



PIC18 J-series Microcontrollers

**Cost Effective, High Performance
8-bit Microcontrollers**

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PIC18 J-Series Microcontrollers

Slide 1


Welcome to the PIC18 J-series microcontroller web-seminar. My name is Alexis Alcott and I am a Product Marketing Manager for the PIC18 J-series products. This presentation is a 25 minute introduction to the J-series devices, how they fit into Microchip's entire microcontroller portfolio, and some of the key features that make the PIC18 J-series devices unique. In one sentence, the PIC18 J-series products are Microchip's 3V 8-bit microcontrollers for cost sensitive applications requiring 10-12 MIPS performance.



Objectives

- **Recognize how the PIC18 J-series fit into Microchip's MCU portfolio**
- **Understand the PIC18 J-series general purpose features and target applications**
- **Know what tools and support are available for the PIC18 J-series**

Often, designers are familiar with Microchip's smaller devices (PIC10, PIC16) and then their applications grow requiring increasing complexity, more performance, and more I/O. We offer a smooth migration for customers with scalable microcontroller solutions. Many customers who want more memory or performance, find the PIC18 J-series, and the ease of use through using a C compiler, to be the perfect solution. This webinar will help you to become familiar with how the PIC18 J-series devices fit into the rest of Microchip's controller portfolio. You will also learn the basic features and target applications for the J-series microcontrollers. Finally, you will learn which development tools and additional support are available to get your designs to market quickly.

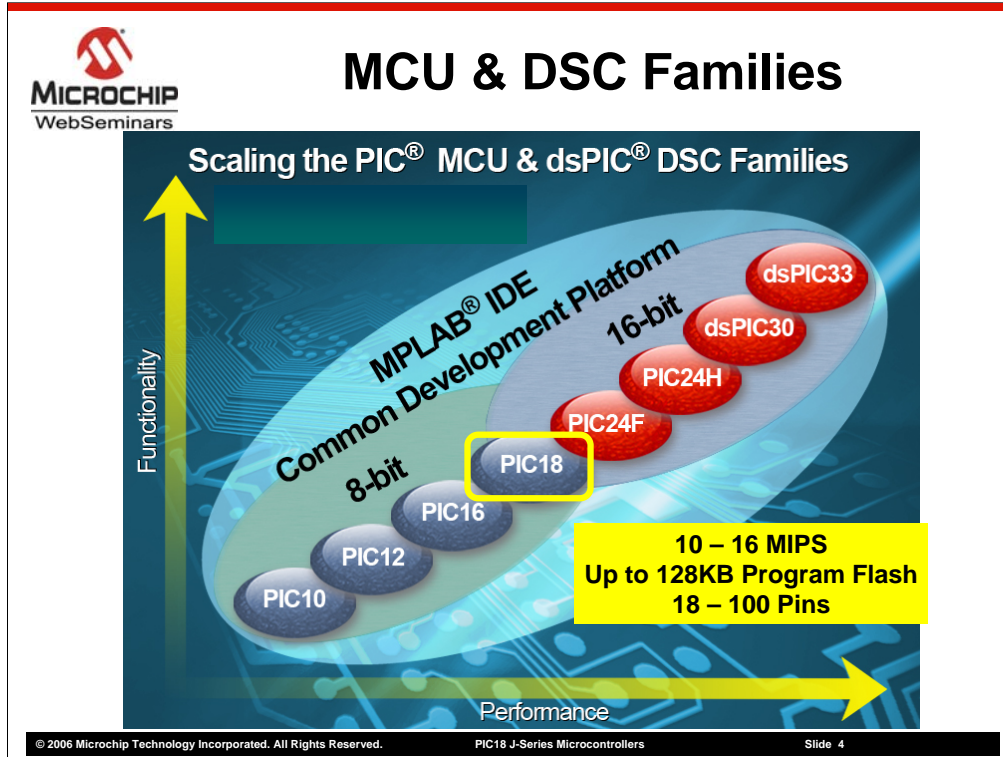


Agenda

- **MCU & DSC Families → PIC18 Options**
- **General Purpose PIC18 J-series Devices**
- **Development Tools & Additional Resources**

