MICROCHIP

Introducing the dsPIC33CH Family of Dual-core Digital Signal Controllers

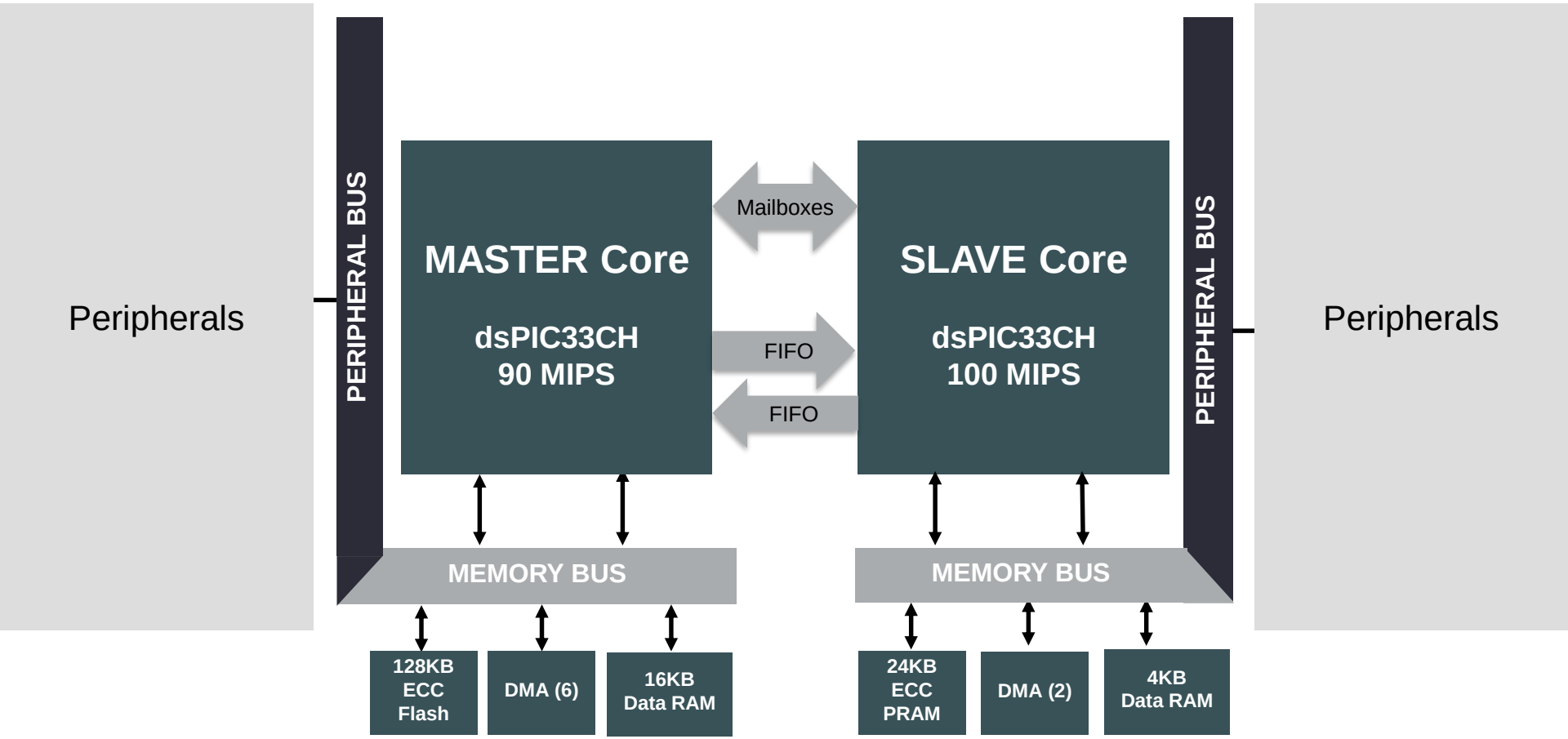
dsPIC33CH Family

Dual DSC Cores

Optimized for High-end Embedded Control

- Simplified Firmware Development with Dual Independent Cores
- Performance Optimized for Digital Power and Motor Control
- New Features / More Integration

dsPIC33CH128MP508 High Level Block Diagram



Operating Temperature: -40 to 125 °C

Example Applications

- **Digital Power**
  - Industrial: AC/DC & DC/DC power supplies
  - Automotive: Converters, chargers, inverters
  - Consumer: Wireless power
- **Motor Control**
  - Automotive: Pumps, fans
  - Industrial: Drones, robotics, tools
  - Consumer: Appliances, toys
- **High Performance Embedded**
  - Automotive: Electronic sensors
  - Industrial: Automation and control
  - Medical: Diagnostic equipment, monitors
  - IoT: Gateways and central processors

