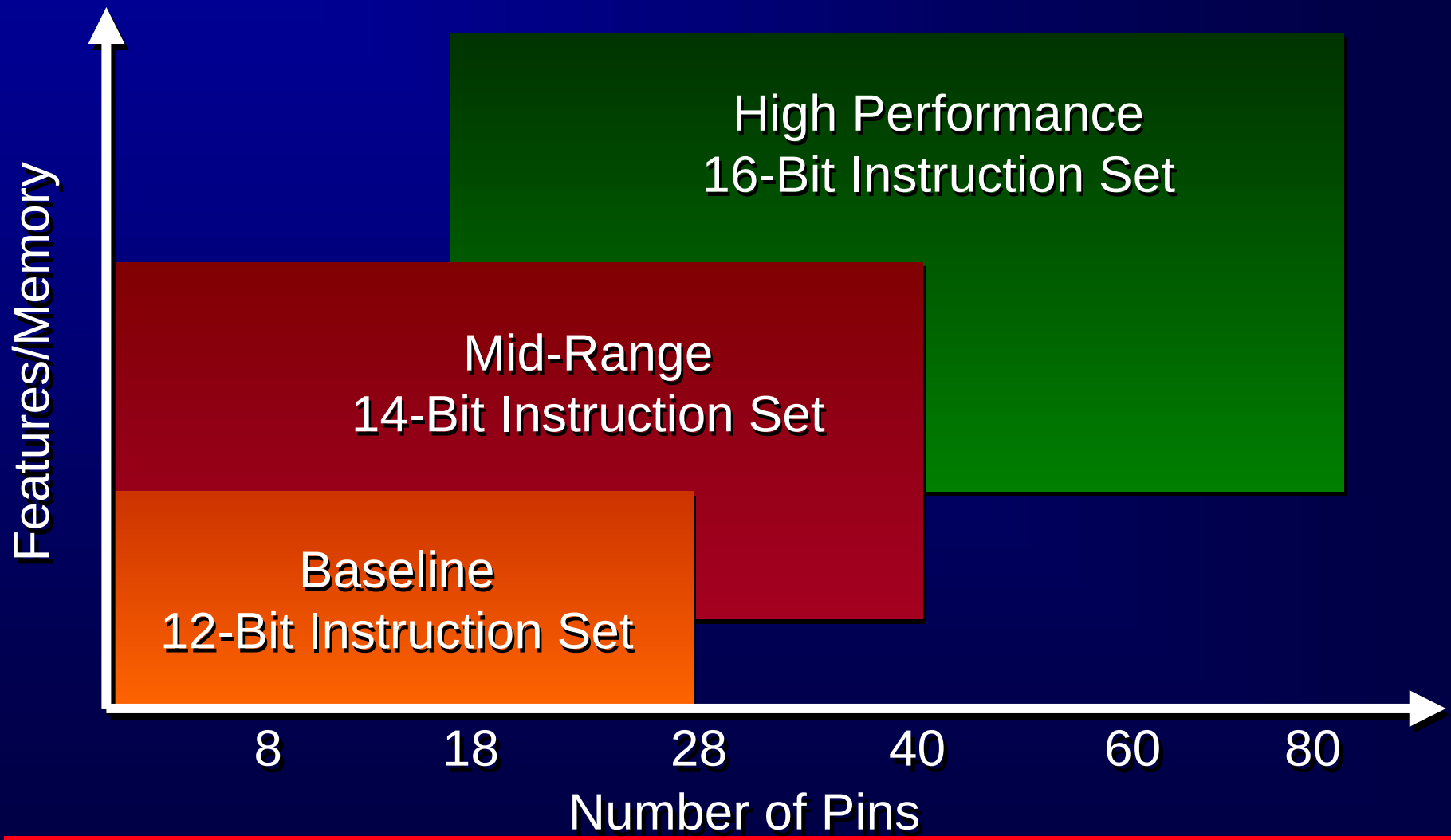
What's New PIC16F PICMicro Released Recently

Microchip PICmicro® Product Families



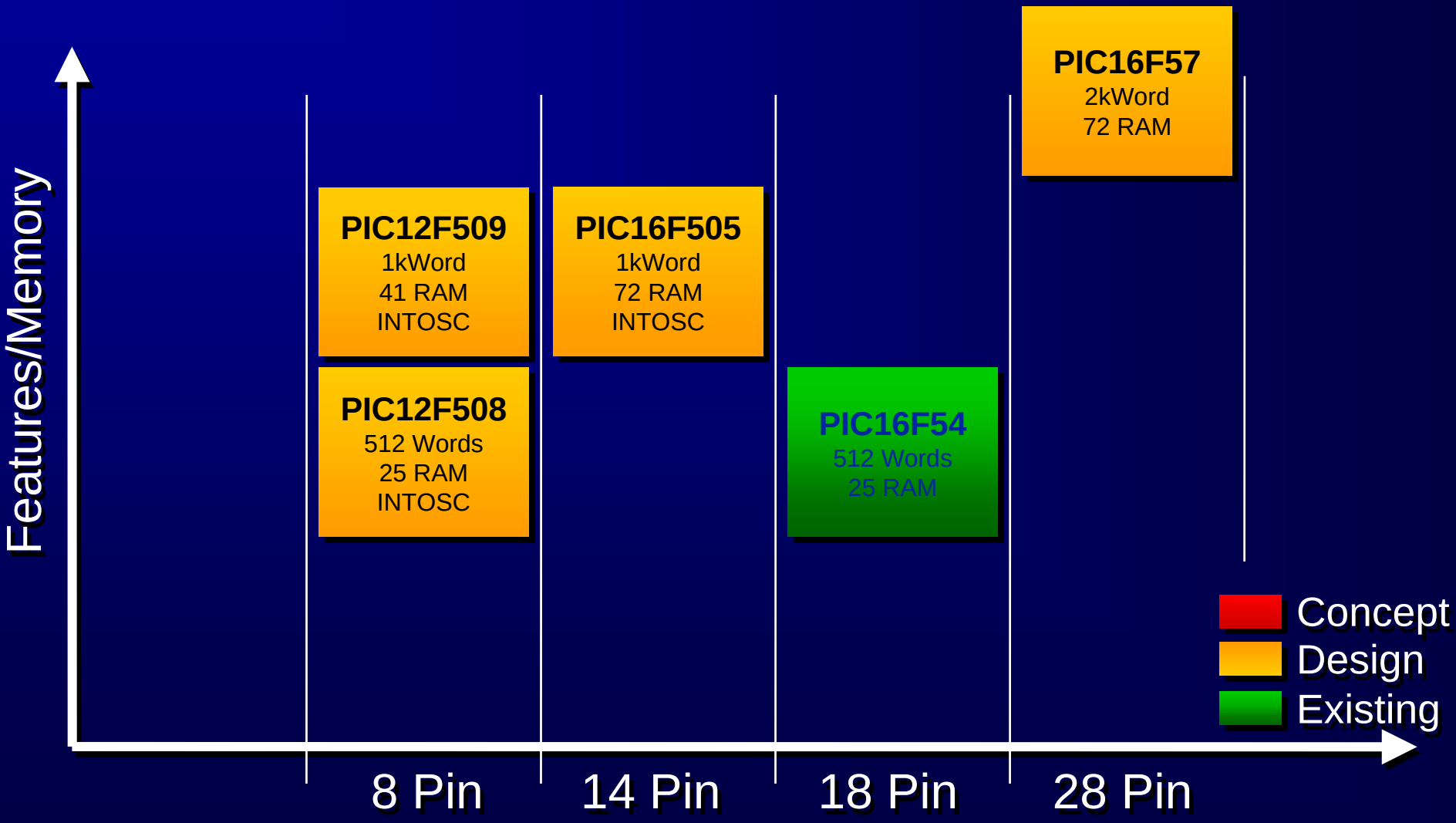
Small Pincount Flash PIC® MCU Agenda

- New Baseline Flash microcontrollers
- Small Mid-Range Flash Microcontrollers
  - ‘Traditional’ 18-Pin
  - ‘Next Generation’ 8/14/20-Pin devices
  - KEELOQ® peripheral/Battery Optimized Update
- 28/40-Pin & Low Pin-count LCD Microcontrollers
- Development Tools

History of the Baseline family of Products

- PIC16C5Xs
  - Started with the PIC1640 - 40 pins
  - Then move on to the PIC1650
  - Eventually moved to the PIC16C54 - 18 pins
  - PIC16C55 - PIC16C54 in 28 pins
  - PIC16C56 - PIC16C54 with 2x memory 18 pins
  - PIC16C57 - PIC16C54 with 4x memory 28 pins
  - PIC16C58 - PIC16C54 with 4x memory 18 pins
  - PIC16CR5X - ROM version
- Most popular devices went through several revisions:
  - PIC16C54, PIC16C54A PIC16C54B, PIC16C54C

Baseline Flash Roadmap



What is new for Baseline Flash?

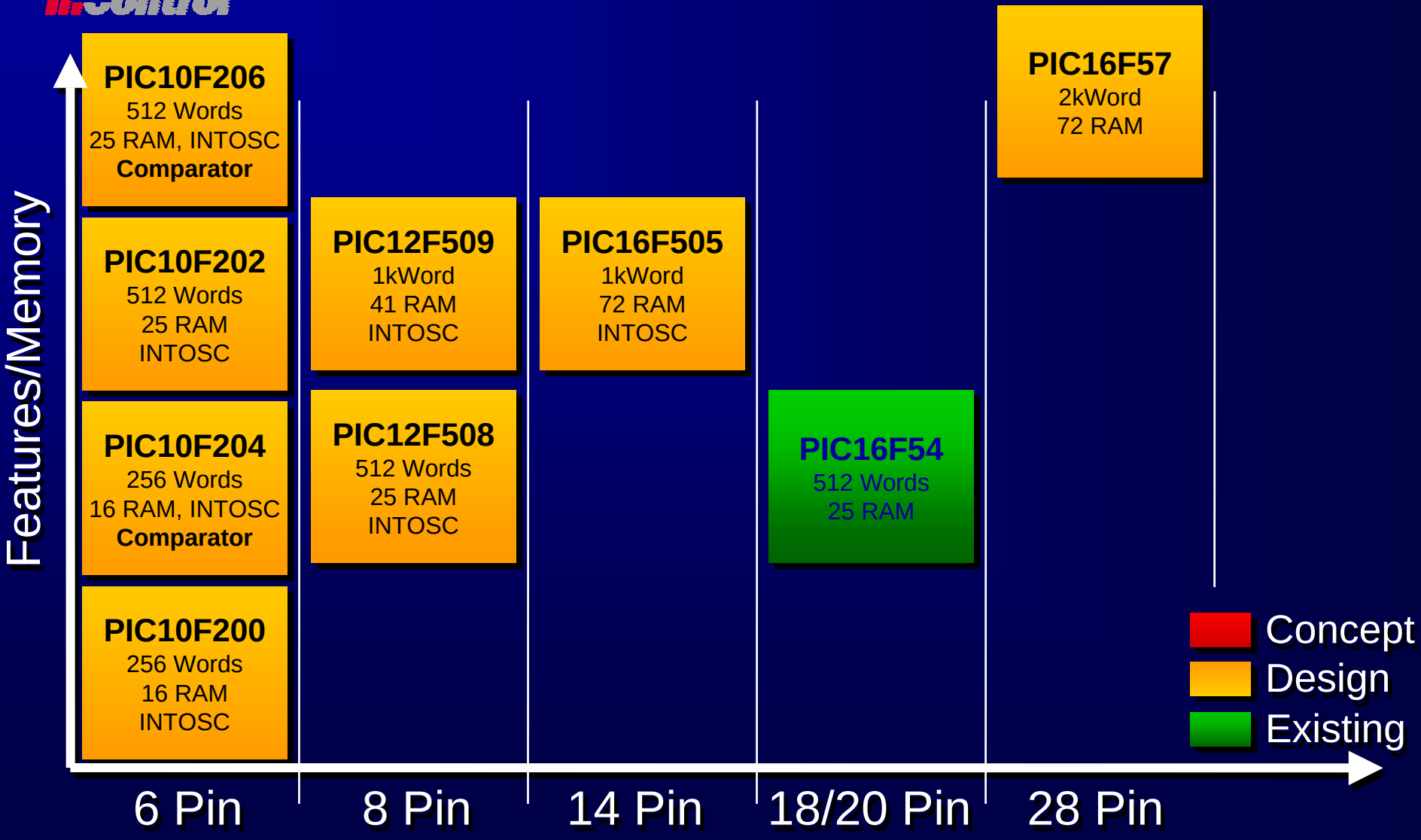
- New POR compared to OTP Products
  - Power On/Off Reset
- No more Voltage/Speed grades, Commercial Temp (2.0V to 5.5V, -40° to 85° C)
  - Fewer part numbers, lower inventory
- ICSP™ capability on PIC16F54/57 (All others had it previously)
- Accurate internal osc on 12F508/509/16F505
  - Calibrated to +/- 1%
  - +/- 2% over temperature and voltage
- PICkit™ 1 support
- Smaller packaging (MSOP)

MICROCHIP
InControl

Introducing...