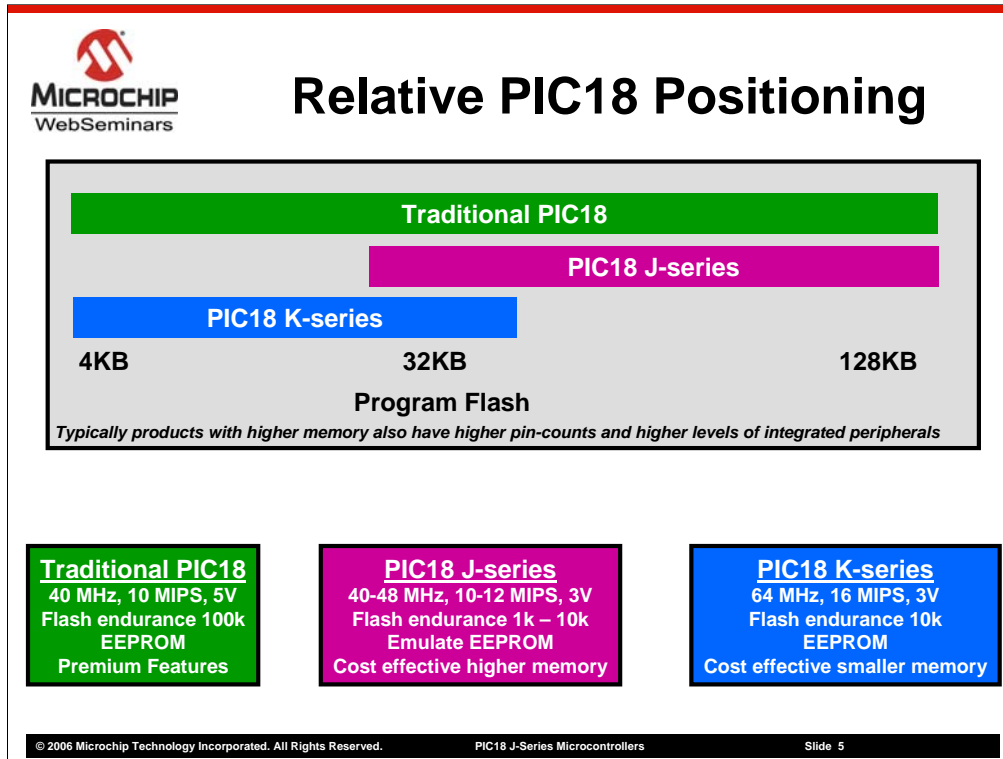
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Here is the agenda for today's short webinar. First we will look at Microchip's entire MCU & DSC portfolio to see how the PIC18 fits, in terms of relative performance and features, and we will dive into the various options within the PIC18 family. Next we will focus on the PIC18 J-series devices to see which options are available for general purpose applications. Finally, we will review the development tools and support resources available.



Microchip offers a complete range of 8-bit and 16-bit microcontroller and digital signal controller families ranging from very small, low-cost PIC10 devices, to sophisticated dsPIC products with digital signal processing. The PIC18 family is an 8-bit MCU which is at the high end of our 8-bit microcontrollers, with 10-16 MIPS performance. In addition to performance, the PIC18 family has a range of program flash up to 128KB and packages ranging from 18 to 100 pins.

The PIC18 devices use Microchip's high performance 8-bit architecture with a 16-bit instruction word and 8-bit data. Nearly all instructions execute in a single cycle making this RISC architecture extremely efficient. The PIC18 family has a rich set of integrated communication and connectivity peripherals to reduce application system cost, and many of the PIC18 devices include nanoWatt technology for power management. Like all of Microchip's microcontrollers, these products offer socket, software and peripheral compatibility for easy migration and scalability.

