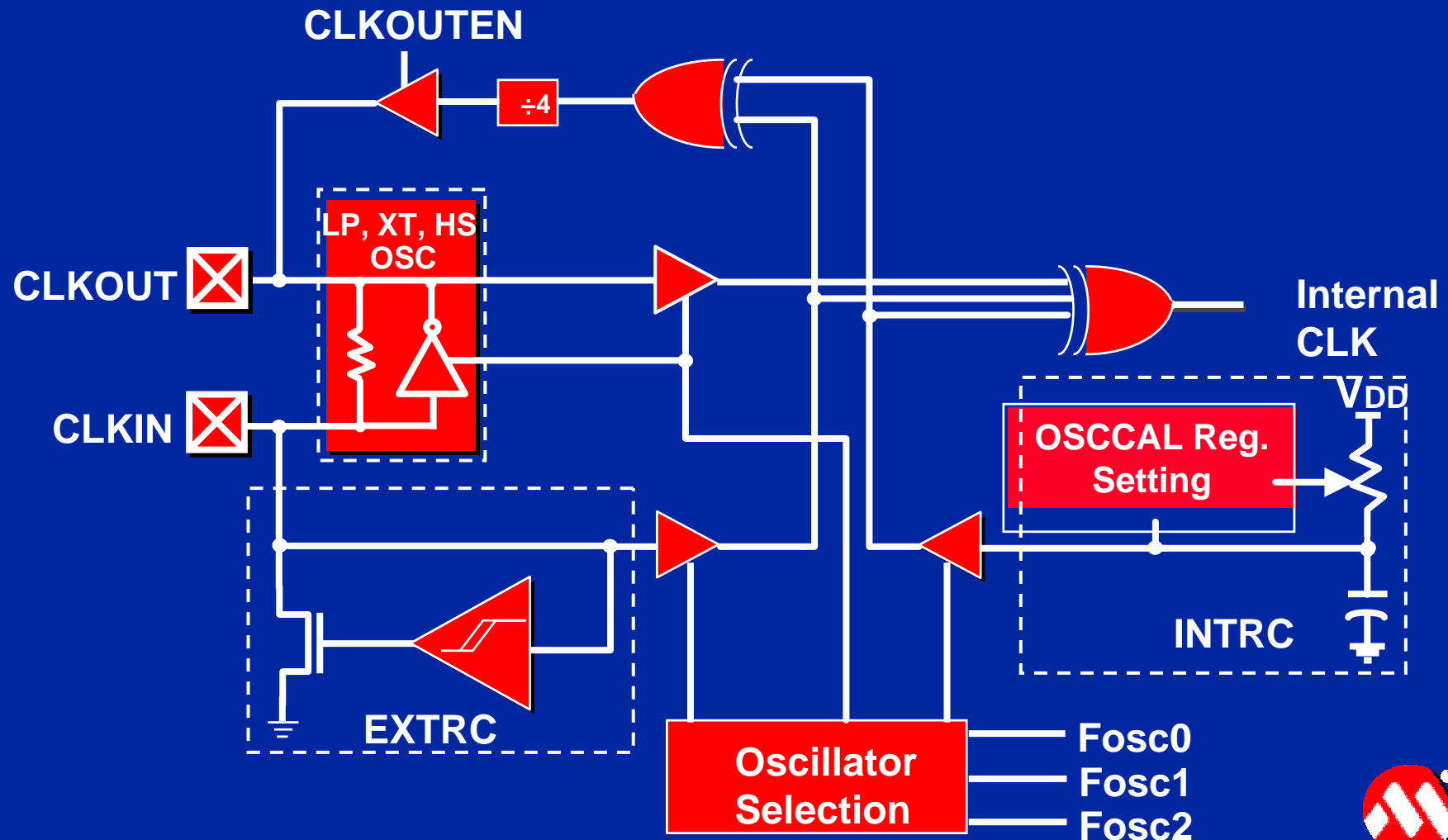# MICROCHIP

Special Features

Check individual data sheets to see which parts have what features

MICROCHIP

Special Features
Oscillators Options

Special Features
Oscillator Options

- Devices ordered according to frequency & V_{DD} ranges (i.e. 04 vs. 20 & C vs. LC).
- External clock can be used in any mode except RC gives flexibility to the user.
  - LP oscillator is designed to consume minimal current.
  - RC oscillator is a low-cost solution: need only one capacitor and one resistor externally.