World's
Smallest
Microcontroller
MICROCHIP
PIC10F

Baseline Flash Roadmap



What are we targeting
(Where do you go with this…)

'Electronic Glue':

- bug fixes for ASICs and other devices, late changes and other stopgaps or 'bandaid' required to get a product into production fast.

Logic Control:

- delays, smart gates, signal conditioning, simple state machines, encoders/decoders, peripheral logic functions on PC Boards.

Mechatronics:

- smart switches, mode selectors, remote I/Os, Timers, LED flashers and any other form of mechanical timers and switches.

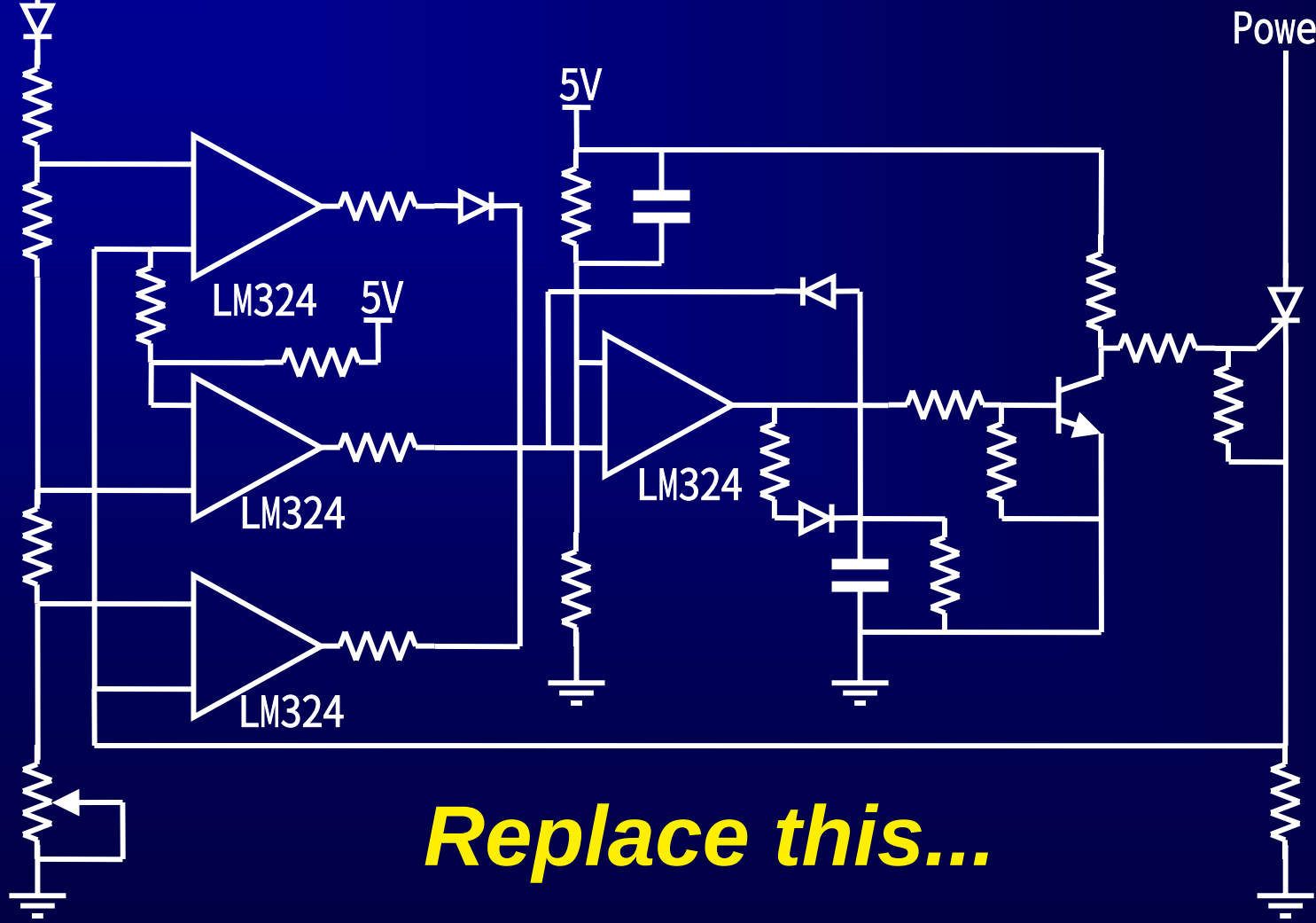
Waveform generation:

- 555 timers, PWMs, remote control encoders, Pulse generation, Programmable frequency source, Resistor Programmable Oscillators.

Intelligent Disposable Electronics:

- emerging "disposable" applications that incorporate electronics intelligence.

6-Pin Product Introduction
The Challenge...

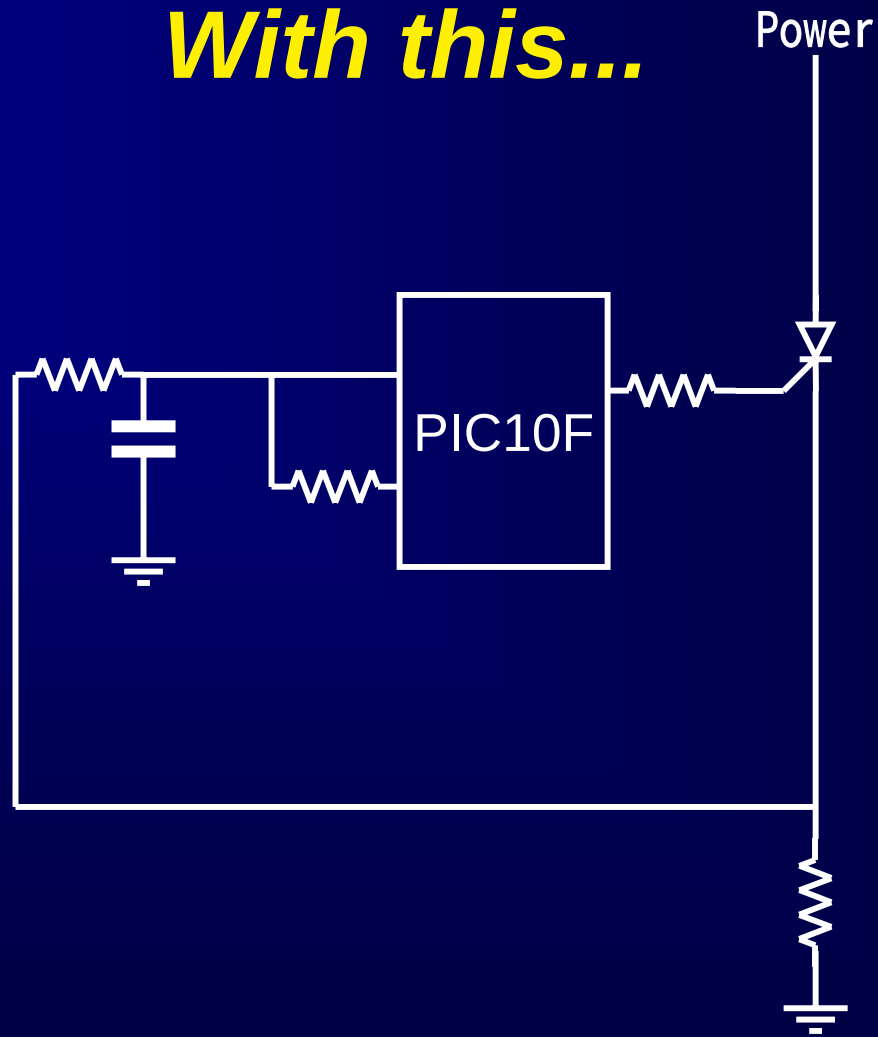


Replace this...

6-Pin Product Introduction
The Challenge...

- Fewer ***Components***
- Less ***Board Space***
- ***Flexible*** / Re-programmable
- Additional ***Features*** Possible
- Often Lower ***System Cost***

With this...



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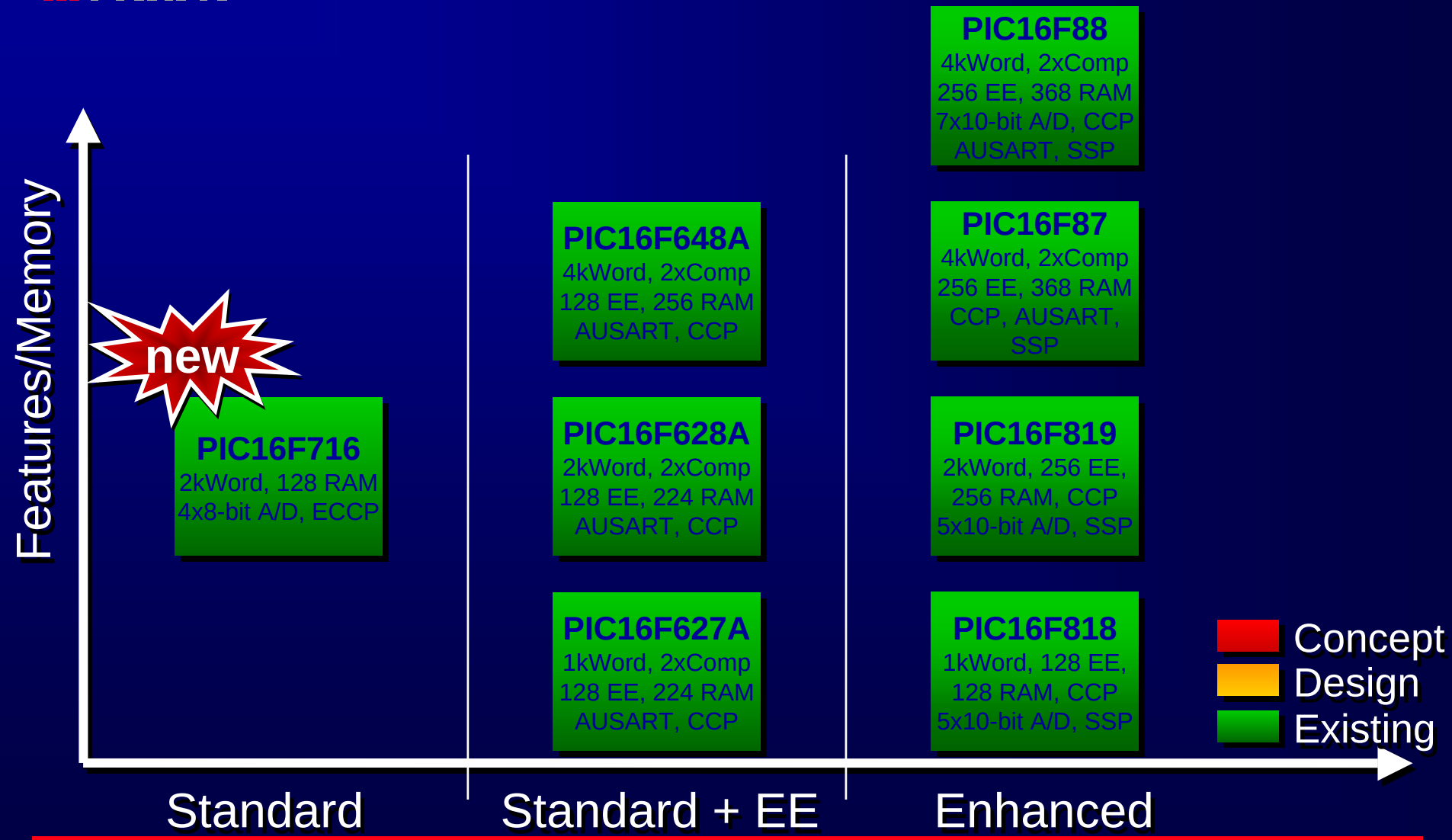
‘Traditional’ Mid-Range 18-Pin Flash PICmicro® MCUs



What changed from the PICC716 to the PIC16F716?