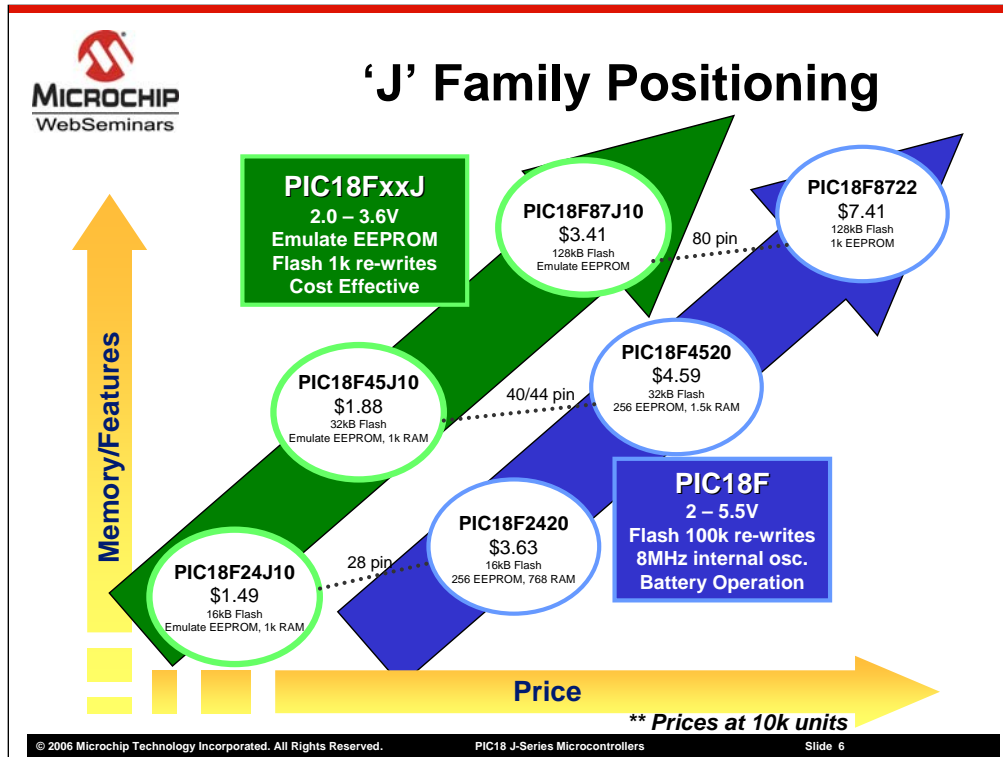


The PIC18 family can be divided into three different groups. First let's take a look at what we call our traditional PIC18 family. These products have been in the market longest and are feature rich. These PIC18 devices are 40MHz, 10 MIPS and have an operating voltage of 2.0 to 5.5 volts. These products have program flash endurance of 100K and include on-chip data EEPROM.


Next, let's take a closer look at the PIC18 J series of devices. They have the same basic instruction set and core of the traditional PIC18. The operating voltage on the J-series is 2.0 to 3.6V which allows you to maximize your performance in a 3 volt application. The J devices are capable of 40-48 MHz and 10-12 MIPS at 3V. These devices have a flash endurance of 1,000 to 10,000 depending on the specific family and all include emulated EEPROM. These devices are the most cost effective solution when more than 32 Kbytes of program memory is required.

The newest addition to the PIC18 family of products is the PIC18 K-series. This family of devices is most cost effective for smaller program memory densities. These products will be 64 MHz, 16 MIPS and initial products will have an operating voltage of 1.8 to 3.6 volts.

The requirements for your design may change or evolve and Microchip will have a variety of product options and solutions to support your needs.



On the right side in blue, you can see a few popular members of our traditional PIC18 5V family at 28, 40 and 80 pins. The PIC18 traditional family has a wide operating voltage 2 – 5.5V and premium features such as 100k endurance flash, data EEPROM, and extremely low power. In contrast, the devices in green are members of our PIC18 J-series. You can see the equivalent J devices in package, peripheral set and memory shown. microchipDIRECT 10k prices are shown to give you an idea of the relative cost savings for the PIC18 J-series. At 28 pins, the J-series device offers a savings of \$2.14 and at 80 pins there is a \$4 savings by using the J-series devices compared to the traditional 5V PIC18 product. For applications that do not require the premium features of the traditional PIC18 family, they can take advantage of a huge cost savings by using the PIC18 J-series devices.




Which PIC18 Should I Use?

	Traditional PIC18	J-series PIC18FxxJxx	K-series PIC18FxxKxx
Relative Price	Premium features	Most cost effective PIC18 with >32KB	Most cost effective PIC18 with <32KB
Performance	10 MIPS at 5V	10-12 MIPS, 40-48MHz at 3V	16 MIPS, 64MHz at 3V
Flash Endurance (typ) & Retention (min)	100k 40 years	1k – 10k 20 years	10k 40 years
Data EEPROM	Data EEPROM	EEPROM emulation	Data EEPROM
Tools	ICD2, REAL ICE, ICE2000	ICD2, REAL ICE, PICKit2	ICD2, REAL ICE, PICKit2
Sleep Mode Power	Lowest	J10 not for battery J11 Low	Lower
Voltage Range	2.0 – 5.5V 5V tolerant inputs	2.0 – 3.6V 5V tolerant inputs	1.8 – 3.6V Future 5V Support

