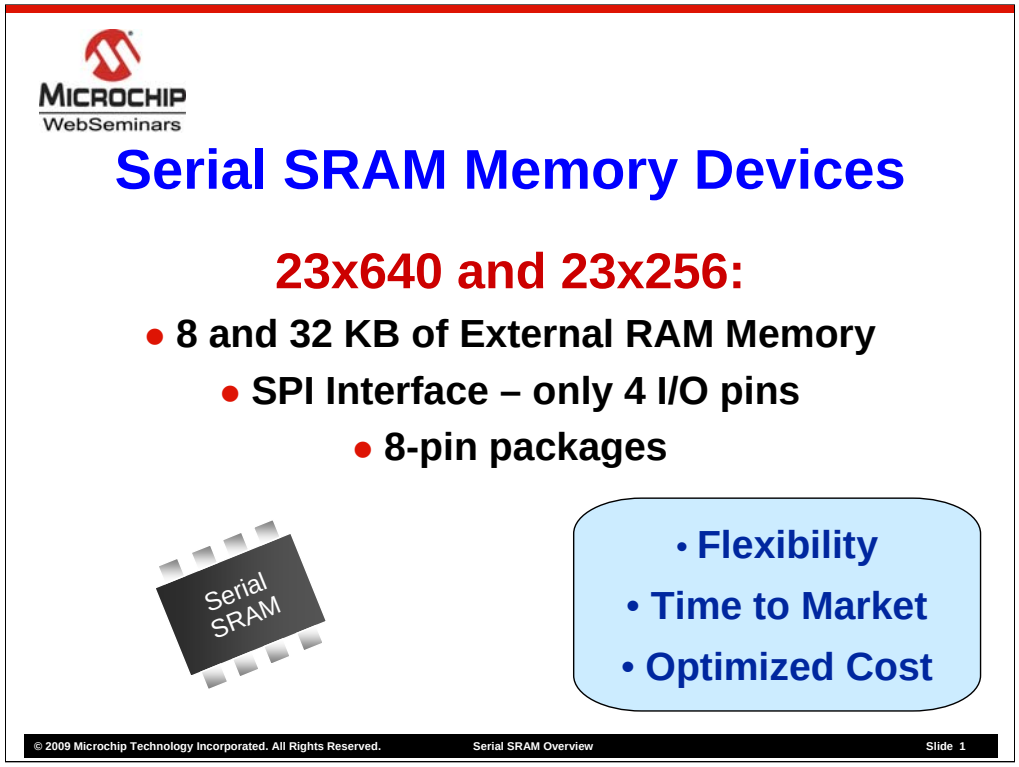
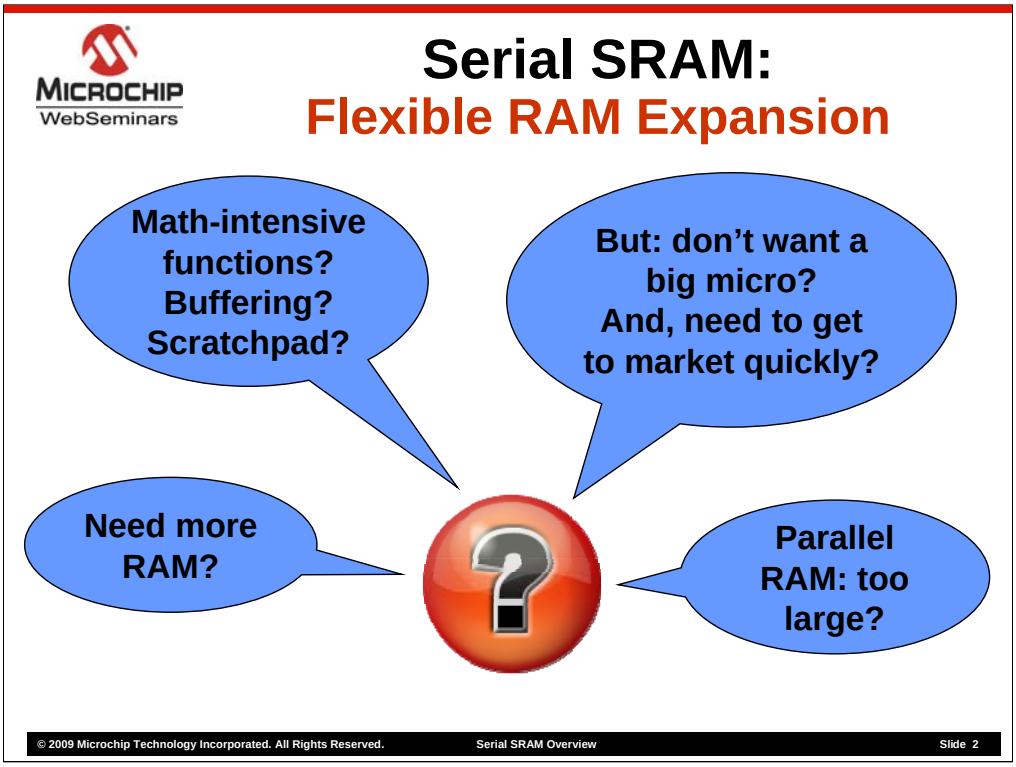


Hi, my name is Barry Blixt, marketing manager for Microchip memory products. Welcome to this 15-minute web seminar in which I will talk about our new serial SRAM memory devices.