MICROCHIP

Special Features
Oscillator Options

- XT oscillator is designed to accommodate standard frequency crystals: can use crystal oscillator or ceramic resonator.

- HS oscillator is used for high frequency crystals e.g. 20 MHz

S5401A Special Features Summary 4 MICROCHIP
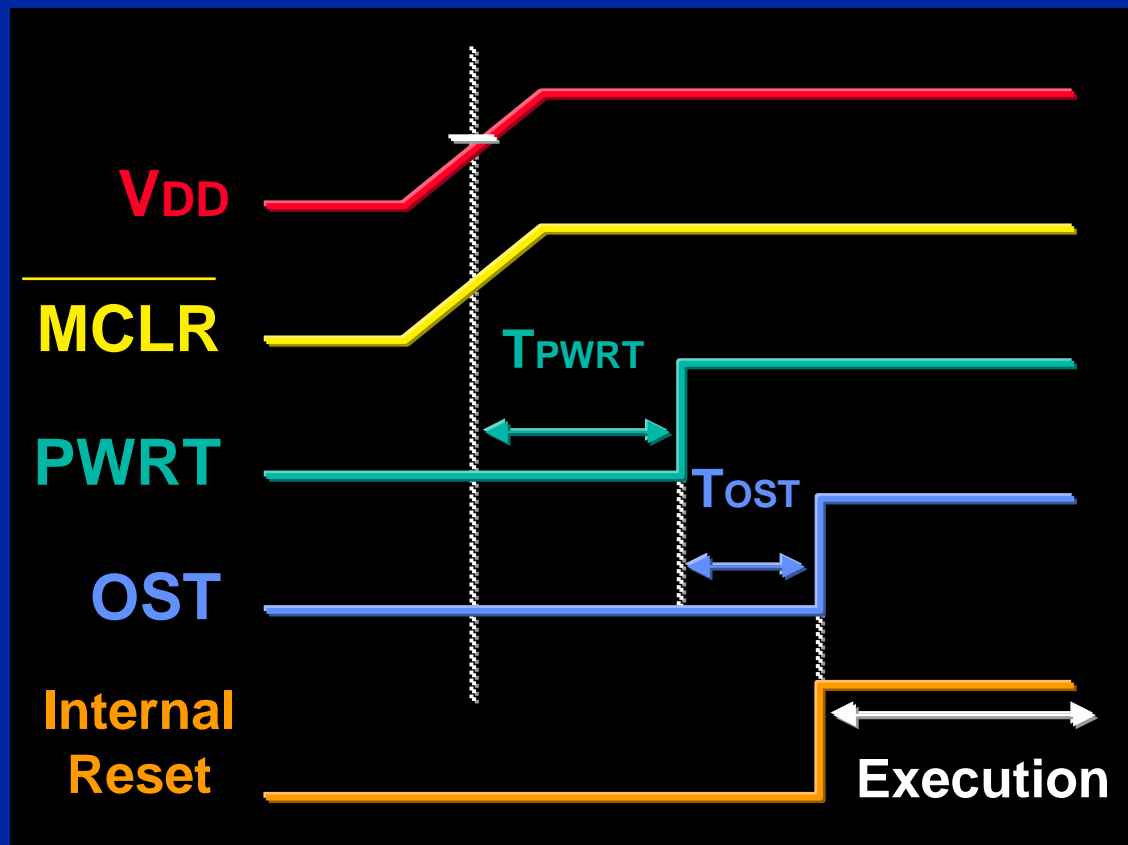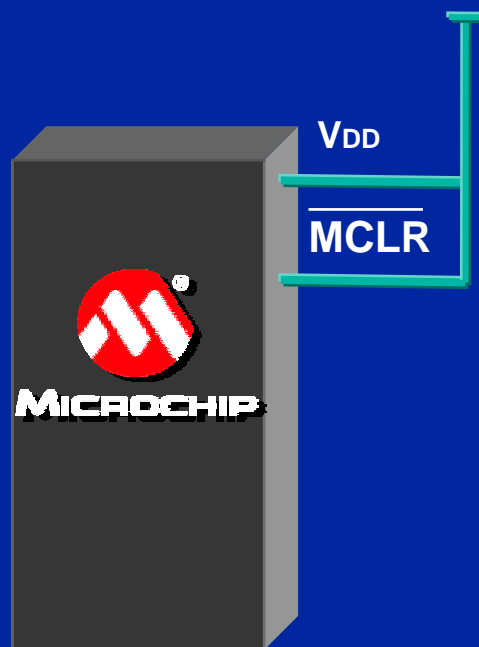
Special Features
Oscillator Options