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If you know you need a PIC18 microcontroller for its high performance, but you are not sure if your application requires a traditional PIC18, J-series or K-series, this chart may help you decide. All of these families share a common PIC18 architecture, code compatibility and migration path. They offer multiple price points to address applications that have different requirements for program flash characteristics, data EEPROM, power consumption, performance, embedded oscillators, and temperature options. For example, the J-series is most cost effective for larger program memory densities while the K-series is most cost effective for smaller program memories. The traditional PIC18 family has premium features such as very high endurance flash, EEPROM, very low power in sleep mode and a wide operating voltage range. Not all applications require these features and you should not have to pay extra for features you are not using. The PIC18 J-series has lower endurance Flash and emulated EEPROM, but is extremely cost effective for complex applications that require >32KB program memory or have complex digital peripherals. The J-series offers a compelling solution for cost sensitive applications. Do you wish you could use the C compiler, and sophisticated communications peripherals on the high-performance PIC18 family, but not sure of the price-tag in your cost-sensitive application? The PIC18 J-series devices provide very cost competitive, high-performance products, redefining the [price-performance ratio](#) for 8-bit microcontrollers.

The J-series also offers a nice migration into Microchip’s PIC24 16-bit family since they share the same manufacturing process and similar connectivity peripherals and protocol software, such as Ethernet and ZigBee. For applications that need additional performance, more memory, and faster peripherals, there is a smooth path from PIC18 to PIC24.




Agenda

- **MCU & DSC Families → PIC18 Options**
- **General Purpose PIC18 J-series Devices**
- **Development Tools & Additional Resources**


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Now that we have looked into the various PIC18 options, let's focus in on the specific products within the J-series general purpose portfolio.



PIC18F87J10 & PIC18F45J10 Family Key Features

GENERAL PURPOSE
Tons of Applications



PIC18F24J10	PIC18F25J10	PIC18F44J10	PIC18F45J10	PIC18F65J10	PIC18F65J15	PIC18F66J10	PIC18F66J15	PIC18F87J10	PIC18F87J15	PIC18F88J10	PIC18F88J15
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**Breakthrough in
Price/Performance for
8-bit MCUs**

Complete 3V portfolio:
28 – 80 pins, 16 kB – 128 kB Flash

High performance PIC18
10 MIPS, 3V, 40 MHz

2.0 – 3.6 voltage range
5V tolerant digital inputs


Self programming Flash
1,000 re-writes typ

Embedded control:
ADC, PWM, timers

Communication peripherals:
EUSART, MSSP for I²C™ and SPI

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The initial products introduced in the PIC18 J-series are the PIC18F87J10 & PIC18F45J10 families. Taking a closer look at these products we find that they are ideal for very cost-sensitive applications that do not rely on a battery. There is no on board EEPROM, however, flash can easily be used to emulate EEPROM or an external EEPROM may be a cost effective solution. 3V applications enable cost, performance and run-time power consumption advantages. The initial PIC18 J-series general purpose portfolio ranges 28 – 80 pins with 16KB to 128KB program memory for a nice migration in both I/O and program memory. For customers who do not need the premium features of our traditional PIC18 family, they can take advantage of aggressive price points for the J series with PIC18F24J10 starting at \$1.49 at 10k units.



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PIC18F87J10

- **Breakthrough in Price-Performance for 8-bit MCUs**
- **10 MIPS/40 MHz at 3V**
- **64 & 80 Pins**
- **32 – 128KB Program Flash**
 - 1k retention
 - 20 years retention
 - self write
- **Right level of integration for your complex application**
- **10k price starting at \$2.14 for PIC18F65J10**




The block diagram for the PIC18F87J10 shows the following components:

- 5x10-bit PWM
- 5x8/16-bit Timers
- 2xI²C™
- 2xUSART
- 2xComp
- 2xSPI
- 66 I/O Ports
- 15 ch 10-bit ADC
- 128 KB Flash
- 10 MIPS CPU
- 4 KB RAM


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The 18F87J10 is the superset device in our 64/80 pin general purpose J-series. With 10 MIPS performance at 3V, this family offers high performance at a lower voltage than the traditional PIC18. The 87J10 family has a robust peripheral set and scalable program memory for complex applications, but with an aggressive price point for applications that do not require 5V, premium flash or integrated EEPROM. These products are available with program memory ranging from 32 to 128 kbytes, with 2 UARTs, 2 SPI/I²C, 15ch 10-bit ADC, and lots of timers and PWMs as shown in the block diagram.