This is a new product line for Microchip that complements our microcontroller offerings. In many applications, Random Access Memory, or RAM, is required for various types of temporary memory. While virtually all microcontrollers contain some RAM, serial SRAM represents a simple way to add additional RAM to an application.

Our 2 new device families, the 23x640 and 23x256 parts, can add 8 or 32 Kbytes of external RAM to an application. These parts use a standard SPI interface that requires only 4 I/Os. And they are available in small 8-pin packages.

In this webinar, I'll talk about how serial SRAM can give you design flexibility, improve your time to market, and reduce your costs.



So is RAM expansion using serial SRAM an interesting proposition for your designs? Here are some questions to think about while we go through the presentation:

•First, do you simply need more RAM for your application?

•Second, are you performing RAM-intensive functions like math algorithms, data buffering, or audio/video applications that need large amounts of temporary storage?

•One solution to these problems is to buy a larger micro with more RAM. But this can result in a more expensive design and a longer time-to-market. Is that acceptable?

•Another solution would be to add external parallel RAM. But this means a large package size as well as requiring more microcontroller I/Os and additional PCB routing.

Serial SRAM products can solve these issues. The rest of this web seminar will build on these ideas.

Now, let's look at our agenda.

MICROCHIP WebSeminars

Agenda: Serial SRAM

- **Feature set and naming convention**
- **Benefits**
- **Internet Radio example**
- **More information…**

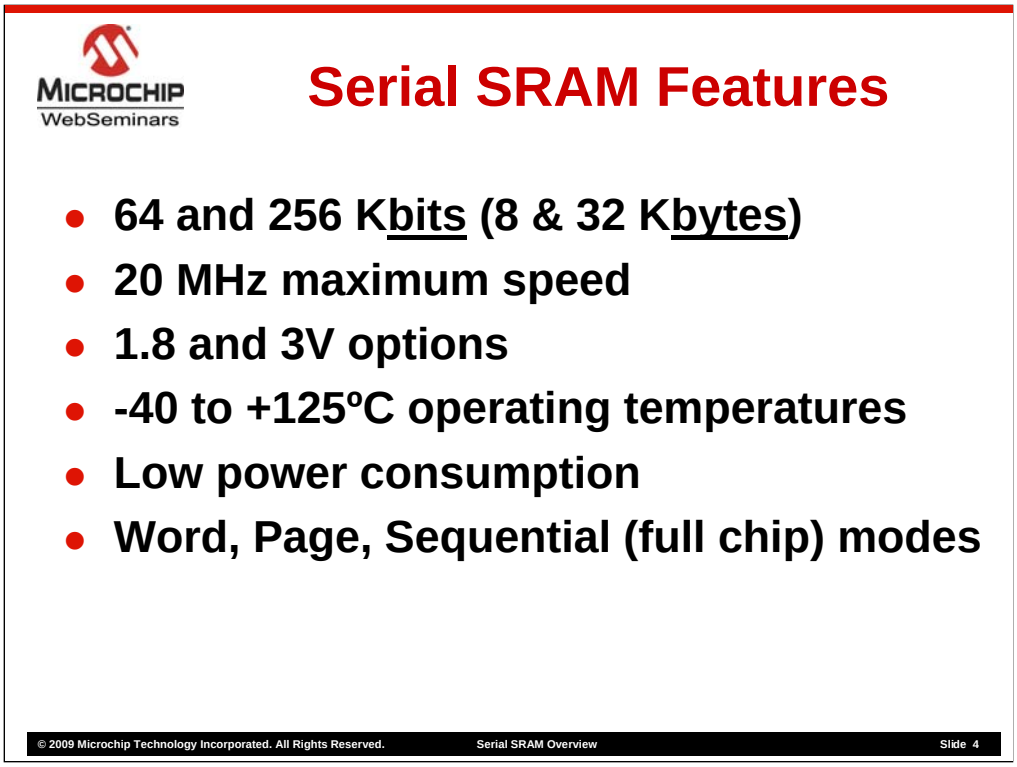
We'll start out by looking at the feature set and naming convention of these products.

Then we'll take a closer look at some of the benefits of serial SRAM.

We'll expand on these benefits with a look at an Internet radio reference design that makes use of serial SRAM.

We'll conclude with ideas for where you can get more information.

Let's get started by taking a look at some of the features of these devices.