(A) Program memory changed from OTP to Flash

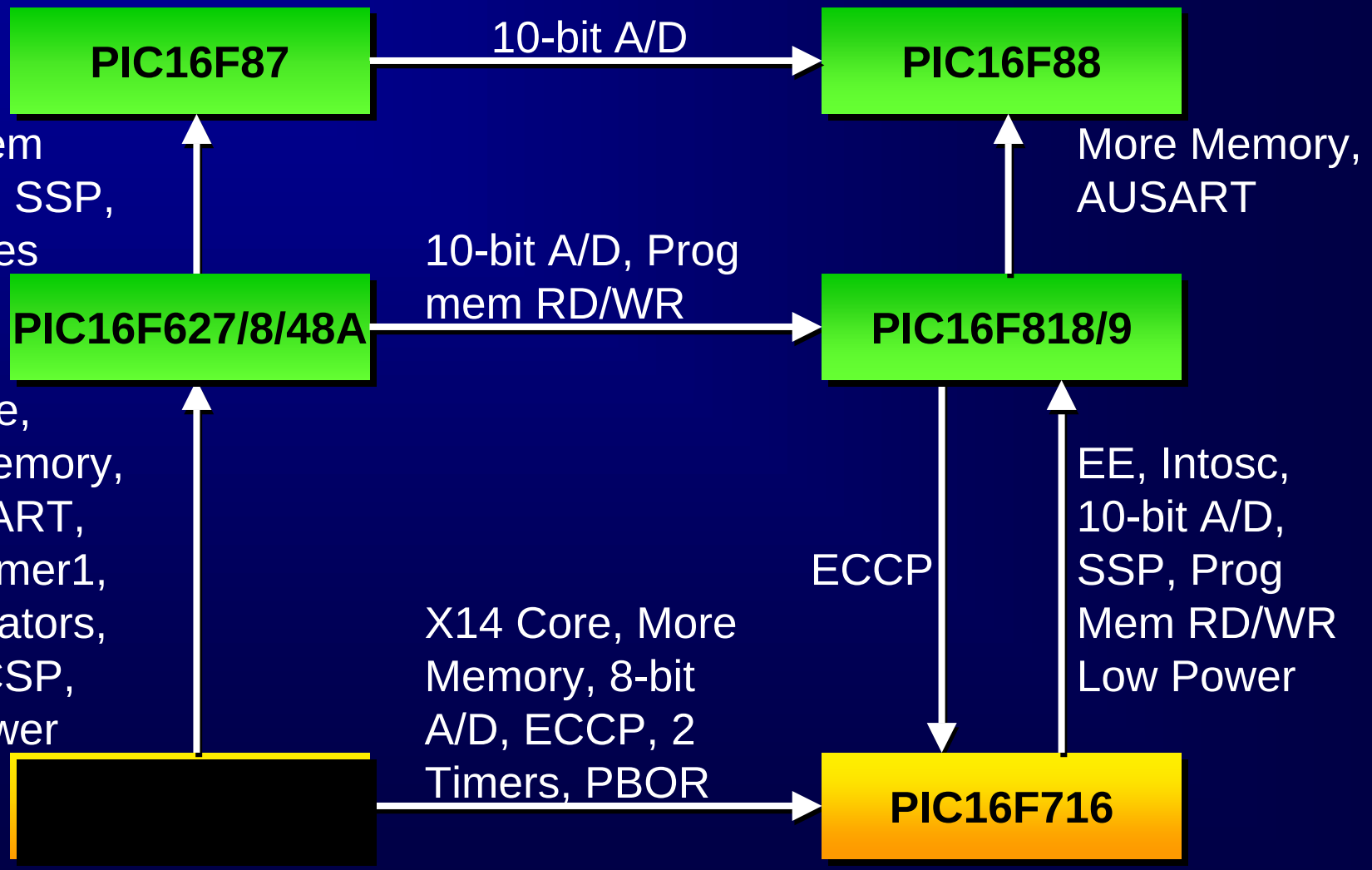
(B) The CCP module is now an ECCP module

(C) The BOR now has 2 levels 2.5V and 4.0V

Strengths of the 'Traditional' 18-Pin Flash Devices

- Traditional 18-Pin pinout
  - Easy migration paths (Example: PIC16F627A-PIC16F628A-PIC16F648A)
- Well rounded peripheral set
  - Communications: AUSART, I^2C™, SPI™
  - Analog: 10-bit A/D, Comparators
  - Digital peripherals: Timers, Capture Compare PWM
- PEEC Flash Technology
  - Enhanced Flash Memory options available
  - Data EEPROM
- nanoWatt Technology
  - Flexible Power consumption options

18-Pin Migration PIC16 Flash



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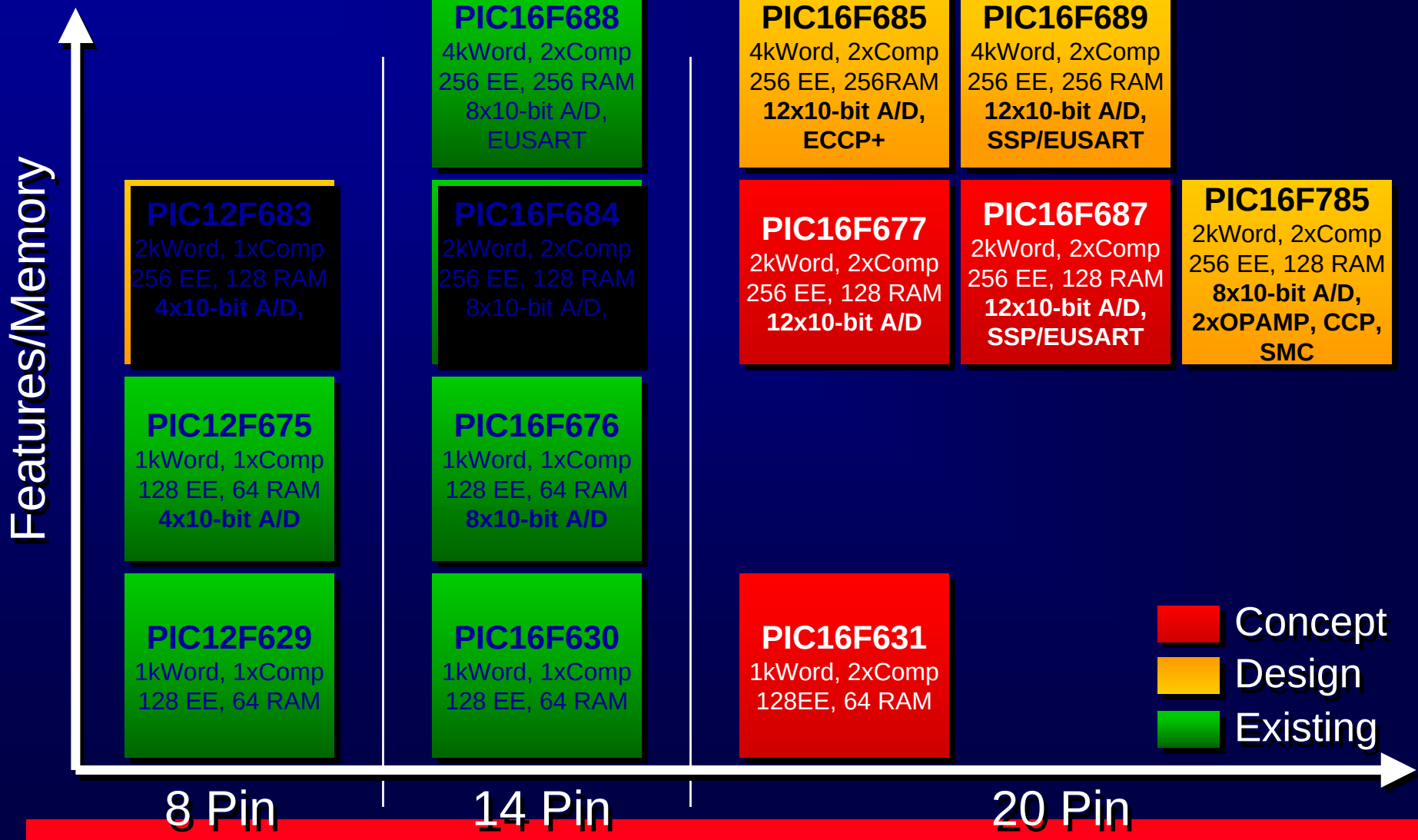
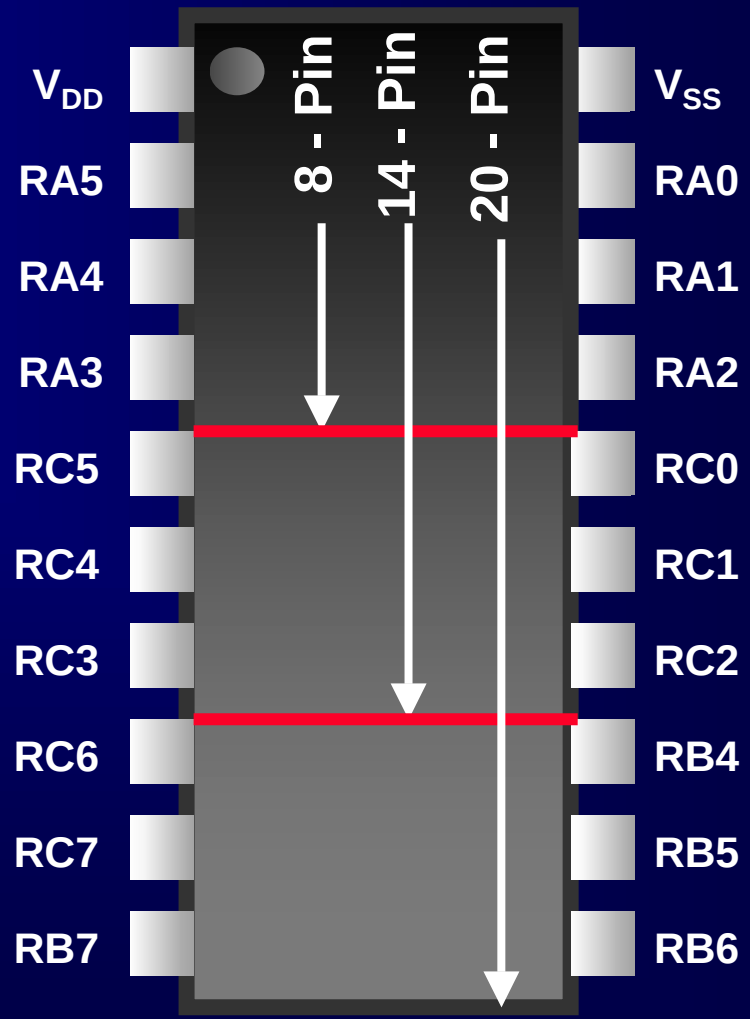
‘Enhanced’ Mid-Range 8/14/20-Pin Flash PICmicro®MCUs



‘Enhanced’ Midrange 8/14/20-pin Pinout

- 20-Pin family
  - Core functions the same as 8/14-Pin
  - Seamless Code and feature Migration in low Pincount Flash Devices
  - Full 18 I/O pins with IntOsc



“History of the 8-pin Micro” PIC12C509A vs. PIC12F629

PIC12C509A

- 12-Bit Instruction Set
- 1024 Words EPROM
- 41 Bytes RAM
- 1x8-bit Timer

PIC12F629

- 14-Bit Instruction Set
- 1024 Words Flash
- 64 Bytes RAM
- 1x8-bit, 1x16-bit Timer
- 128 Bytes EEPROM
- Comparator
- Improved Internal Osc
- BOR

