certainly cheaper per feature than the 68HC24, the 68HC24 was a perfect match for the 68HC11. Use of the 68HC24 allowed our boards to be used as both single board computers with significant I/O density, as well as development systems for target single chip computers. Code developed and run on the board could be subitted to Motorola as ROM code for single chip which should then run the same in the final chip as they did on the 68HC11-68HC24 expanded combination.

Our first 68HC11 board was the NMIX-0022. This single basic board layout was offered in many partial-to-fully-populated versions, including the NMIX-0021, NMIX-0022, NMIT-0021 and NMIT-0022. The 0022's boards included the PRU and the 0021' s did not. The PRU was also used on some of our SPCL special features boards. Many of our customers used the NMIX-0022 as the basis of their custom designs, as well.

Later, we used less of the 68HC24's as our NMIX-0020 became more popular. On this design, the PRU was removed and a keypad and LCD interface were put in its place. Still, many I/O intensive applications still used the 68HC24. Now all of them will have to have an alternate solution to continue past the parts retirement.

Possible Solutions

Just leaving empty holes on the board will certainly allow us to continue to sell NMIX/T-0021's, but for our customers who have designed in the NMIX-0022 or have based a custom design using the 68HC24, an empty spot in their design will not be very satisfying.

Three different approaches to replacing the 68HC24 occur to me. Assuming no other manufacturer picks up and supplies the 68HC24, the ports must be replaced in some other manner.

I see one possible solution to select and program an FPGA to recreate the exact functions of the 68HC24. We'd have to get mighty lucky to find an FPGA that could be 100% pin compatible. More likely, using an FPGA on a daughter board which adapted its pinout to either the same pattern as the 68HC24 socket's hole pattern, or fit the JEDSTACK which is a very common feature on most all of our boards. Use of the JEDSTACK replacment might be more convenient in one sense, but would have an effect on

connectorization, and might not be functional. Forinstance, if the 68HC24 was used in a custom design, the signals form the 68HC24 might be routed directly to the existing NMIX-0022 connector and then on to connection points elsewhere on the board. Another potential draw back of using an FPGA to replace the 68HC24 is the current requirements will almost surely by higher. Battery based applications might be affected. The use of the FPGA is the only solution I can imagine that would be 100% compatible with every feature of the 68HC24 and work perfectly with old software without any changes.

The second possible solution that occurs to me is to replace the 68HC24 with another parallel port part. The 68HC21 and similar variants, or even the 82C55, could provide the equivalent number of port lines. None would be pin for pin compatible. Also, the 68HC24 has some internal address decoding, so either external glue logic or PLD's would be needed to place the chosen part in the memory map. As a result, either the daughter board adapted to the 68HC24 socket pattern, or one on a JEDSTACK connector would be required. While the alternate port part can offer the same number of pins, it will surely not be compatible with existing software. Programming capabilities will be needed. The original source and the ability to recreate the object code will be necessary, as well as the services of a programmer to affect the changes. If no programmer familiar with the original code is available, we may be able to provide these programming services.

Most conversions should be rather simple. Address locations and bit functions may vary slightly. The 68HC24 has a few somewhat unique handshaking features. Other parts offer handshaking as well, but they may not be an exact match. So to the degree the special features of the 68HC24 were used, the job of reprogramming will become more difficult. Hopefully we'll find this to be the rarer case. most likely the 68HC24 will have been used as simple port lines.

This brings the last solution possibility to mind. For people who only need specific, individual ports lines without any handshake strobes, or what have you, we could make a daughter board with a random logic which appear at the same address. Also, one of our standard parallel port 2x4"s might be added to the JEDSTACK. Then, the software and connectorization issues must be addressed, but they will be very few, and we can proceed quickly into the market with this solution.

In any case, we can work to a solution and are looking forward to hearing feedback on these ideas. We don't feel we can just arbitrarily choose one, because we do not know all the applications and design details where our standard and customized boards are used. Please consider these solutions and give us feed back on how we can best assist you.

Of course, there is another possibility. it might be time to upgrade your entire design, and we'd like to help. This might be as simple as a relayout to a board with a different port part. Or it could be a complete change of processor. Many of the new processors come in packages with have many pins. They do not need a part like the 68HC24 to maintain high I/O density. We could offer assistance in laying out your product with the newer processor. We may be able to help you convert your software to a newer preocessor as well, even if your source code or programmer is long gone. We may be able to "decompile" old code in many cases and rebuild source. If conversion is not possible, which will be only in the rarest cases, updating your product might be desirable, anyway. Again, old code can be decompiled (although it is always easier to start from the original source and engineering notes) and move to a newer processor. Power, speed, and features may be improved in the process. Please consider letting us help you with your engineering needs.

Currently we are upgading our product line as well. We are working with the 68HC12 and Mcore processors currently. We may find syndergy in working together, if you wish to go to a newer processor or board design.