Furthermore, the PIC18 J10 products offer a breakthrough in price performance for 8-bit microcontrollers. They are still rich with peripherals with the right level of integration for complex applications that are also very cost sensitive.


 **PIC18F45J10**

- **Same performance and Flash characteristics as PIC18F87J10**
- **28 & 40/44 Pins**
- **16 – 32 KB Program Flash**
- **Smaller peripheral set**



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Compared to the PIC18F87J10, the PIC18F45J10 has the same performance (10 MIPS at 3V), Flash characteristics (1k endurance, 20 year retention) and operating voltage range (2.0 – 3.6V). The 18F45J10 is a smaller version, with 28/40/44 pin options and 16-32kB Flash as well as a compact peripheral set shown above in the block diagram. The PIC18F24J10 is the most cost effective PIC18 device on the market today!



PIC18F87J11 GP

Specific Features

- **PIC18 J-series**
 - 12 MIPS, 48 MHz, 3V
 - 8 MHz Int Osc, 4xPLL
- **Compared to PIC18F87J10**
 - Higher performance
 - Improved Flash characteristics
 - Lower power in Sleep mode
 - 8 MHz int osc
 - Parallel Master Port

Basic Feature Set

- **Package: 64/80 Pins**
- **Memory**
 - 64/96/128 KB Flash
 - 4 KB SRAM
- **Analog**
 - 15 x 10-bit ADC, 2x comp.
- **Communication**
 - 2 x EUSART, 2 x SPI/MI²C
 - Parallel Master Port (PMP)
- **Timers**
 - 2 x 8-bit, 3 x 16-bit
 - 2 x CCP, 3 x ECCP
- **Operating Voltage**
 - 2.0 – 3.6

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The PIC18F87J11 family has the same basic peripheral set as the PIC18F87J10, with the following enhancements:


First, higher performance with 12 MIPS and 48MHz at 3V

Next, improved Flash characteristics (10k endurance & word write capability for improved EEPROM emulation)

Third, lower power in sleep mode for battery operated applications

Also, integrated 8MHz internal oscillator, with 4x PLL, can generate 32MHz without any external clock source

Finally, a Parallel Master Port for connection to parallel interfaces such as driving a large display



PIC18F85J11 General Purpose (GP)

Specific Features


- **PIC18 J-series**
 - 10 MIPS, 40 MHz, 3V
 - 8 MHz Int Osc
 - 1k typ Flash endurance
- **Compared to PIC18F87J10, this family has**
 - Lower power in sleep mode for battery operated applications
 - 8 MHz int osc
 - Different peripheral set

Basic Feature Set

- **Package: 64/80 Pins**
- **Memory**
 - 8/16/32 KB Flash
 - 1/1/2 KB SRAM
- **Analog**
 - 12 x 10-bit ADC, 2x comp.
- **Communication**
 - EUSART, AUSART, SPI/I²C
- **Timers**
 - 4 x 8-bit, 1 x 16-bit
 - 2 x CCP
- **Operating Voltage**
 - 2.0 – 3.6

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One more J-series general purpose family, the PIC18F85J11, is in a 64/80 pin package with smaller program memory sizes (8 – 32KB) and a smaller peripheral set for a very cost effective solution. However, the PIC18F85J11 family also offers some enhancements compared to the PIC18F87J10 family including lower power in sleep mode and the 8MHz internal oscillator.



PIC18 J-series Additional Devices

GENERAL PURPOSE		Ethernet	
PIC18F87J10 GP 32 – 128 KB 64 - 80 pins 10 MIPS	PIC18F87J11 GP 64 – 128 KB 64 - 80 pins 12 MIPS	PIC18F97J60 Ethernet 64 – 128 KB 64 - 100 pins 10 MIPS	
PIC18F45J10 GP 16 – 32 KB 28 - 40 pins 10 MIPS	PIC18F85J11 GP 8 – 32 KB 64 - 80 pins 10 MIPS	PIC18F85J90 LCD 8 – 32 KB 64 - 80 pins 10 MIPS	
		PIC18F87J50 FS USB 2.0 32 – 128 KB 64 - 80 pins 12 MIPS	


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In addition to the PIC18 J-series general purpose (GP) devices we have already discussed, there are several PIC18 J-series devices to target Ethernet, LCD, and USB markets. Each of these devices are supported by design centers with application notes, free software and drivers.