PIC12F629 vs. PIC12F683

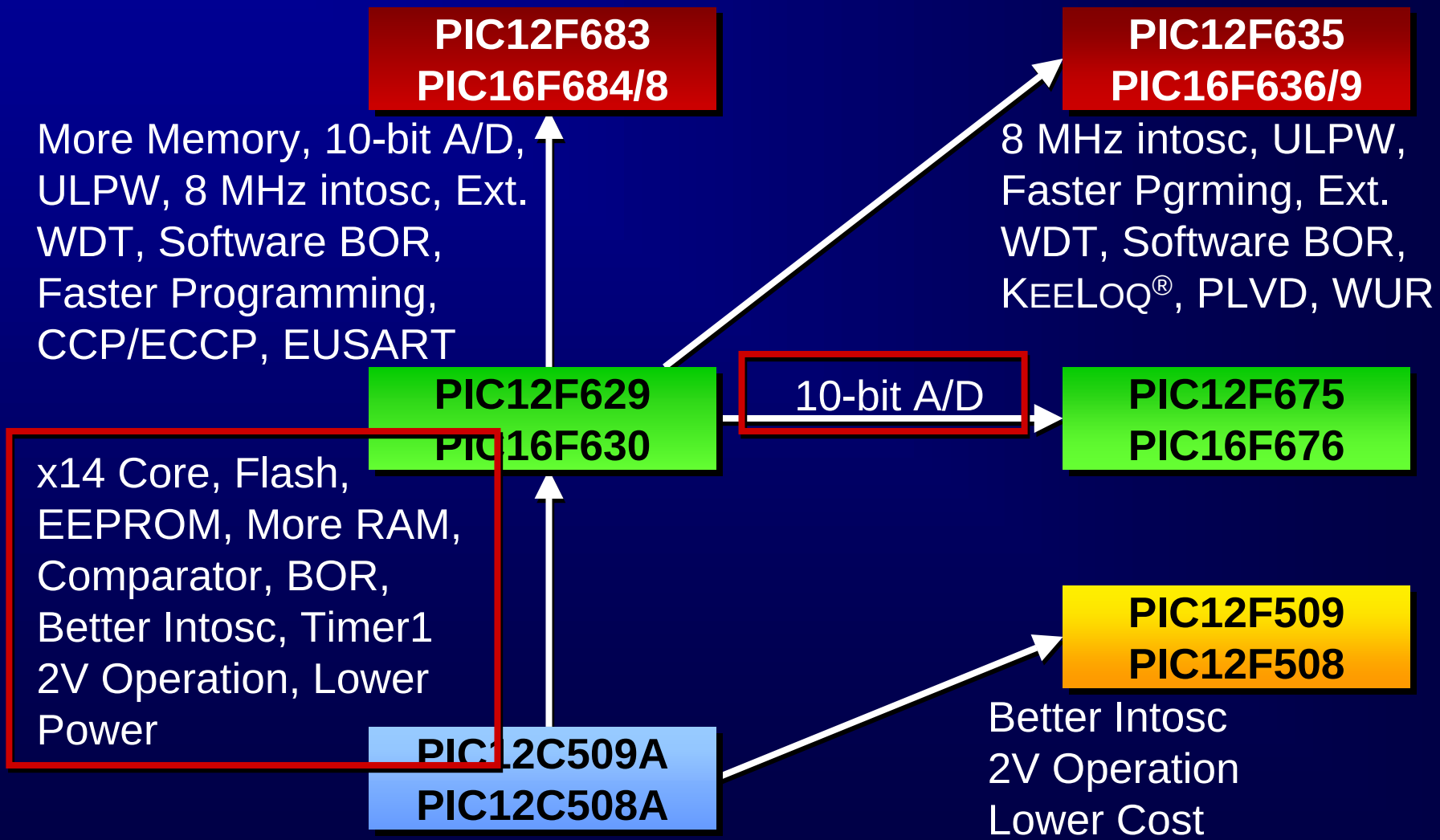
PIC12F629

- 1024 Words Flash
- 64 Bytes RAM
- 1x8-bit, 1x16-bit Timer
- 128 Bytes EEPROM

PIC12F683

- 2048 Words Flash
- 128 Bytes RAM
- 2x8-bit, 1x16-bit Timer
- 256 Bytes EEPROM
- 8 MHz Internal Osc (Software Control)
- BOR (Software enable)
- CCP Module
- 4x10-bit A/D
- ULPW, Extended WDT
- Faster Programming

8/14-Pin Migration



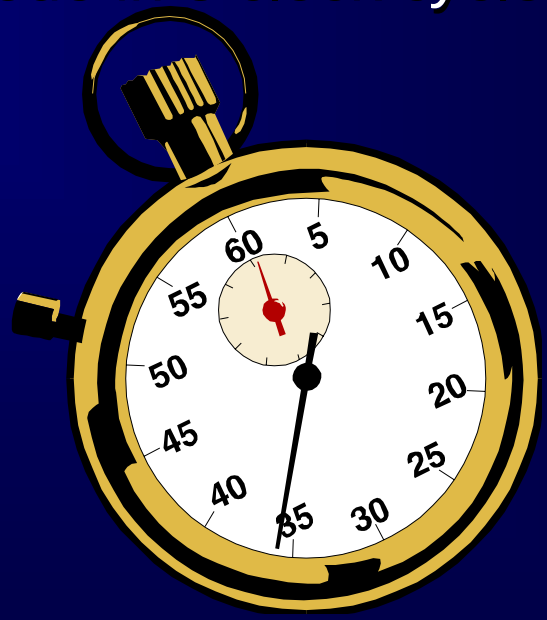
The secret weapon… The Comparator

- Good General Purpose Comparator Standard on all products
- Internal Voltage Divider (V_{REF}) available
  - Up to 32 Software Programmable levels available
- Many Different operating modes
  - Programmable input multiplexing
  - Output is externally available (Use as a stand-alone analog component)
  - Switched off if not used to save power
- Can be used as an A/D Converter

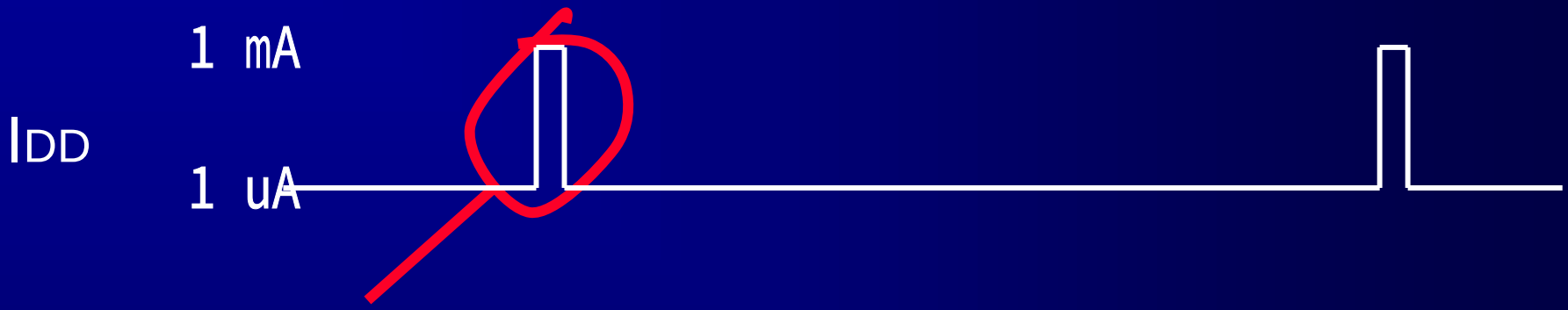
See Comparator Tips&Tricks (DS41215) for comparators uses

Internal Oscillator

- Best in the industry stability over temperature and voltage
- Quick startup
  - Controller starts to execute code in 8 clock cycles
- Factory Calibrated to ±1%
- Often replace Resonator



Why is a quick startup important?



Device wakes up, test a condition and goes back to sleep

For Battery Applications:

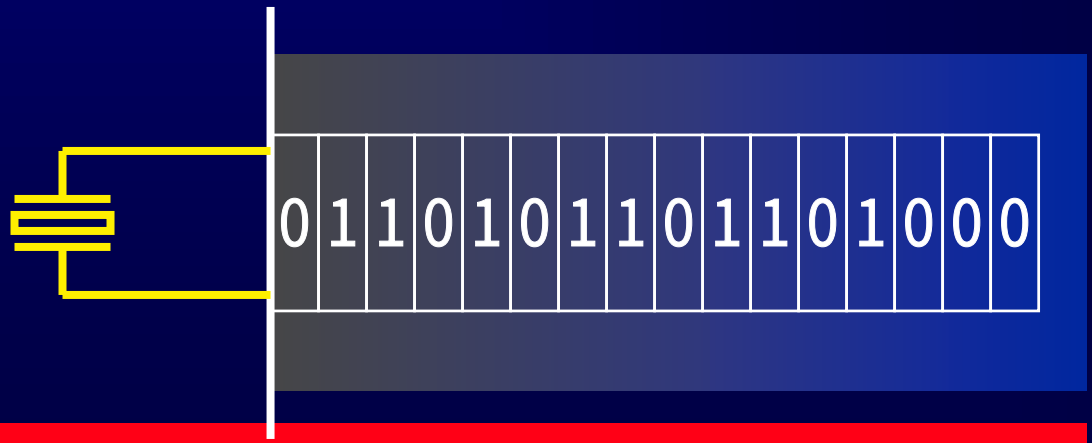
- Minimize ‘On’ time
- Minimum Sleep current

A quick startup time reduces ‘on’ time

Result: Longer Battery Life

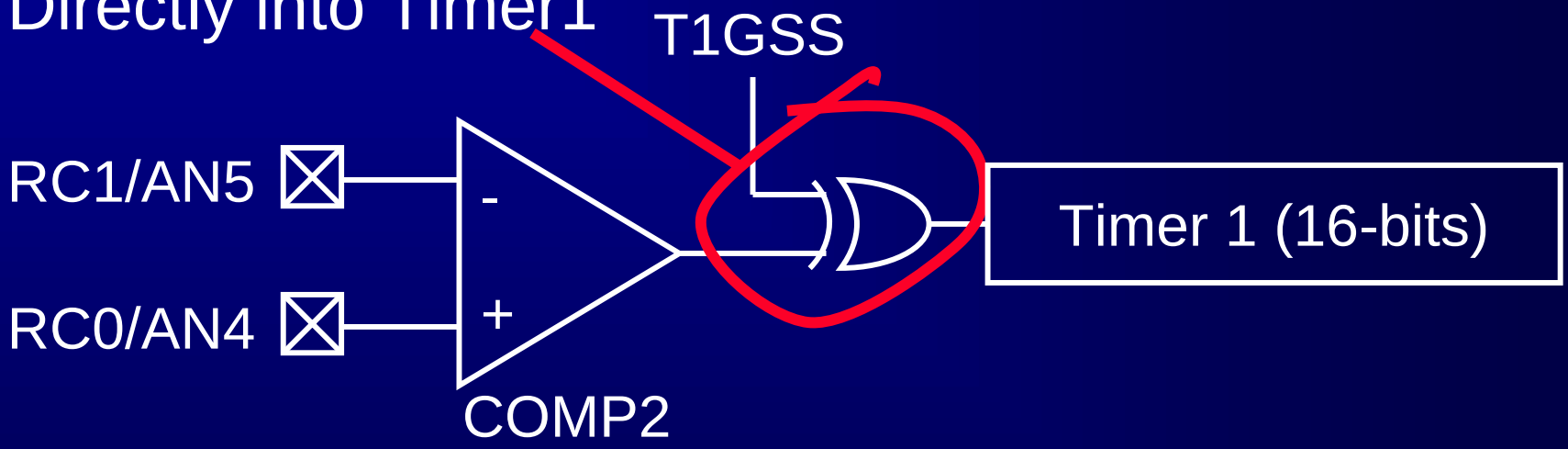
Timer1

- 16-bit Synchronous/Asynchronous Timing
- High Resolution A/D with Comparators
- Allow external LP crystal operation
  - Periodic wakeup from SLEEP mode
  - Low Power accurate timing when combined with quick startup internal oscillator