Example Application: Air Conditioner

Power Factor Correction

Fan

Compressor

MASTER Core

dsPIC33CH
90 MIPS

SLAVE Core

dsPIC33CH
100 MIPS

Simplified Firmware Development

Dual-Core Flexibility

- **Dual independent cores simplify development**
  - Enables multi-team software development
  - Separate time-critical control loops from house keeping, diagnostics and communication functions
  - Optimize each core's firmware separately
  - Eases debug, minimal code interaction between cores
  - Live Update supports real-time firmware updates

Design Separately, Integrate Seamlessly

Example Core Use Cases

	Slave Core	Master Core
Digital Power	Closes control loop in firmware by running latency-critical compensator algorithms	Runs PMBus stack and system-level functions
Motor Control	Provides speed and torque control by executing time-sensitive control algorithms	Runs functional safety routines, CAN-FD stack and other system-level functions
High Performance Embedded	Accelerates math intensive functions such as DSP filtering of sensor inputs	Facilitates reliability and fault tolerance for safety critical applications

Performance Optimized

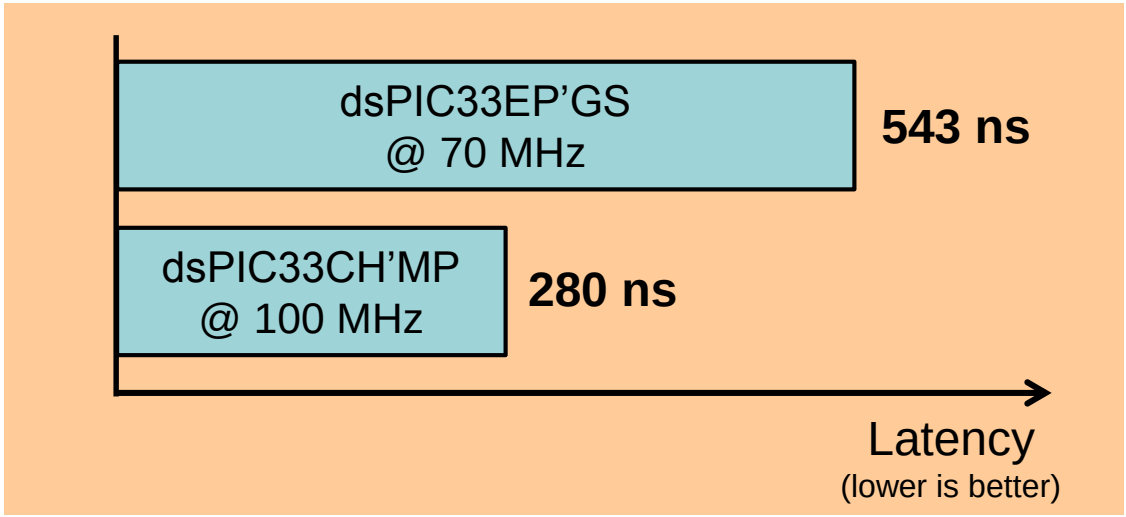
Value Of Higher CPU Performance

- **Digital Power**
  - Higher switching frequencies facilitate higher power densities
  - Adaptive algorithms provide improved efficiency over widely varying load conditions
  - Non-linear and predictive algorithms improve dynamic response to transient conditions
- **Motor Control**
  - Multiple motors including a PFC power stage controlled with a single DSC reduces costs
  - Greater than 100K RPM needed for some applications
  - High torque at near zero RPM (example: power tools)
- **High Performance Embedded**
  - More sophisticated real-time filtering to improve sensors