- 4 or 5 Different Oscillator Options (Selectable via configuration bits including OTP devices)

- XT	Standard frequency crystal oscillator	100kHz - 4MHz
- HS	High frequency crystal oscillator	4MHz - 20MHz
- LP	Low frequency crystal oscillator	DC - 200kHz
- RC	External RC oscillator	DC - 4MHz
- INTRC	Internal RC oscillator	4MHz $\pm$ 5%

MICROCHIP

Special Features
Using POR / PWRT / OST

V_{DD}

$\overline{MCLR}$

V_{DD}

$\overline{MCLR}$

T_{PWRT}

PWRT

T_{OST}

OST

Internal Reset

Execution

S5401A   MICROCHIP

Special Features
Using POR / PWRT / OST

- **POR**: Eliminates the need for external reset circuitry (internal chip-reset is generated on V_{DD} rise detect: 1.2 - 2.0V range). (POR is always enabled).

- **PWRT**: Power-up timer protects against slow rising V_{DD} (holds device in reset for 72ms from POR). (POR is enabled by configuration bit).

- **OST**: Oscillator start-up timer adjusts for different crystal / resonator frequency (holds device in reset for additional 1024 OSC after POR & PWRT). (OST is always enabled in XT and HS modes).

- Internal reset available on some parts to gain an input pin.

Special Features
SLEEP Mode

- The processor can be put into a power-down mode by executing the SLEEP instruction

    - System oscillator is stopped

    - Processor status is maintained (static design)

    - Watchdog timer continues to run, if enabled

    - Minimal supply current is drawn - mostly due to leakage

    - SLEEP Current: 0.1 - 2.0µA typical

Special Features
SLEEP Mode

	Events that wake processor from sleep
MCLR	Master Clear Pin Asserted (pulled low)
WDT	Watchdog Timer Timeout
INT	INT Pin Interrupt
TMR1	Timer 1 Interrupt
ADC	A/D Conversion Complete Interrupt
CMP	Comparator Output Change Interrupt
CCP	Input Capture Event
PORTB	PORTB Interrupt on Change
SSP	Synchronous Serial Port (I2C™ Mode) Start/Stop Bit Detect Interrupt
PSP	Parallel Slave Port Read or Write