Timer 1 with Comparator Gate Control

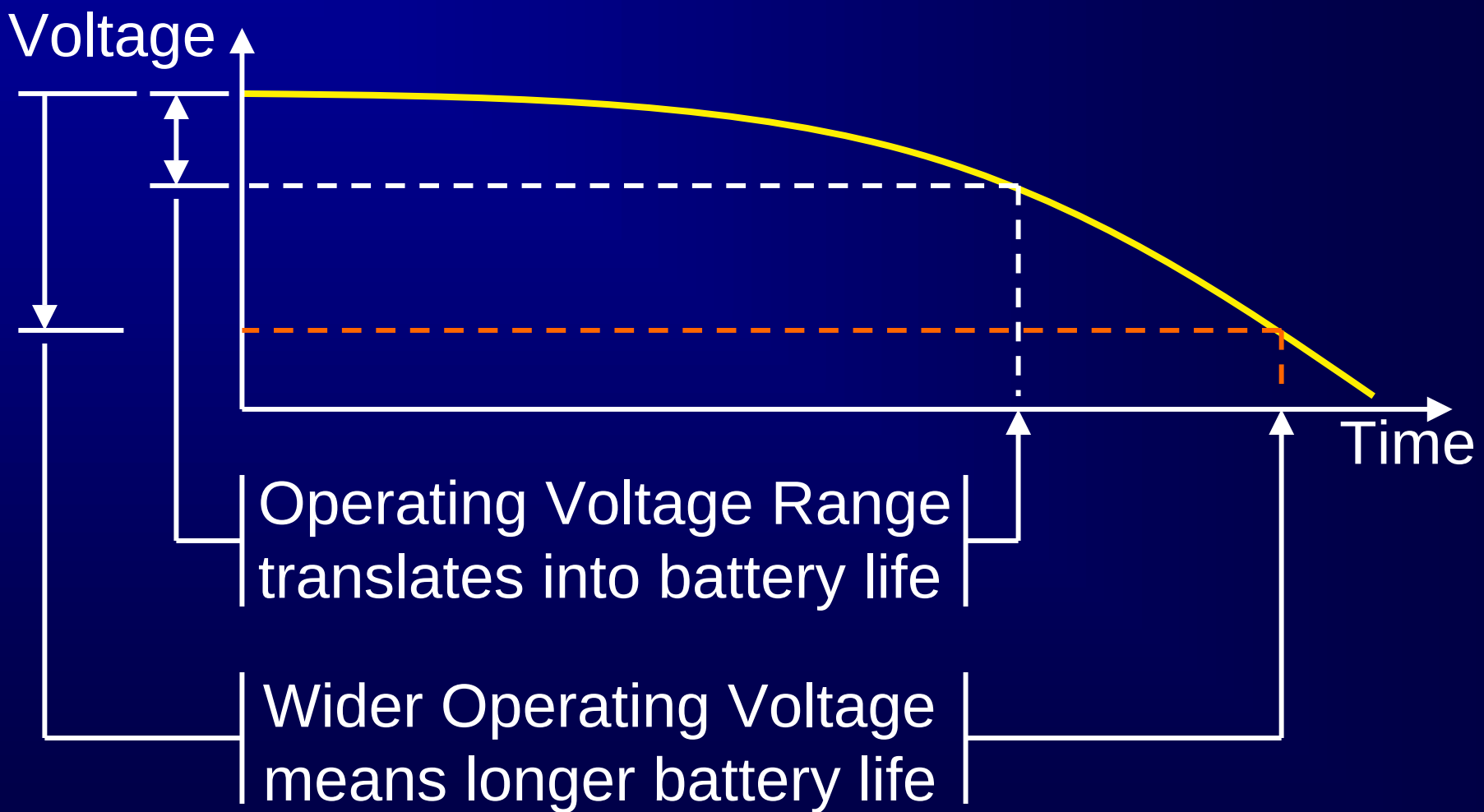
Comparator Output Directly into Timer1



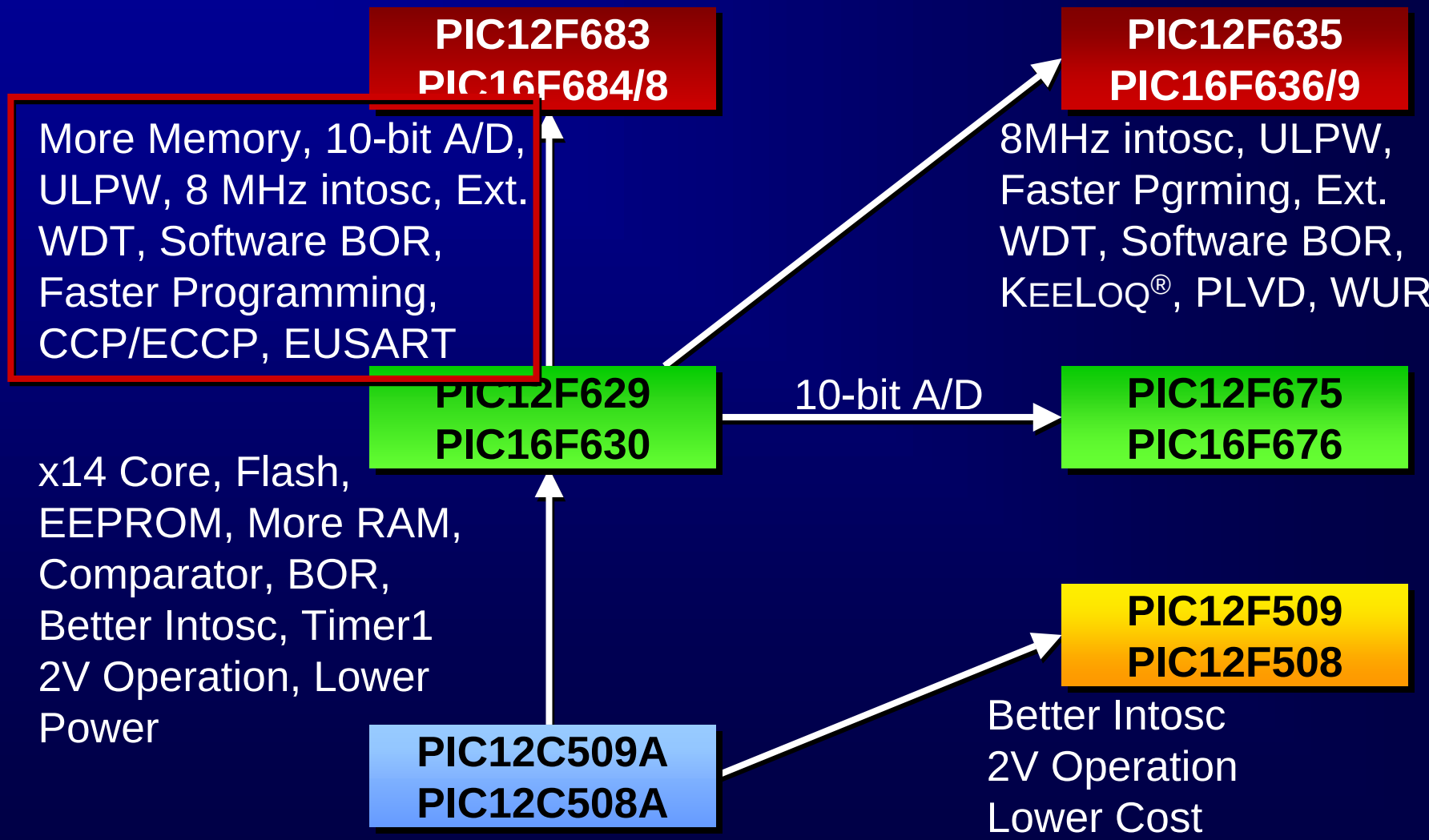
This can be used for:

- ***Additional Input Capture***
- ***A/D Conversion up to 14-bits+ (See AN700)***
- ***Counting Analog Events***

Wide Operating Voltage - Longer Battery Life



8/14-Pin Migration



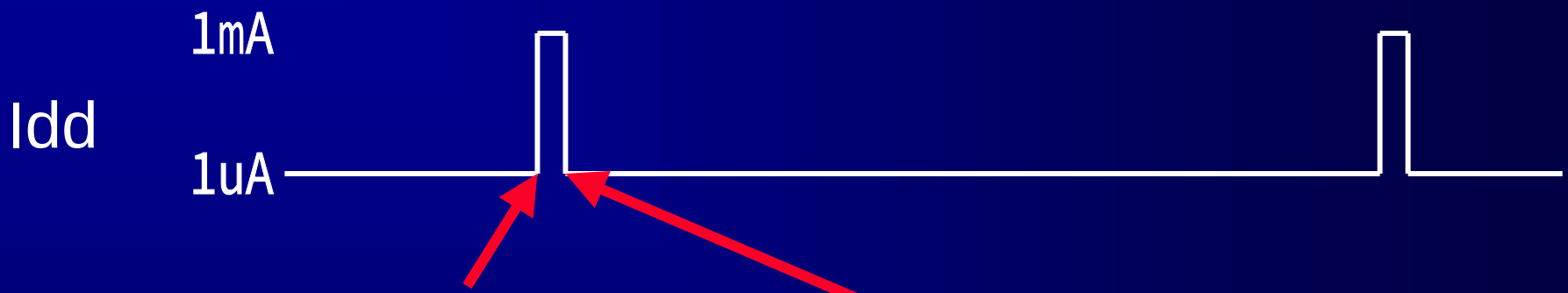
How is the internal oscillator on the 68x different from the 629/630/67x?

(A) The maximum frequency increased from 4MHz to 8MHz

(B) The Frequency is software controlled as in the PIC18 nanoWatt devices

(C) It offers the failsafe clock monitor

Software controlled Brownout Reset



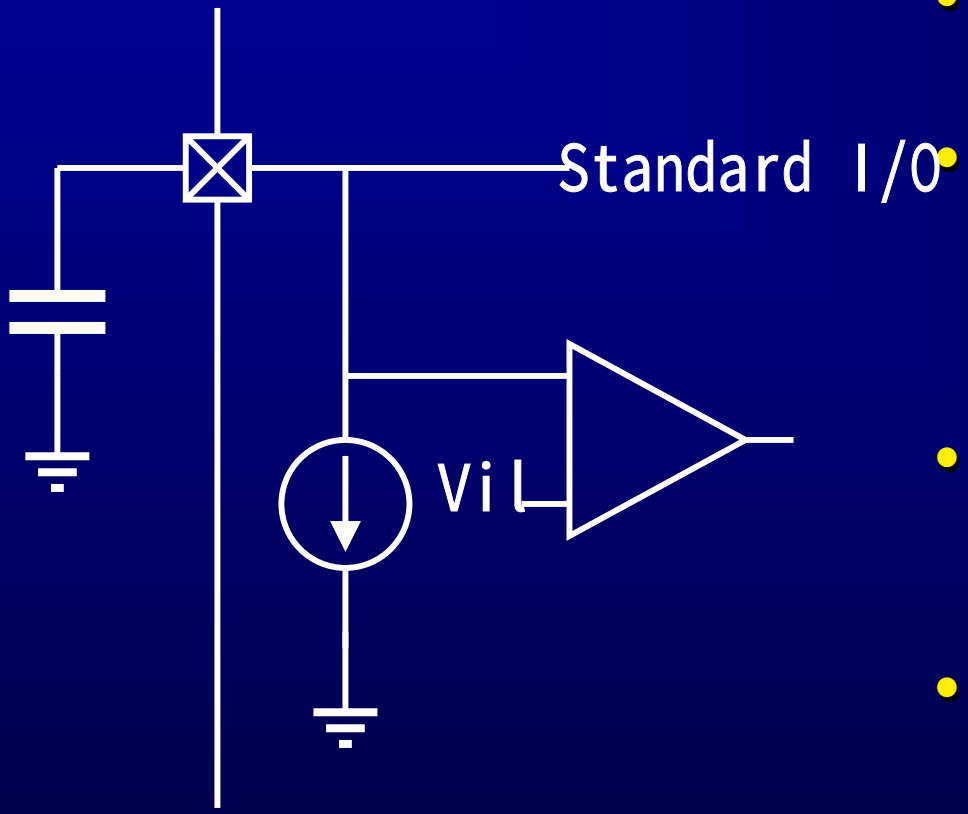
Switch BOR on during Program execution

Switch BOR off when device goes to SLEEP

A software controlled BOR ensures reliable operation, but still have low power

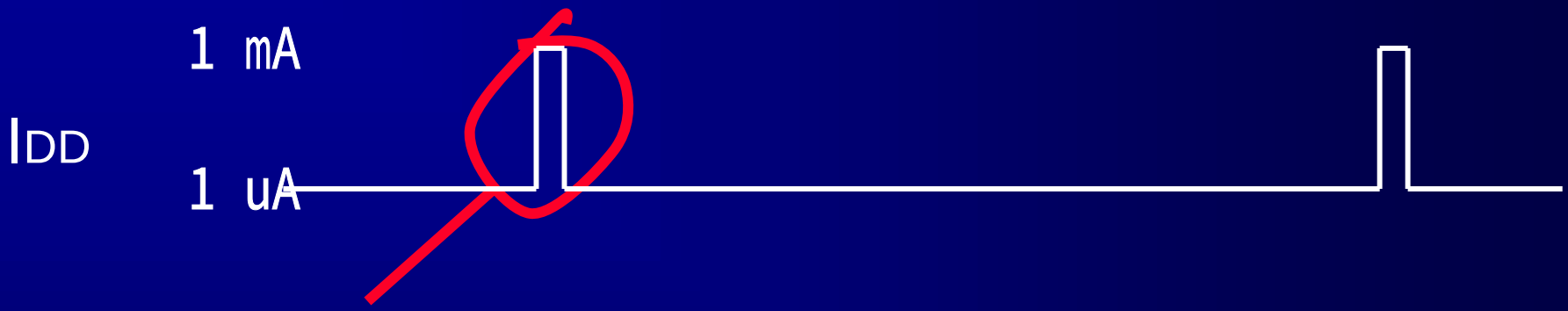
Result: Longer Battery Life and More reliable operation