The PIC18F97J60 includes an embedded Ethernet controller for remote monitoring and control. The 18F97J60 family is compliant with the industry standard for 10BASE-T (10 Mbps) Ethernet. The family comes with an integrated, on-board MAC and PHY, making Ethernet communications possible. The superset device, PIC18F97J60, is a 100-pin part with 128 Kbytes Flash, 3 Kbytes of data RAM and 8 Kbytes of dedicated buffer RAM.

The PIC18F85J90 includes LCD drive for segmented displays with up to 48 segments and 192 pixels. The LCD on the PIC18F85J90 enables voltage contrast control with an internal boost capability. The superset device, PIC18F85J90, is an 80-pin part that includes 32 Kbytes Flash memory with 2 Kbytes of data RAM.

The PIC18F87J50 includes full-speed USB 2.0 support in 64/80 pins. This Full-Speed USB family has program flash ranging from 32KB – 128KB, with performance up to 48MHz/12 MIPS at 3V. The 18F87J50 has a very rich set of peripherals including 2 UARTs and 2 MSSPs as well as a new Parallel Master Port (PMP) for driving parallel data to a display or connection to large external data memory.

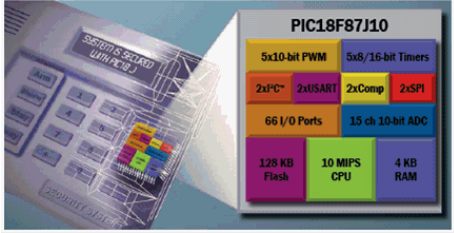

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Target Applications

- **Consumer**
 - Universal Remote
 - MP3 Accessory
 - Toys/Games
 - Security/Alarms
 - Computer Peripherals

- **Medical**
 - Blood Pressure Monitor
 - Glucose Monitor
 - Diagnostic Equipment
 - Biometrics

- **Industrial**
 - Motion Control
 - Factory Automation
 - Security
 - Remote Monitor




PIC18F87J10			
5x10-bit PWM	5x8/16-bit Timers		
2xPC*	2xUSART	2xComp	2xSPI
66 I/O Ports		10 ch 10-bit ADC	
128 KB Flash	10 MIPS CPU	4 KB RAM	

- **Automotive**
 - Rear View Mirror
 - Compasses
 - Tire Pressure Monitor
 - Sensors

- **Appliance**
 - White Goods
 - Air Conditioners
 - Thermostats
 - Sensors & Controls

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Target applications for the PIC18 J-series are shown on this slide, ranging from consumer to industrial to appliance markets. Within each of the traditional microcontroller application areas, there are typically some applications that are extremely cost sensitive which are ideal targets for the PIC18 J-series products.



Agenda

- **MCU & DSC Families → PIC18 Options**
- **General Purpose PIC18 J-series Devices**
- **Development Tools & Additional Resources**



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So that is an overview of the PIC18 J-series portfolio. Now, let's see what development tools and resources support these products.



PIC18 J-series Development Tools

- **MPLAB® IDE**
 - Free download
- **MPLAB® C18 Compiler**
 - #SW006011 free evaluation
- **MPLAB® ICD 2**
 - #DV164005
- **PM3 Device Programmer**
 - #DV007004
- **Real ICE™ Emulation**
 - #DV244005




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Microchip's PIC microcontrollers are supported by the MPLAB IDE which is used to integrate the development, debug and software utilities available when developing code for a product. MPLAB is the only platform you will need to develop for all of Microchip's MCUs and DSCs and it can be downloaded for free on our website. Language tools are available from Microchip in the form of an Assembler (MPASM), a linker (MPLINK) and a C compiler. The C compiler for the PIC18 family is called MPLAB C18 and a free student version can be downloaded from our website.

MPLAB IDE is designed to work with all of Microchip's standard hardware tools such as ICD 2 and PM3 programmer. ICD 2 is a flash upgradeable in-circuit debugger which is connected to and powered by the USB connection on the host PC.