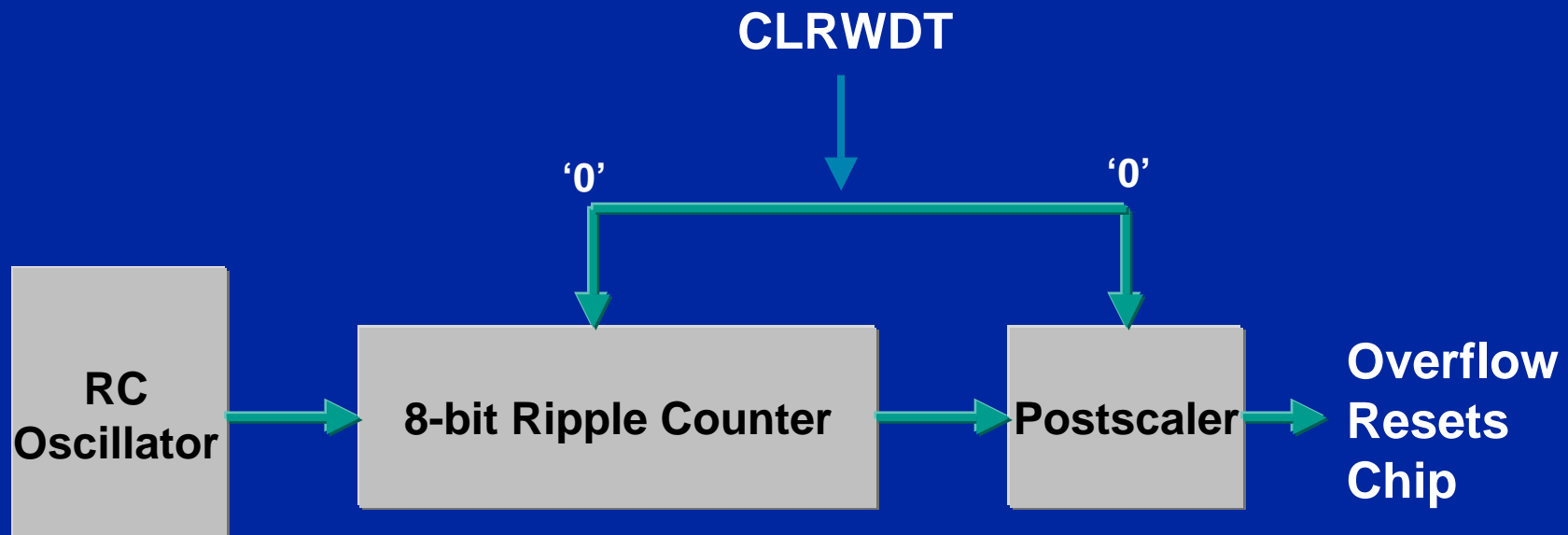MICROCHIP

Special Features
WDT: Watchdog Timer

- Helps recover from software malfunction

- WDT cannot be disabled by software

- Programmable timeout period: 18ms to 3.0s typical

- Operates in SLEEP; on time out, wakes up CPU
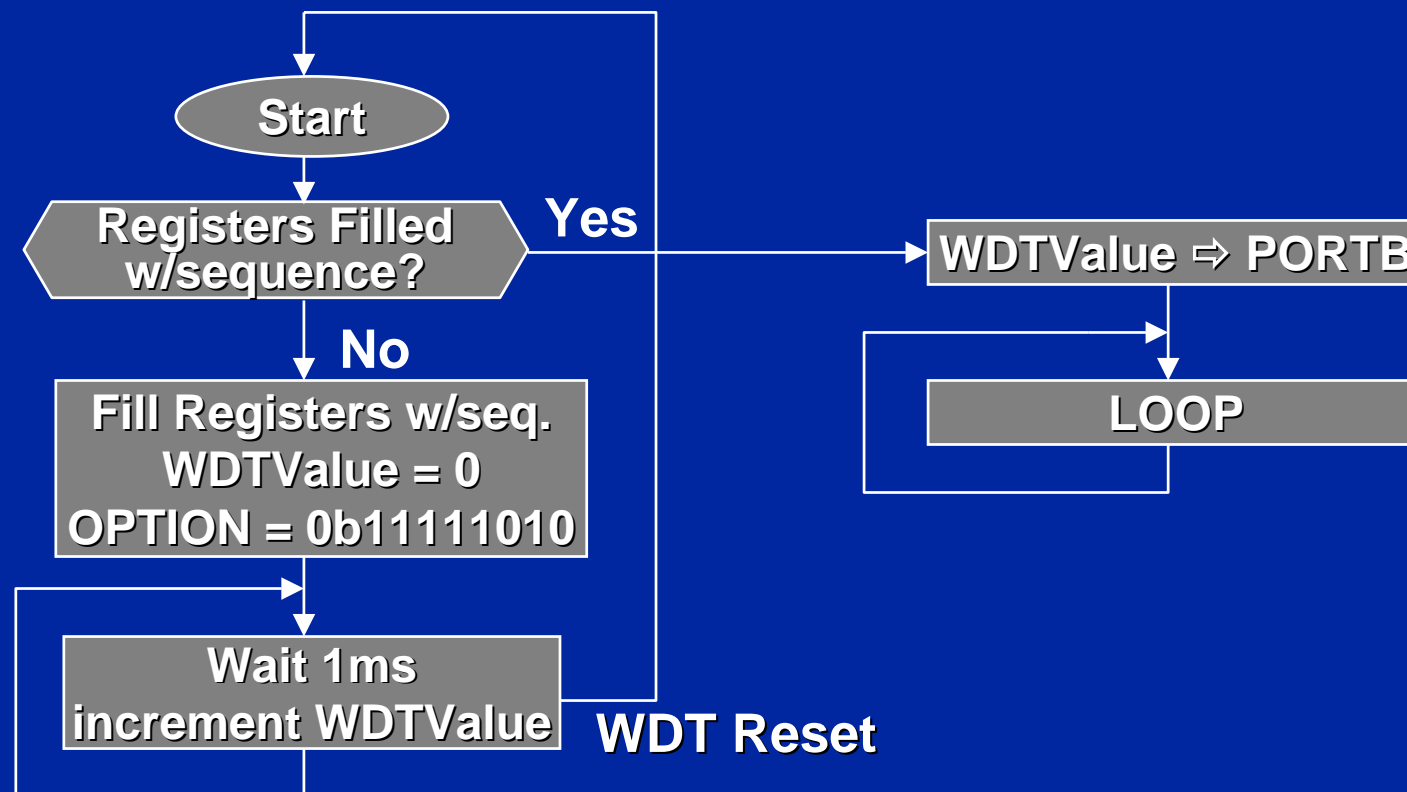
S5401A   MICROCHIP