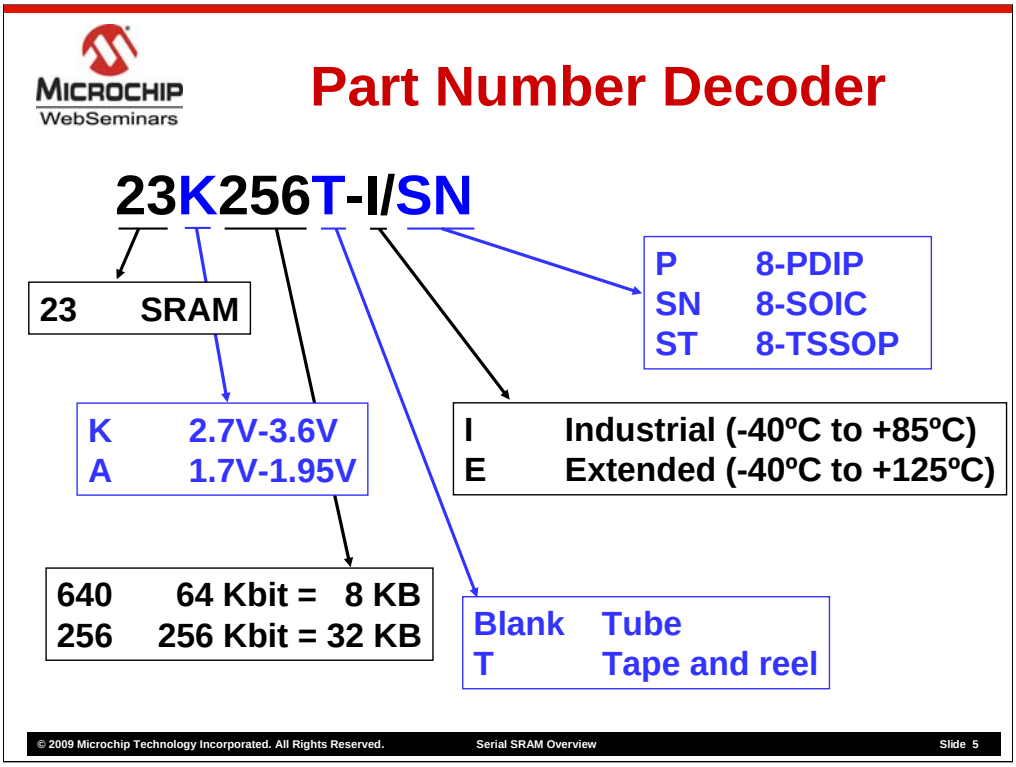
First, they come in 2 densities: 64 and 256 Kbits. If you usually think in terms of Kbytes, this works out to 8 and 32 Kbytes, respectively. To give you a sense of scale, compare these densities to a typical 8-bit microcontroller that has a maximum of 4-8 Kbytes of on-board RAM. You can dramatically increase the amount of RAM by using serial SRAM.

Second, the devices operate at bus speeds up to 20 MHz, making for very fast data transfer.

The devices are available in 1.8 and 3 volt options. Both options have operating temperatures of -40 to 125 degrees C

The devices have very low current consumption, making them excellent for battery and other low-power applications. Maximum standby current is only 4 uA.

The parts can operate in 3 modes as specified in the status register: Word mode, where data is read to or written from a specific word address. Page mode, where data is transferred to or from a 32 byte page. And sequential mode, in which the entire chip can be accessed with a single command.



Since these are new devices, I'd like to go through the part numbering convention. I'll decode the 23K256T-I/SN part number.

We've chosen "23" as the prefix to designate a serial SRAM device.

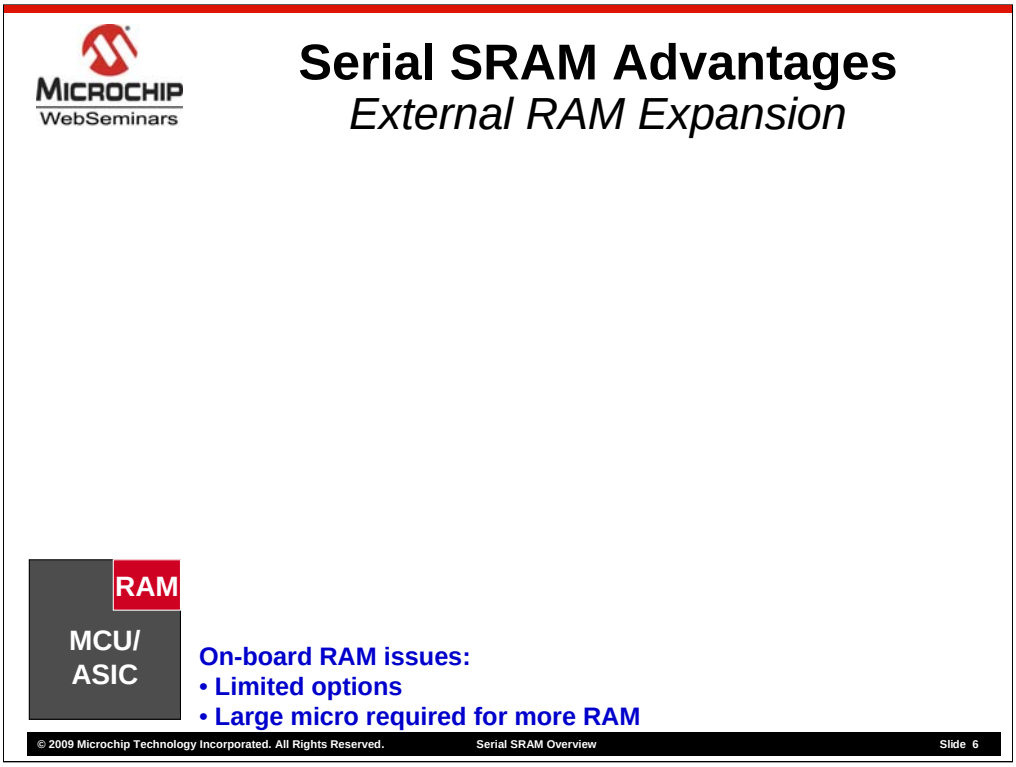
The second character determines the voltage range. "K" parts are good from 2.7 to 3.6 volts, so are compatible with most microcontrollers. "A" parts are from 1.7 to 1.95 volts in order to work with low-power ASIC devices.