Ultra Low Power Wakeup (ULPW)



- Allows slow changing inputs to PIC® MCU
- Application include:
  - Basic Timer (Low Power)
  - Low Voltage detect
  - Temperature sensing
- Available on PIC12F683, PIC16F684, PIC16F688 + more products
- ***See AN879***

Extended Watchdog



Device wakes up, test a condition and go back to sleep

Extended Watchdog:

- Lower Power Consumption During Sleep
- Increased time between watchdog timeouts

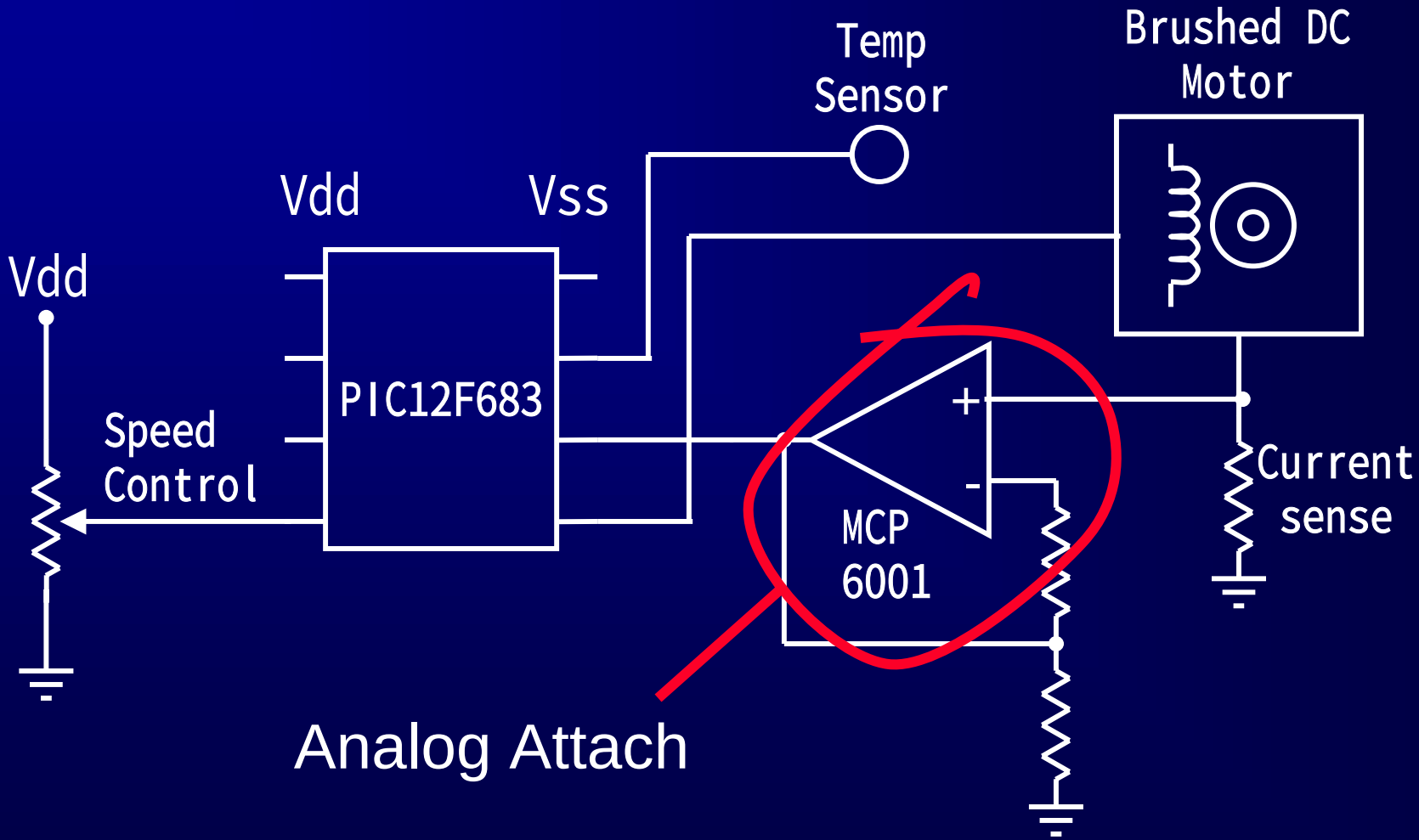
Capture/Compare/PWM Module

- Standard CCP Module in PIC12F683
  - ***First 8-pin device*** with Capture, Compare, and PWM
  - 16-bit Capture/16-bit Compare,10-bit PWM
- Enhanced ECCP Module in PIC16F684
  - All CCP features
  - Single, half and full H bridge outputs
  - Dead band control
  - Auto-shutdown feature using combinations of C1, C2 and INT

Typical Applications using the CCP/ECCP

- Motor control speed
- D-to-A Conversion
- Stepper motor, micro-step controller
- Timing control and event sequencing
- Magnetic/pneumatic actuator intelligent control
- LED/Lamp intelligent driver
- PWM of AC power
- Switching power supply controller

Low Cost Motor Control Example Application



See CCP/ECCP Tips&Tricks (DS41214)

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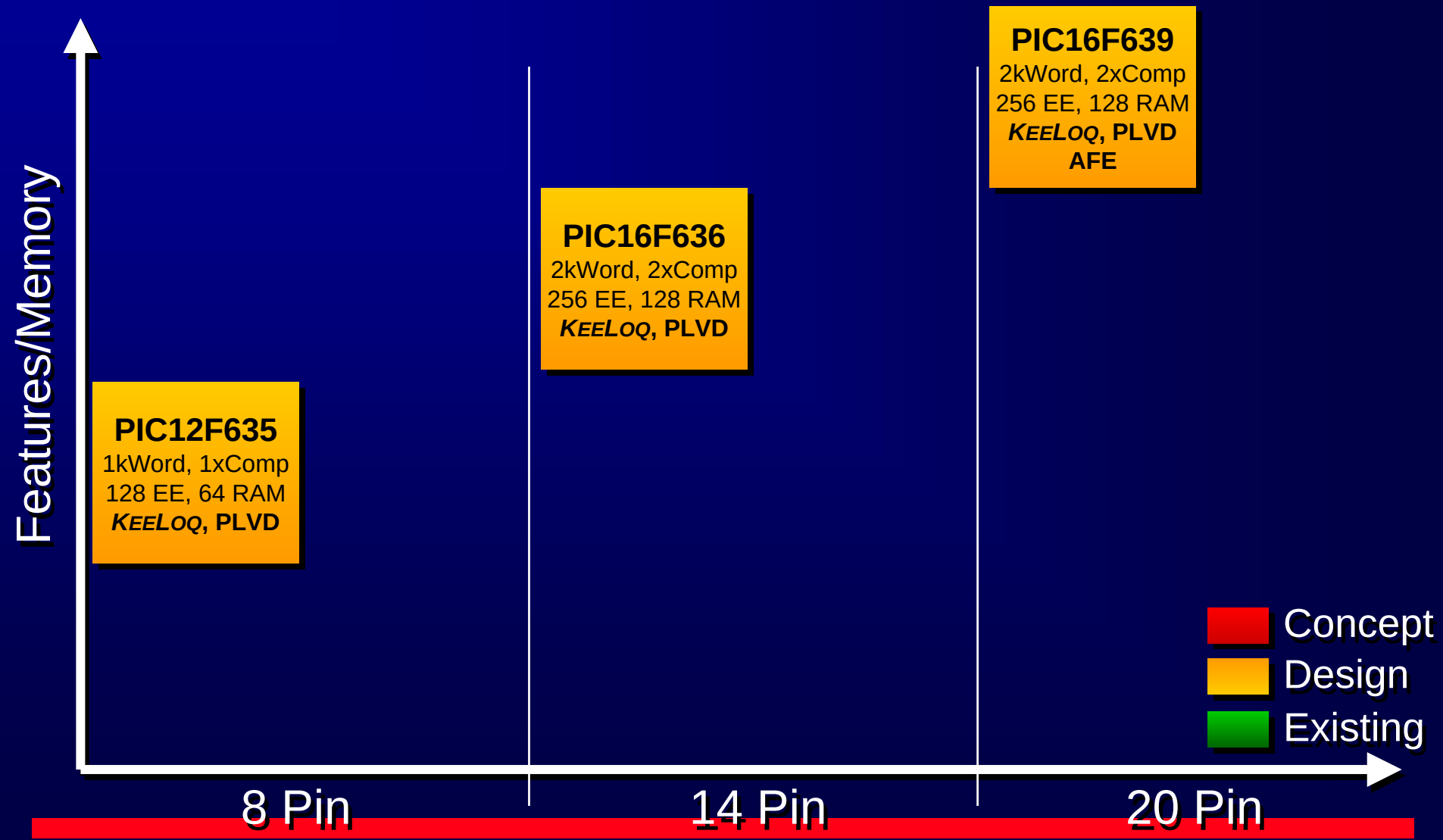
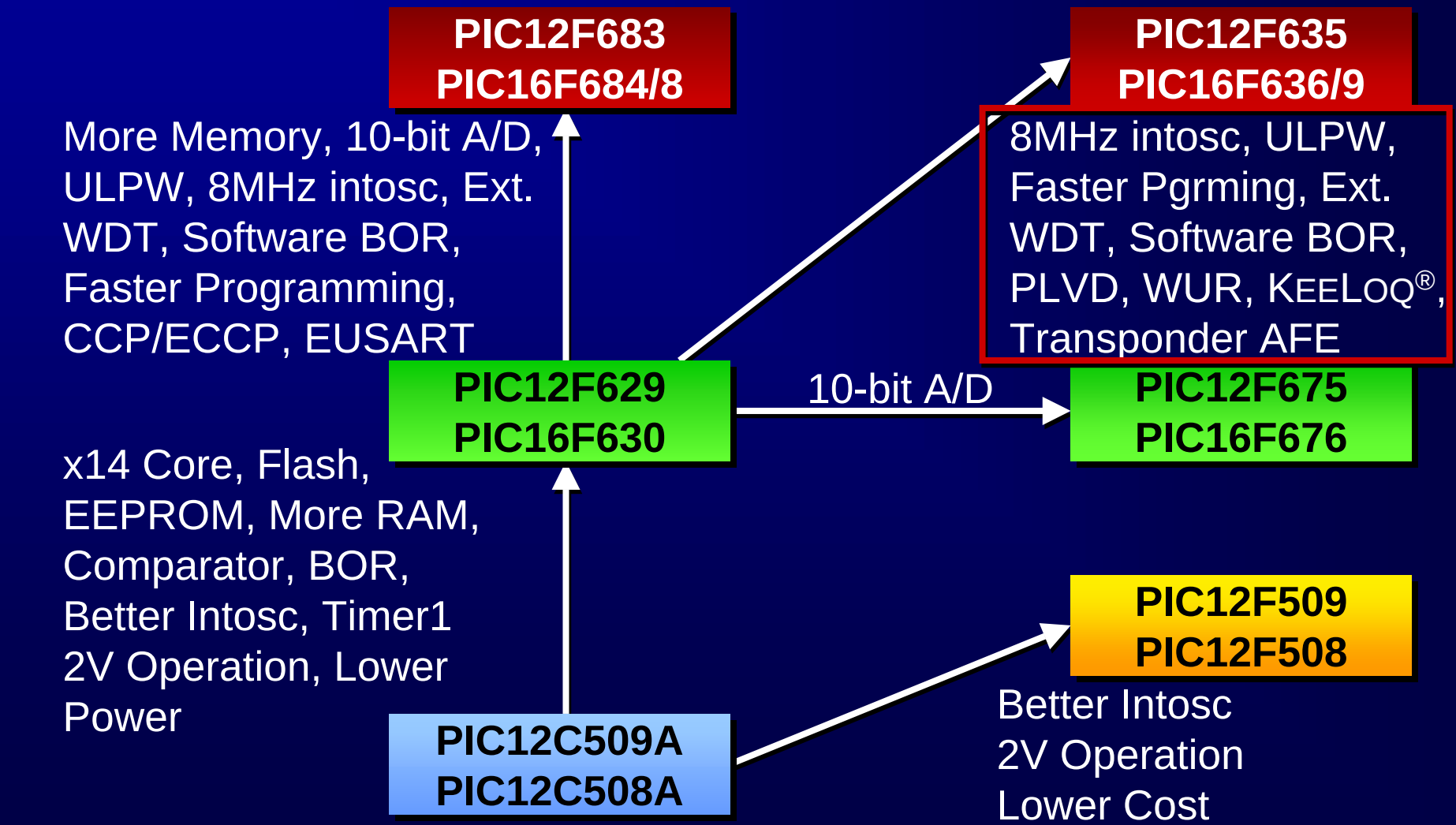
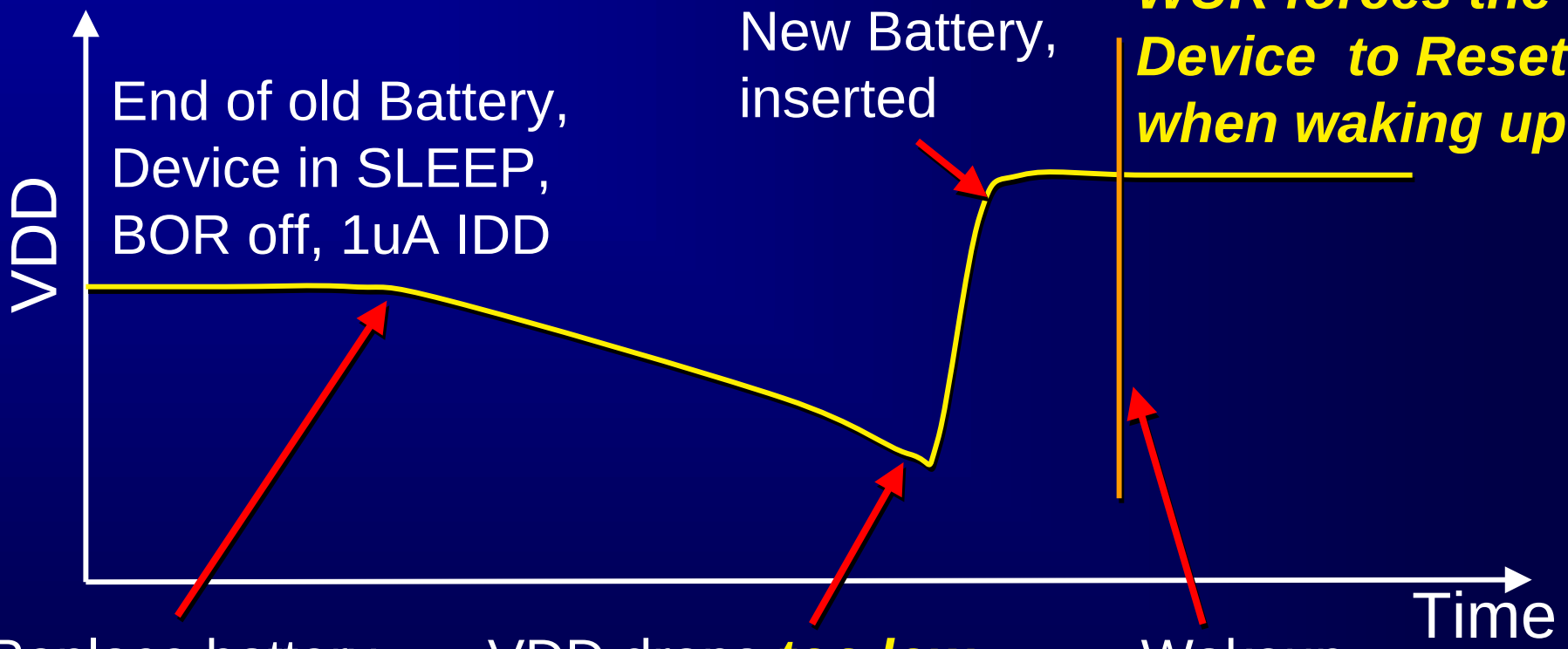
8/14/20-Pin Roadmap
Battery Optimized