Special Features
WDT: Watchdog Timer

CLRWDT

'0'   '0'

| RC Oscillator | → | 8-bit Ripple Counter | → | Postscaler | → | Overflow Resets Chip |

- **Uses its own free-running on-chip RC oscillator**
- **WDT is cleared by CLRWDT instruction**
- **WDT overflow resets the chip**

MICROCHIP

Special Features
WDT: Watchdog Timer

- Simple software routine executed at start-up informs user of value of the WDT time-out.

Start

Registers Filled w/sequence? — **Yes** → **WDTValue ⇨ PORTB**

No

Fill Registers w/seq.
WDTValue = 0
OPTION = 0b11111010

Wait 1ms
increment WDTValue

WDT Reset

LOOP

See TB004 for details.

Special Features
Standard BOD: Brown Out Detection

- While V_{DD} is below BV_{DD} (3.8V-4.2V), the PICmicro® will remain in Brown-Out Detect Reset.

- Once V_{DD} rises above BV_{DD}, the Power-Up Timer will keep the chip in reset an additional 72ms.

- If V_{DD} drops below BV_{DD} while the Power-Up Timer is running, the chip will reset the Power-Up Timer and return to Brown-out Detect Reset.

- Once again, when V_{DD} rises above BV_{DD}, the Power-Up Timer will keep the chip in reset an additional 72ms.
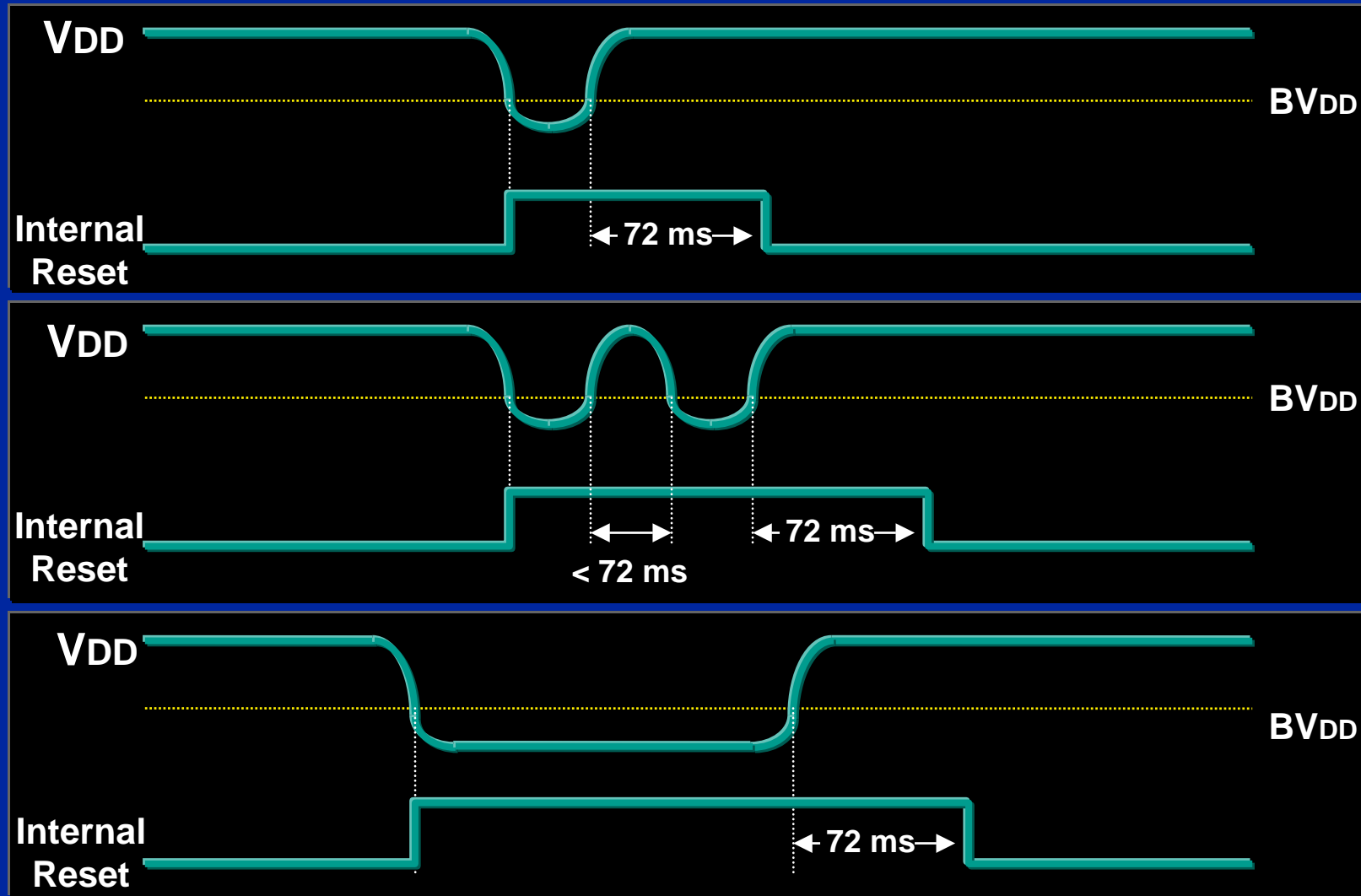
Special Features
Programmable BOD: Brown-out Detection

- Reset when V_{DD} falls below a programmed trip point

- Trip point fuse programmable to 2.5V, 2.7V, 4.2V and 4.5V

- Module current if enabled < 50μA

- Fast Response < 1μs

Special Features
BOD: Brown Out Detection

Special Features
Low-voltage Detection