The third code determines the memory size: 640 for 64 Kbits and 256 for 256 Kbits. This corresponds to 8 and 32 Kbytes.

If there is a T in the next slot, it is shipped in tape and reel. Blank means it will be packed in in tubes.

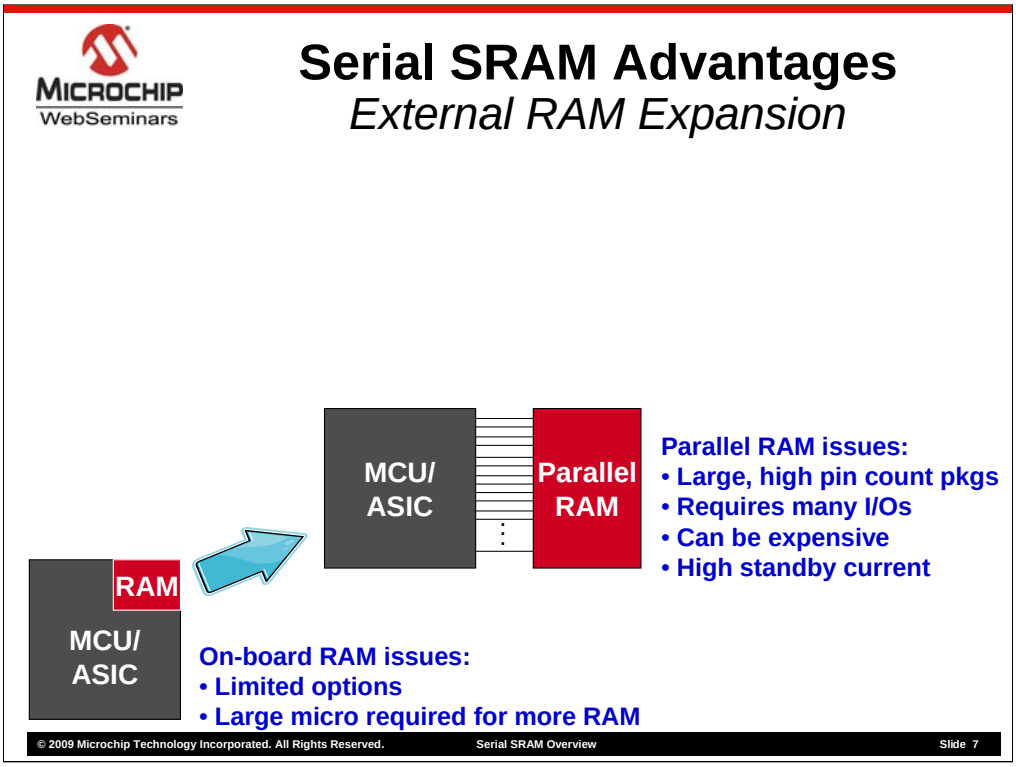
Finally the last 2 places determine the temperature range – "I" being industrial temp and "E" being extended temp. – and the package code. The devices are available in 8-lead SOIC, TSSOP, and PDIP packages.

Now that we know what the parts do and what they are called, let's look at how they help improve designs.