8/14-Pin Migration



Wake-up Reset Function (WUR)



Replace battery, Capacitor starts discharging

VDD drops ***too low for PC/RAM*** to keep value, but ***too high for POR*** trigger

Wakeup event

PLVD

- Programmable Low Voltage Detect (PLVD)
  - 8 Options ranging from 1.9V - 4.5V
- Allows detection of low battery voltage without the use of an external reference
- Software controlled (Switch off during SLEEP)

New KEELOQ® Peripheral What is it?...

- Hardware Encryption/Decryption peripheral:
  - Offers the ability to implement KEELOQ encryption/decryption on a microcontroller
  - Faster encryption/decryption than done with software
- Consists of:
  - Registers for (Key, data, configuration)
  - Non-linear lookup table
  - State machine
- Easy to use ‘Load n Go’ operation
- Reliable, proven algorithm for authentication

KEELOQ® Peripheral Where will people use this?...

- Remote Keyless Entry
- Authentication (Identity, Property)
- Security systems (All remote sensors and the communication between these)
- Pseudo random number generation (Example: Electronic dice for toys)

Which of the following nanoWatt Features are unique to the PIC12F635/16F636

(A) Wakeup Reset (WUR) Function

(B) Programmable Low Voltage Detect (PLVD)

(C) Ultra Low Power Wakeup (ULPW)

Killer Attributes of the 'Enhanced' 8/14/20-Pin Devices

- Flash Program and EEPROM Data Memory
- Up to 12 channels of 10-bit A/D
- Comparator(s) Standard on all products
- Precision Internal Oscillator (2 Versions)
- Wide Operating Voltage (2.0V - 5.5V)
- 16-bit Timer (Timer1) on all Products
- nanoWatt Features
- Brownout Reset (BOR)
- Advanced Peripherals

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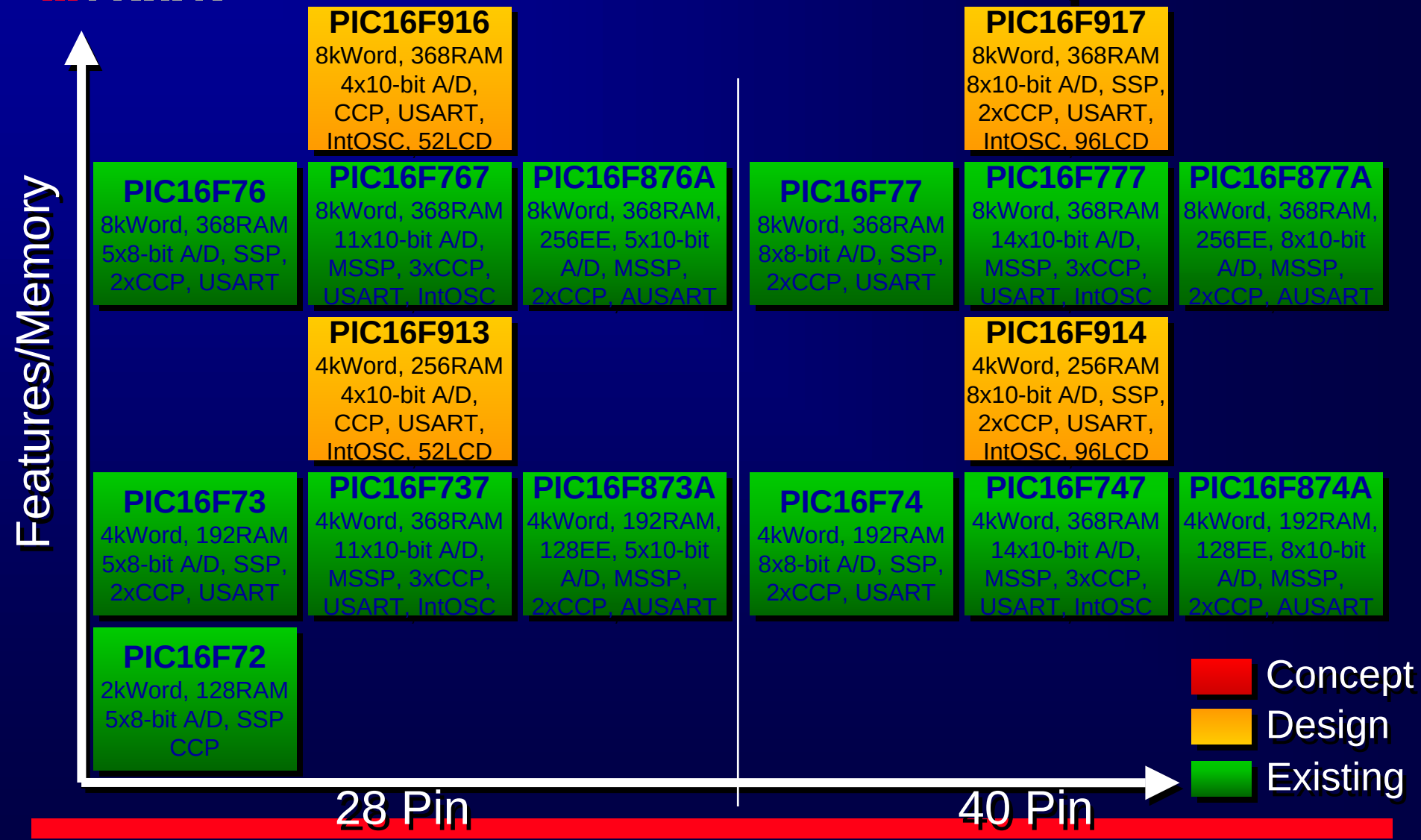
PIC16F 28/40-Pin Roadmaps



PIC16F7x7 Features

- 4Kw/8Kw Standard Flash
- 368 Bytes RAM
- 25/36 I/O
- 11/14 Channel 10-bit ADC
- 2 Comparators
- 3 CCP(PWM)
- LVD/BOR
- AUSART/MI^{2}C/SPI
- INTOSC: 8 MHz
- Power Managed Modes
- Packaging:
  - 28 Lead- PDIP, SOIC, SSOP, 6x6 QFN
  - 40 Lead-PDIP, 8x8 QFN
  - 44 Lead-TQFP

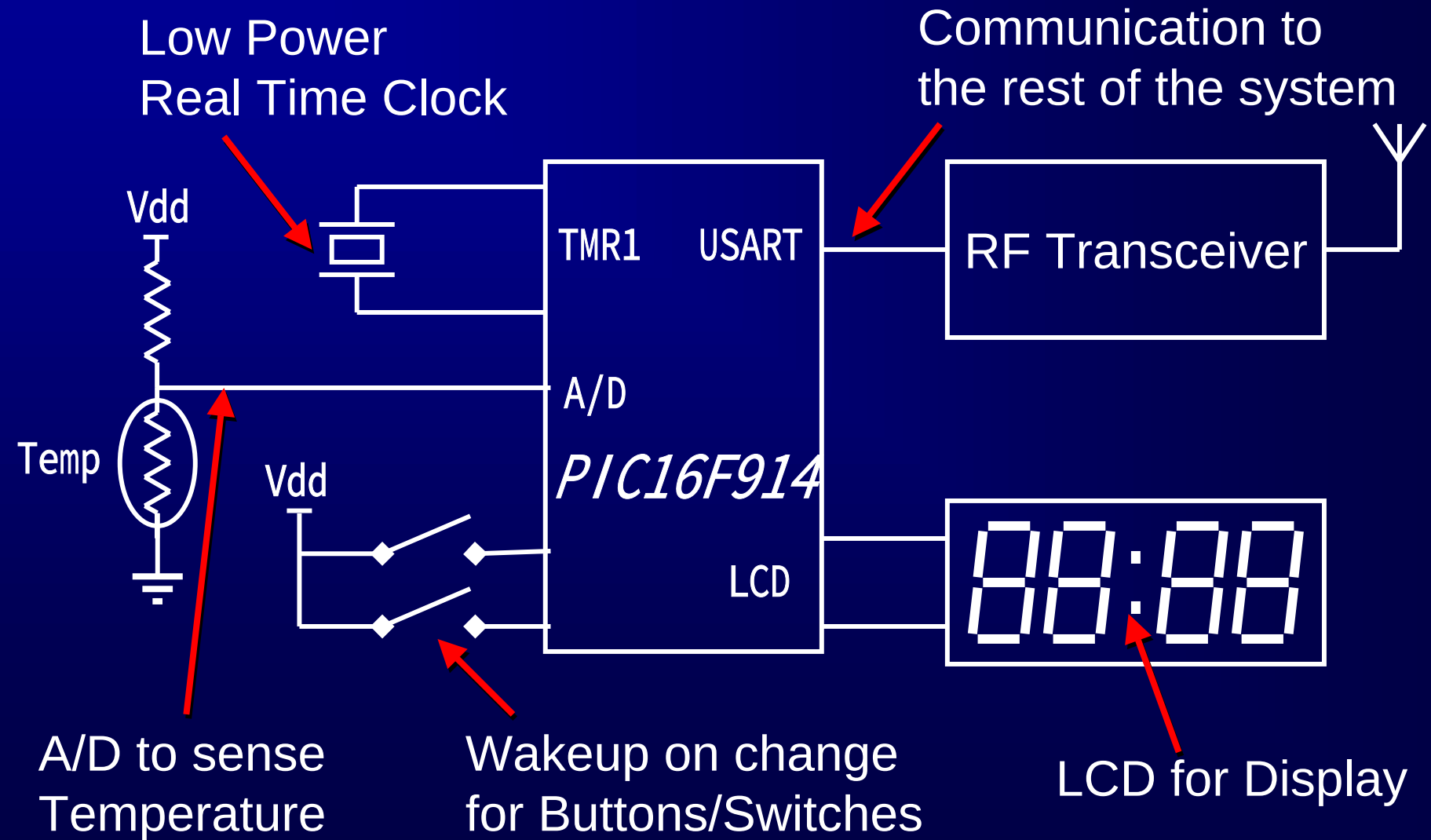
PIC16F7x7 Features vs. PIC16F7x and PIC16F87X