Microchip's new MPLAB REAL ICE supports the entire PIC18 J-series. It is a low cost emulation system (\$499) with high speed USB connection for full emulation speed and includes logic probes, device adapters, debug & programming with capture and I/O port trace.



PIC18 J-series Demo & Development Boards

- **HPC Explorer + Plug-In Modules**
 - PICDEM™ HPC Explorer #DM183022
 - PIC18 J-series Plug-in Modules (#MA180011-MA180016)

- **PICKit™ 2 + PIC18J Demo Board**
 - PICKit 2 Programmer #PG164120
 - PIC18J Demo Board #DM164120-5



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For demo and development, the PIC18 High Pin Count (HPC) Explorer Board can be used with Plug-in Modules which automatically configure the board for 3V. Various plug-in modules are available for the J-families. The HPC Explorer Board is a low-cost demo board which can easily interface with the MPLAB ICD 2 to evaluate the performance of the PIC18 J-series devices with simple plug-in modules. The board includes prototype area, LEDs, and PICTail connector to allow connection to expansion boards.

Also, the PICKit 2 is a popular low-cost dev kit & programmer for PIC10 and PIC16 devices. Now we have extended this into the PIC18 J-series. The PICKit2 Programmer (PG164120 \$34.99) can be used with the new PIC18J Demo Board (\$23.99). It is a demo board with a PIC18F87J10 device and a small prototype area. You can program via a 6-pin ICSP™ header. There is no debug support for the PIC18 J-series on the PICKit 2.

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3V Design Resources


3V Design Center www.microchip.com/3V

3V Newsletters	Quarterly
3V Designer Tips & Tricks Document	DS41285A
PIC18F to PIC18FxxJ Migration Document	DS01021A
AN1025 Converting 5V supply rail to regulated 3V	DS01025A
EDN Article: Don't Pay for Level Translators	

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The PIC18 J-series represents the first 3V family of 8-bit MCUs from Microchip. The PIC18 J-series takes advantage of smaller manufacturing technologies in order to attain aggressive pricing with a higher level of integration at lower cost. This smaller manufacturing technology requires a 3V operating voltage. For customers who are used to designing with 5V systems, who want to take advantage of the cost savings from this family, we have developed a 3V Design Center with resources to help with this transition. The design center can be found at www.microchip.com/3V and includes newsletters, tips & tricks documentation, migration docs, application notes and technical articles.



The 3V PIC18 J-series devices easily integrate with 5V designs. All digital inputs are 5 V tolerant. And outputs on J-series devices can drive 5V depending on the input characteristics (either TTL or through a pull-up resistor). For customers that do not want to use 3V devices, we have an entire portfolio of traditional PIC18 5V devices to chose from and will continue to innovate and introduce new 5V products.



Software Support

- **TCP/IP Stack used with ENC28J60**
 - www.microchip.com/ethernet

- **ZigBee™ or MiWi™ stack used with MRF24J40**
 - www.microchip.com/zigbee



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You can easily match a PIC18 J-series microcontroller with one of our stand-alone Ethernet or ZigBee controllers for instant Internet or RF communication in your applications. The PIC18 J-series microcontroller is ideal for running the free downloadable protocol stack for TCP-IP, ZigBee or MiWi protocol. MiWi is Microchip's proprietary 802.15.4 wireless protocol with compact code size. Each of these applications has a design center website to get your design started quickly.



Additional Resources

- www.microchip.com/PIC18J
 - Technical Documentation
 - Promotions
 - Development Tools
 - Design Centers
- www.microchip.com
 - support.microchip.com
 - Online discussion groups
 - 24/7 technical support
 - sample.microchip.com
 - microchipDIRECT.com



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Now that you know more about the PIC18 J-series products, you probably want to get started on your next design! Or at least you might want to learn more about the specific products available in this family. There is a dedicated website at www.microchip.com/PIC18J where you will find additional information and resources related to our J-series products. There is also a webpage at www.microchip.com/PIC18 which highlights all of our PIC18 devices. On Microchip's homepage, you will find support links to 24/7 tech support as well as online discussion groups. To order free samples, go to sample.microchip.com. You can purchase development tools directly from Microchip via microchipDIRECT.com.

That brings this webinar to its end. I hope you have learned more about the PIC18 J-series products, how they fit into Microchip's entire portfolio, and what tools and resources are available to support this family. Thank you for your time and hopefully you will consider the PIC18 J-series for your next cost-sensitive complex application.