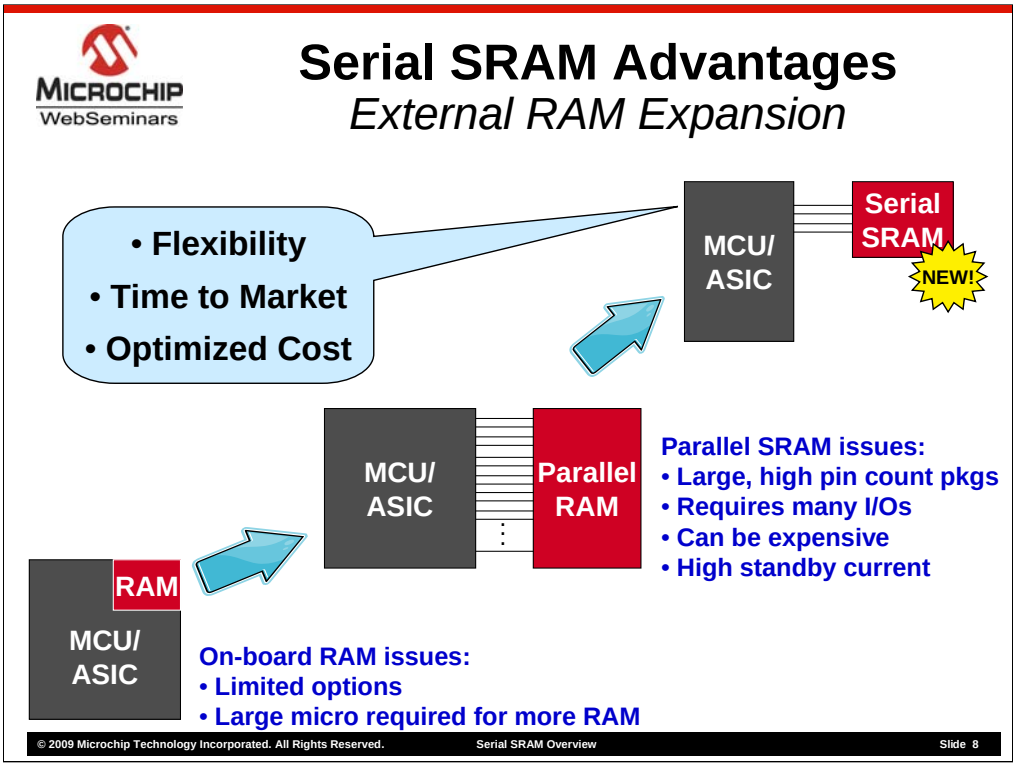


To understand the advantages of serial SRAM, let's assume an application that requires a large amount of RAM. The easiest way to get it, of course, is to use a micro with RAM on board. As I mentioned earlier, even high-end 8-bit micros have less than 8 KB of RAM, and most have much less. What if you need more? Or what if you want to increase the functionally of a current design, but you need more RAM to do it? What are your options?

First, you could buy a larger micro. But, since there are limited RAM options in most micros, this probably means a more expensive device. And, if you are only buying a larger micro to get the extra RAM, you're also probably paying for extra features that you don't need. And, a larger micro also requires more board space.



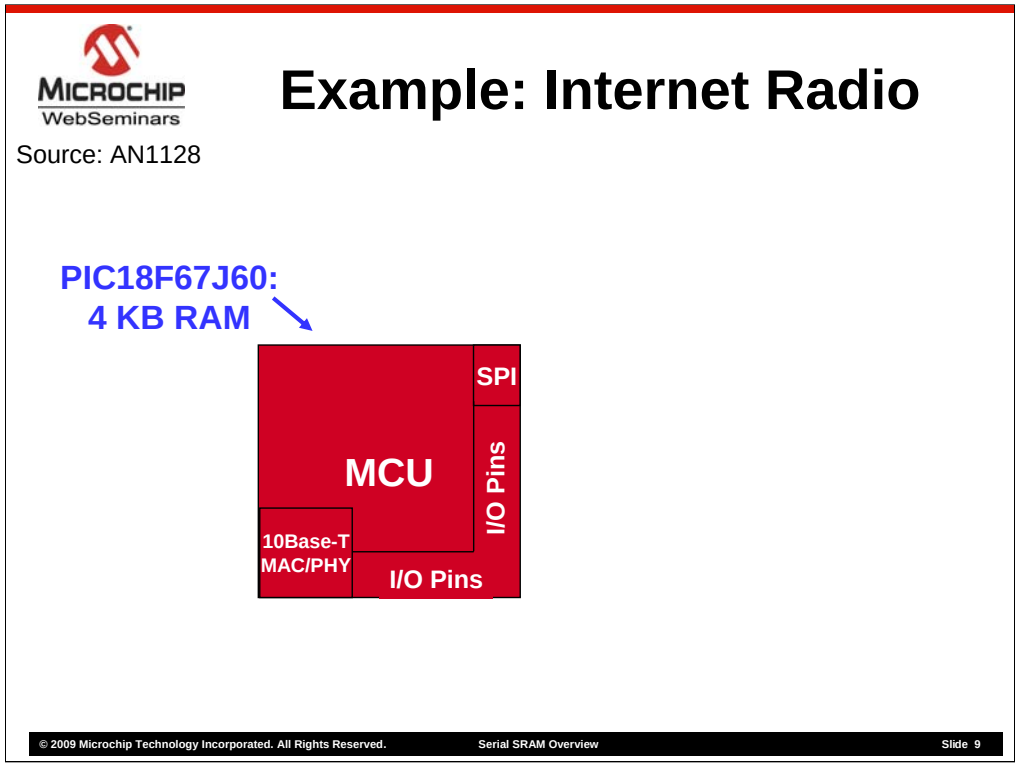
Your next option is to use off-chip memory, most commonly parallel RAM. You can certainly get a wide range of densities, up to 128 Mbits. And, being parallel, it is very fast. But traditional RAM has its own disadvantages. First, the packages are large – at least 28 pins and often 44 - and can be expensive. These large packages take up a good deal of board space. And, the parallel interface for a 32 KB RAM chip requires an external address and data bus using 16 to 24 I/O pins. These pins may not be available on your current microcontroller. Finally, Parallel RAM typically has fairly high standby current consumption.