	Prog. Memory (Words)	Data RAM (Bytes)	Data EE (Bytes)	Pins	I/O Pins	A/D Chn/Res	Comp-arators	8/16-bit Counters	Voltage Range	CCP (PWM)	LVD / BOR	Serial	On-chip Osc	LP Modes
PIC16F73	4K	192	-	28	22	5x8-bit	-	2/1	2.0-5.5	2	Yes	USART/ I^2C/SPI	-	-
PIC16F74	4K	192	-	40	33	8x8-bit	-	2/1	2.5-5.5	2	Yes	USART/ I^2C/SPI	-	-
PIC16F76	8K	368	-	28	22	5x8-bit	-	2/1	2.5-5.5	2	Yes	USART/ I^2C/SPI	-	-
PIC16F77	8K	368	-	40	33	8x8-bit	-	2/1	2.0-5.5	2	Yes	USART/ I^2C/SPI	-	-
PIC16F737	**4K**	**368**	**-**	**28**	**25**	**11x10-bit**	**2**	**2/1**	**2.0-5.5**	**3**	**Yes**	**AUSART/ MI^{2}C/SPI**	**1**	**Yes**
PIC16F747	**4K**	**368**	**-**	**40**	**36**	**14x10-bit**	**2**	**2/1**	**2.0-5.5**	**3**	**Yes**	**AUSART/ MI^{2}C/SPI**	**1**	**Yes**
PIC16F767	**8K**	**368**	**-**	**28**	**25**	**11x10-bit**	**2**	**2/1**	**2.0-5.5**	**3**	**Yes**	**AUSART/ MI^{2}C/SPI**	**1**	**Yes**
PIC16F777	**8K**	**368**	**-**	**40**	**36**	**14x10-bit**	**2**	**2/1**	**2.0-5.5**	**3**	**Yes**	**AUSART/ MI^{2}C/SPI**	**1**	**Yes**
PIC16F873A	4K	192	256	28	22	5x10-bit	2	2/1	2.0-6.0	2	PBOR	**AUSART/ MI^{2}C/SPI**	-	-
PIC16F874A	4K	192	256	40	33	8x10-bit	2	2/1	2.0-6.0	2	PBOR	**AUSART/ MI^{2}C/SPI**	-	-
PIC16F876A	8K	368	256	28	22	5x10-bit	2	2/1	2.0-6.0	2	PBOR	**AUSART/ MI^{2}C/SPI**	-	-
PIC16F877A	8K	368	256	40	33	8x10-bit	2	2/1	2.0-5.5	2	PBOR	**AUSART/ MI^{2}C/SPI**	-	-

Small Pincount LCD PIC16F91x

- Same basic Feature set as 68x Devices…
  - 8 MHz, Clock Divides, EEPROM, Comparators, etc.
  - Low Power 32 kHz Timer1
- LCD Peripheral
  - 52 Segments for 28-Pin Devices
  - 96 Segments for 40-Pin Devices
  - LCD Operation similar to PIC18F8490 Family
- Other Peripherals include
  - Up to 2x CCP Modules
  - 10-bit A/D
  - AUSART/SSP

Example Application: Wireless Thermostat



What typical external components can be integrated with the 91x in the previous design

(A) Real Time Clock

(B) EEPROM for calibration, User program

(C) A/D for Temperature measurement

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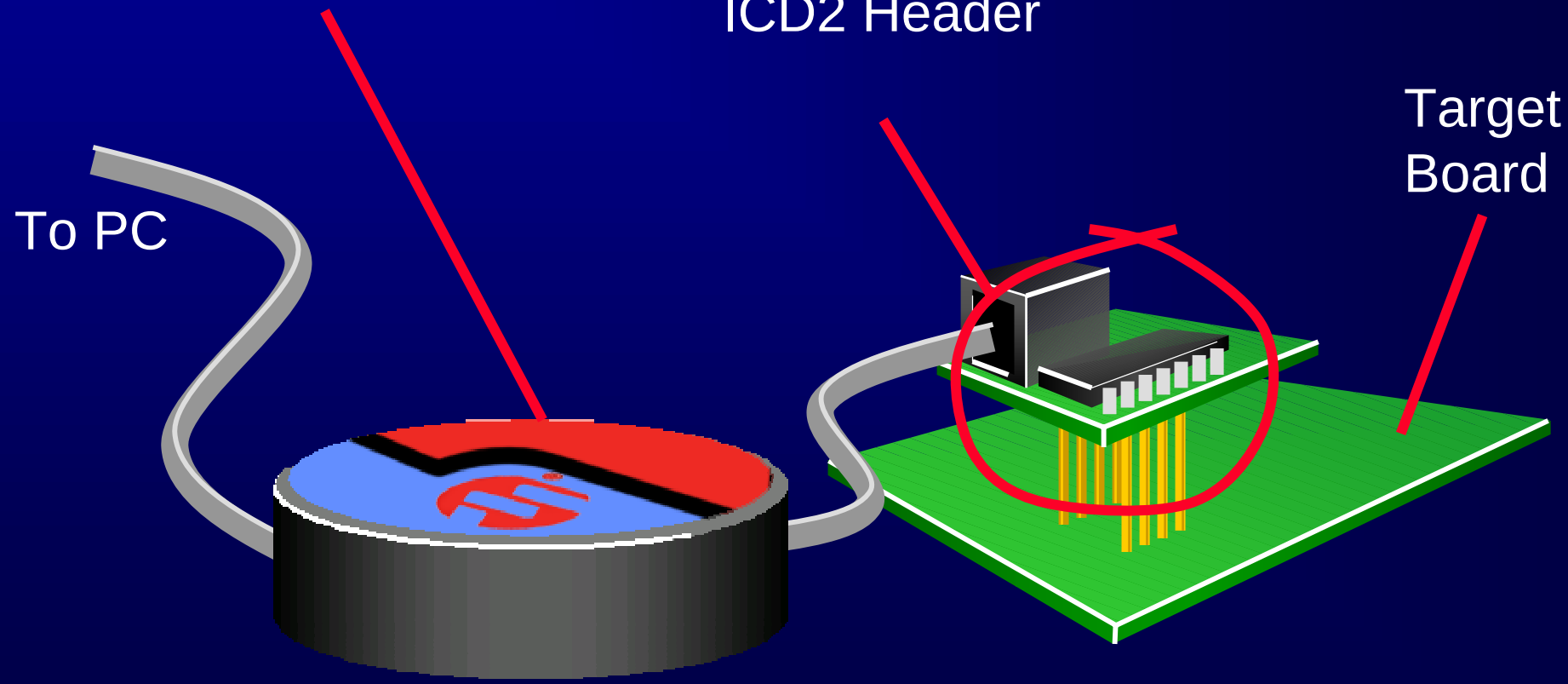
ICD for 8/14/20-Pin Devices (Including new Baseline Flash)

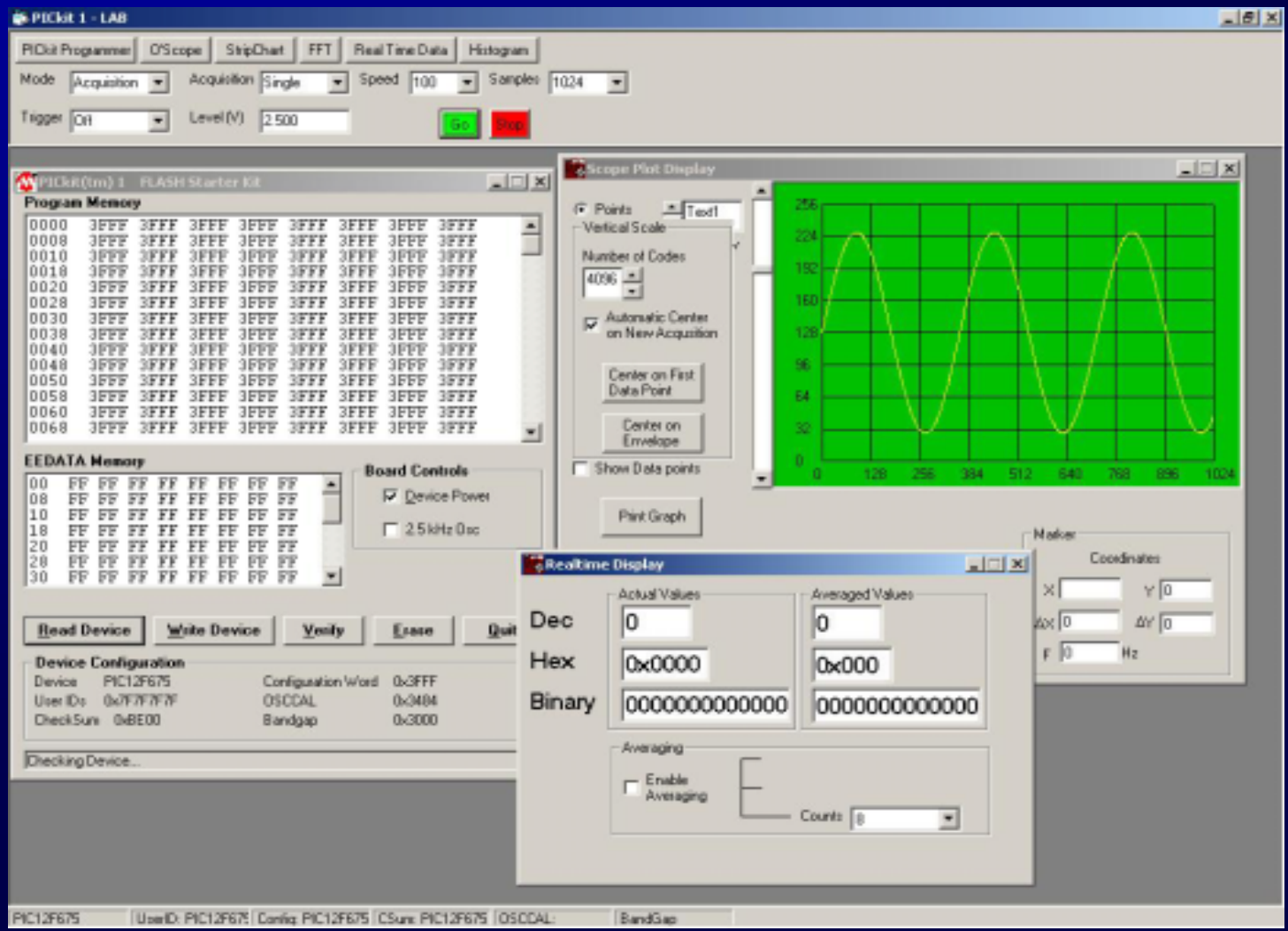
ICD2 (DV164005, DV164006,DV164007)



PICkit™ 1

- What's new…
  - Supports new Products PIC12F683, PIC16F684, PIC16F688
  - Will also support Baseline ICSP™ capability
  - GUI Improvements to interface application with PC
- Low Cost, Easy-to-start
  - $36 USD
  - Tutorials included

PICkit™ 1 V2.00 with Signal Analysis PICtail™ Daughter Board



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Thank you
Questions?