- Low-voltage detect indicated by a flag or an interrupt when V_{DD} falls below a programmed trip point

- Software programmable to 1 of 11 voltages ranging from 1.8V to 4.5V, & external input

- Module current when enabled < 50μA

- Software module enable to save power

  - Strobe on for very short duty cycle

  - Very desirable in battery applications

MICROCHIP

Special Features
In-Circuit Serial Programming™

- What is ICSP™?
  - Enhanced In-System Programming technique
  - Programmed after assembly
  - Uses only two I/O pins to serially input and output data
  - Not intrusive on the normal operation of the PICmicro MCU

Special Features
In-Circuit Serial Programming

- Advantages of ICSP
  - Reduce time to market.
  - Reduce manufacturing cycles.
  - Reduce cost of field upgrades.
  - Calibrate and serialize system during manufacturing.
  - Add revision code, date code, manufacturing ID, or other code.
  - Reduce handling, important for DIE or fine lead packages.

Special Features
In-Circuit Serial Programming

- How do I connect to ICSP?
  - Only two I/O pins used for programming
    - I/O 1 is clock input
    - I/O 2 is data input/output
  - V_{PP} is program voltage
    - Driven to +13V
  - V_{DD} is device operating voltage
    - Driven to +5V during programming
    - Driven to V_{DD} (max) and V_{DD} (min) for verify

MCLR/V$_{PP}$ ——— **V$_{PP}$**

V$_{DD}$ ——— **V$_{DD}$**

V$_{SS}$ ——— **V$_{SS}$**

I/O 1 ←— **Clock**

I/O 2 ←→ **Data**

14-bit Core PICmicro