Microchip now provides Serial SRAM, which represents another way to introduce off-chip RAM into a design. The connection to the micro is the classic SPI interface, which is well understood and easy to design with, especially since many micros already have an SPI interface port. As shown here, it only requires 4 I/O pins. It is very easy to add up to 32 KB to a design with one small, 8-lead SOIC or TSSOP package. And remember that serial SRAM is very well suited to embedded designs due to its very low standby current.

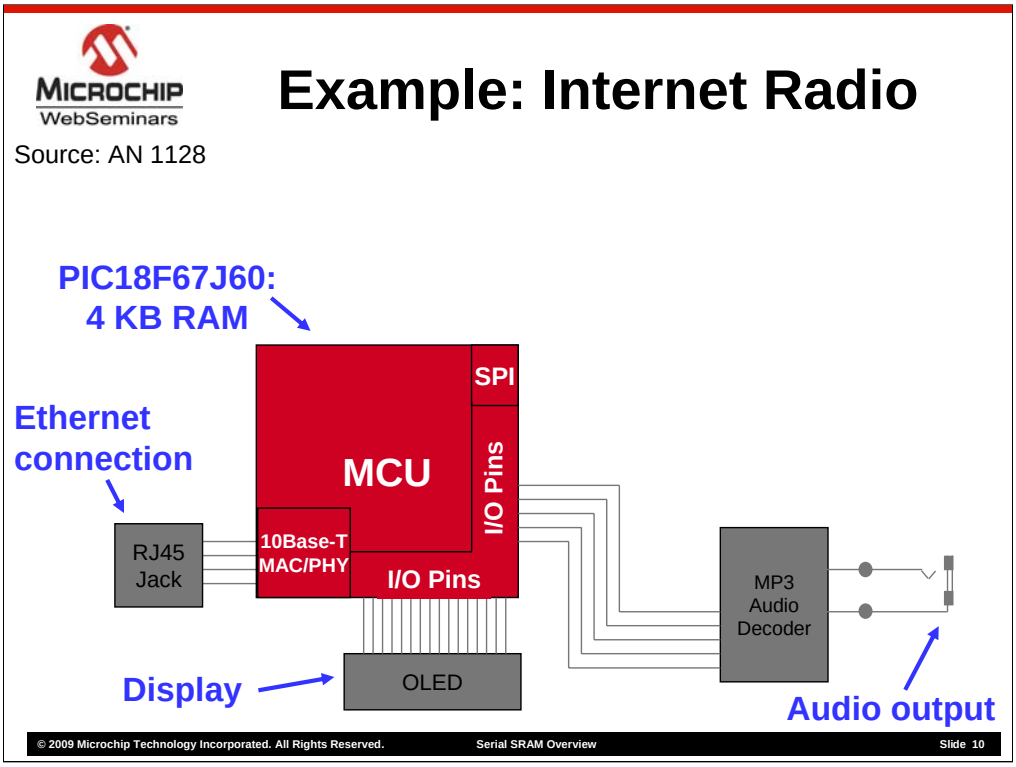
In applications that don't need a lot of processing power and can use a small- to mid-sized micro, or in applications that require a lot of RAM, serial SRAM can be a good option to keep costs down and to get to market faster. Microchip gives its customers flexible design options. We have micros with many RAM options, and now we offer external serial SRAM as another option.

So, the advantages of serial SRAM include flexibility, time to market, and reduced system cost. I'll expand on those points in the next slide as we look at an actual application.



Here, we'll look at Microchip's internet radio reference design as an example of an application that uses serial SRAM. The radio receives signals from internet radio stations, like SHOUTcast.com, then plays back the data as audio. The heart of the design, as shown here, is Microchip's PIC18F67J60 8-bit microcontroller. Notice that the micro has an integrated 10Base-T MAC/PHY along with an SPI port and several I/Os. The device has 44 pins and 4 Kbytes of RAM.

On the next slide, I'll add some of the key components.



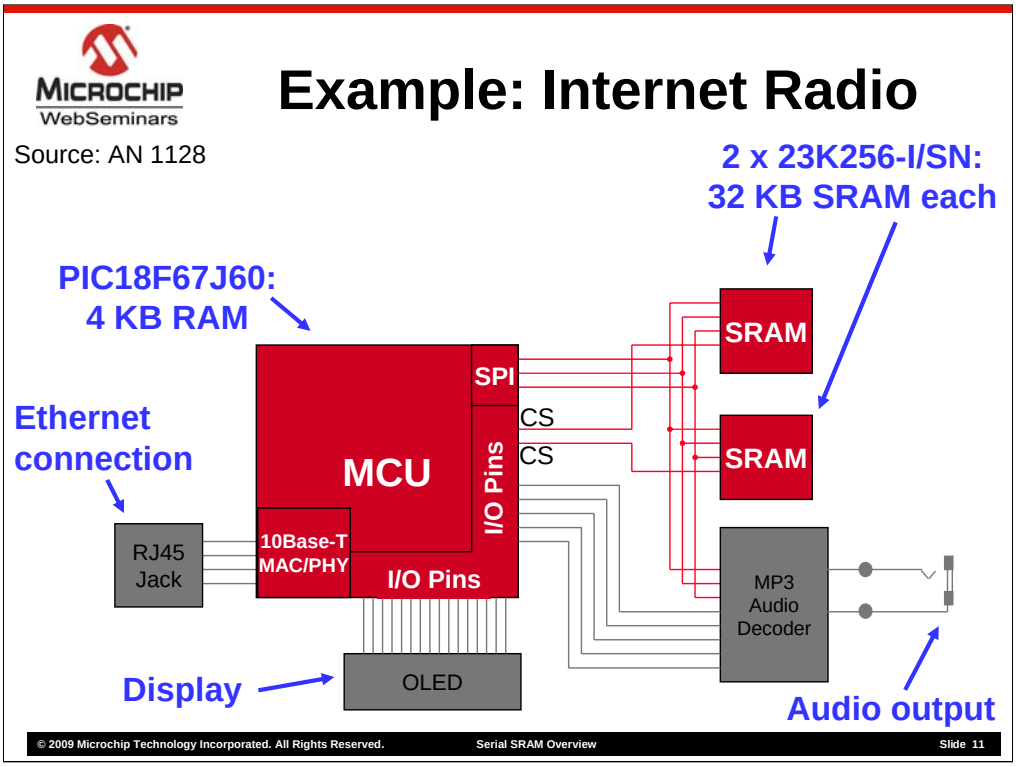
I've just added 3 external devices.

First, the RJ45 jack connects to the microcontroller through its integrated MAC/PHY to receive Ethernet data. Second, the system has an external OLED display that can be used for user inputs like volume and bass control. It can also display information about the song being played. Finally, the system uses an MP3 audio decoder to output the data as audio, in this case music from the Internet.

One issue with internet data is the large amount of packet losses and delays that must be handled. Data packets can become lost for 300 ms or even longer. So, the reference design requires a large amount of buffering to make up for these latencies.

Notice that the microcontroller only has 4 Kbytes of RAM. This is not nearly enough to handle the large amount of buffering required. Without a large RAM buffer, the user would hear clips and pops due to the missing data packets.

Now, I'll add two SRAM chips onto the design to see how we increase the available RAM.

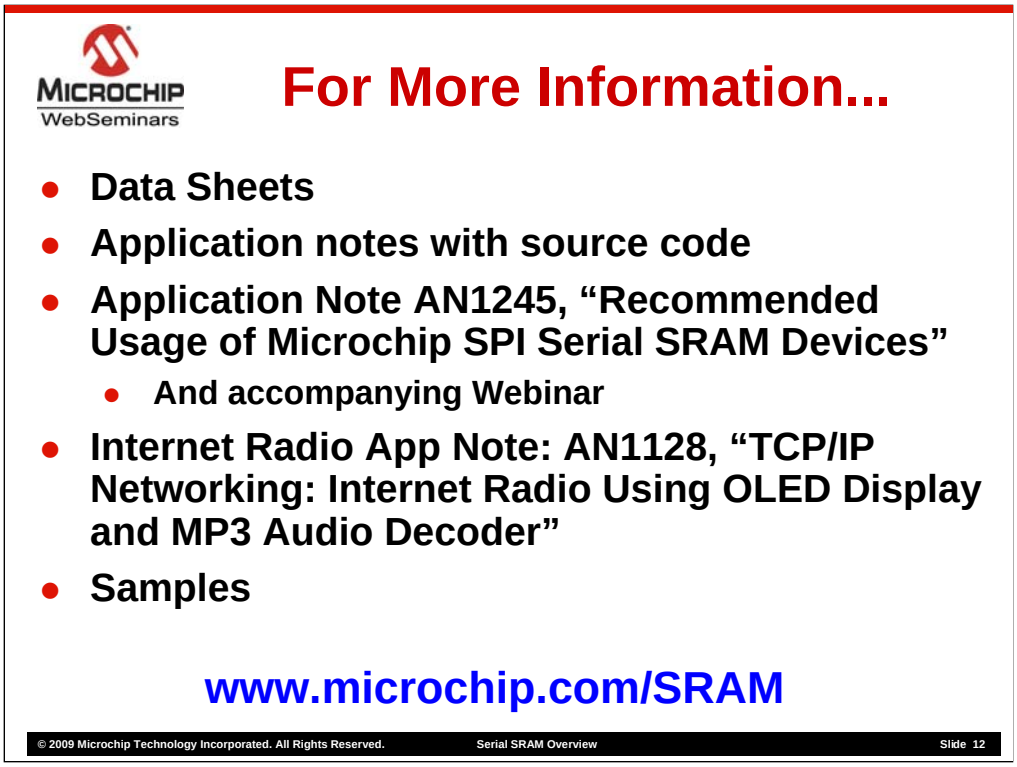


Here I've added the 2 serial SRAM devices. Rather than using a larger – perhaps even a 32-bit – microcontroller, the design makes use of these two 32 KB serial SRAMs. The first SRAM chip is used for the high-level TCP layer and stores MP3 data with all metadata – including song title.

After the data has been processed by the micro, raw MP3 data packets are stored in the second SRAM chip until they are required by the audio decoder. Having raw MP3 files ready for the decoder eases its processing requirements.

Now let's focus on the two SRAM chips. The first SRAM device requires 4 connections to the microcontroller: data in, data out, clock, and chip select. You can see these connections in red between the SRAM chip and the MCU. Three of these connections use the micro's built-in SPI port while chip select (here labeled "CS") uses an I/O pin. The second SRAM chip is wired into the same 3 SPI port pins and only requires one more micro I/O for a second chip select.

This is an example of an application that requires a great deal of memory storage to buffer data. But, it does not require a great deal of processing power – it just needs to temporarily handle a large amount of data. So, a fairly small and inexpensive 8-bit PIC18 device was selected, even though it only has 4 Kbytes of RAM. Serial SRAM allowed us to keep costs down by using a smaller microcontroller.



We have much more information available on our web site.

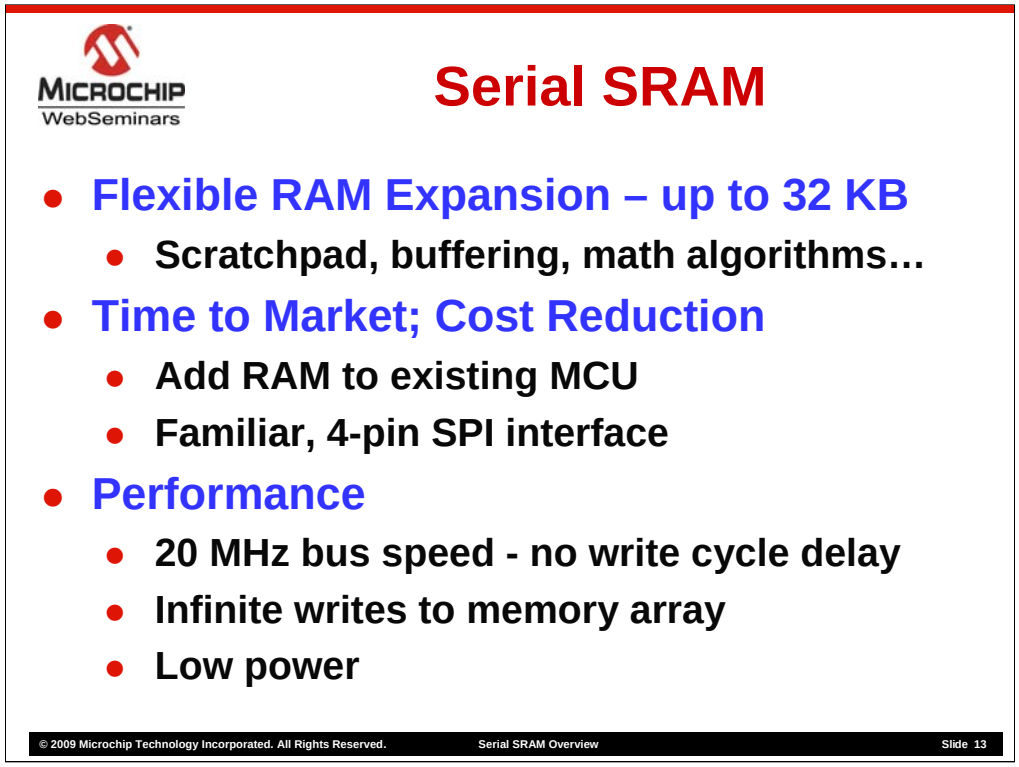
For specific product information, see our data sheets and application notes – most with code.

We also have a 2nd webinar with its accompanying application note (AN1245) that describes some recommended usages for serial SRAM devices.

For more information on the internet radio, see our application note AN1128. And, you can buy this reference design on our web site.

We have a fully stocked sample inventory of these devices. You can order samples – as well as production quantities - from our web site.

All these can be found on our SRAM home page at www.microchip.com/SRAM.



And that completes this web seminar on serial SRAM. I'd like to summarize the important benefits of this new product line.

First, serial SRAM gives designers a way to expand the available RAM in an application. You can add up to 32 Kbytes of SRAM in a small 8-lead package. This is great for applications that require a lot of memory – as we saw in the internet radio application – and data-intensive algorithms.

Using serial SRAM can decrease your time to market and help to keep costs down since you can add RAM to an existing micro design. And, the SRAM parts use the very familiar SPI interface which makes for quick, easy designs using just 4 I/Os.

Finally, the serial SRAM products have excellent performance characteristics. The parts run up to 20 MHz. And, since data is written directly to the array with no interruptions for write cycles, data can be written very quickly into the devices. In fact, you can write the entire 32 KB memory in only 13 ms.

The devices use volatile cell technology, so the array can be written an infinite number of times.

And finally, the parts have been designed with the embedded market in mind and have very low power characteristics.

Thanks very much for your time, and don't forget to check out our web page for samples and more information.

Trademarks