Digital Power Supply: Faster Algorithm Execution

Compensator Calculations Implemented in Firmware

- 3-Pole 3-Zero compensator algorithm commonly used
- New dsPIC33CH core offers nearly 2x performance increase



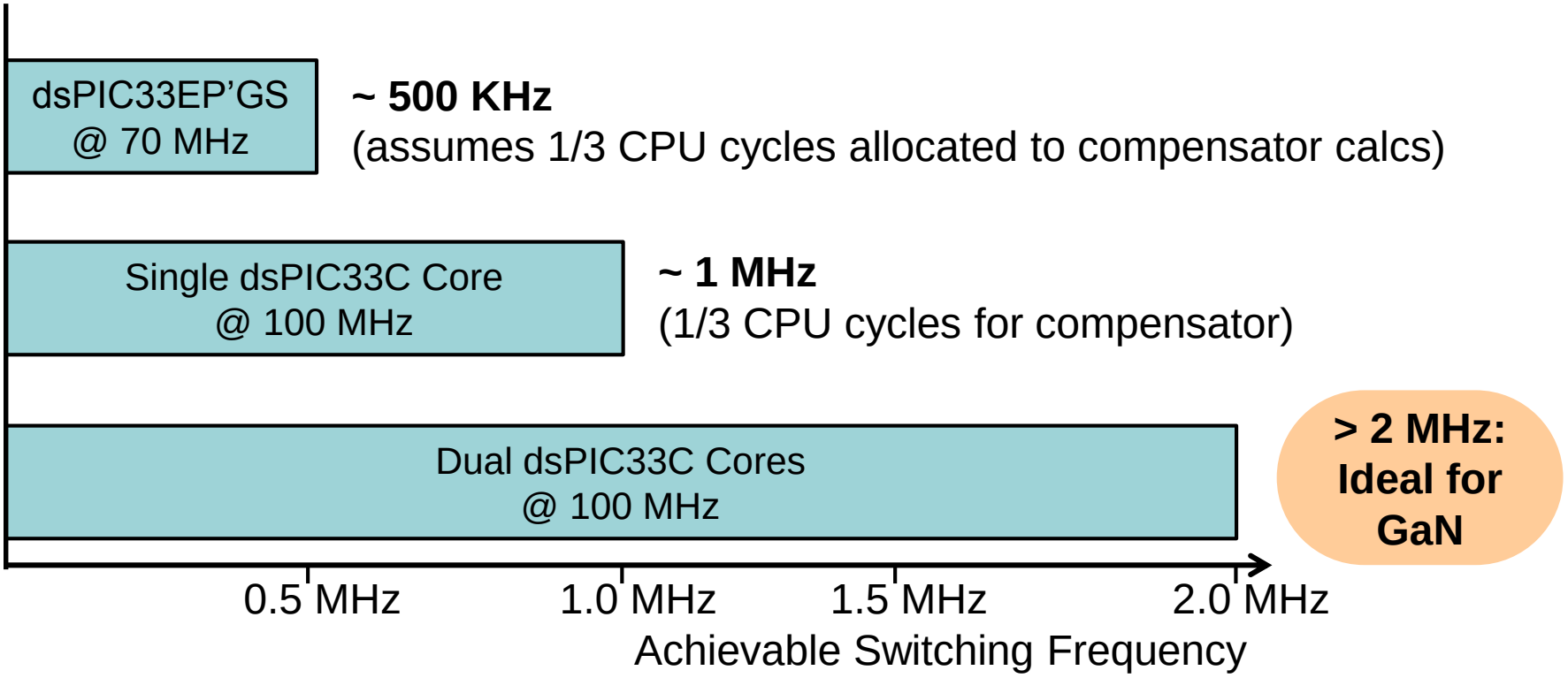
dsPIC33C Core Performance Enhancements:

- Context-selected accumulators & status registers
- New instructions
- 100 MHz clock

Digital Power Supply: Higher Switching Frequency

Advantages of higher power supply switching frequencies

- Increased power density (physically smaller supplies or more power per inch^3)
- Smaller lower-cost components (smaller transformers, inductors & capacitors)
- Improved transient response

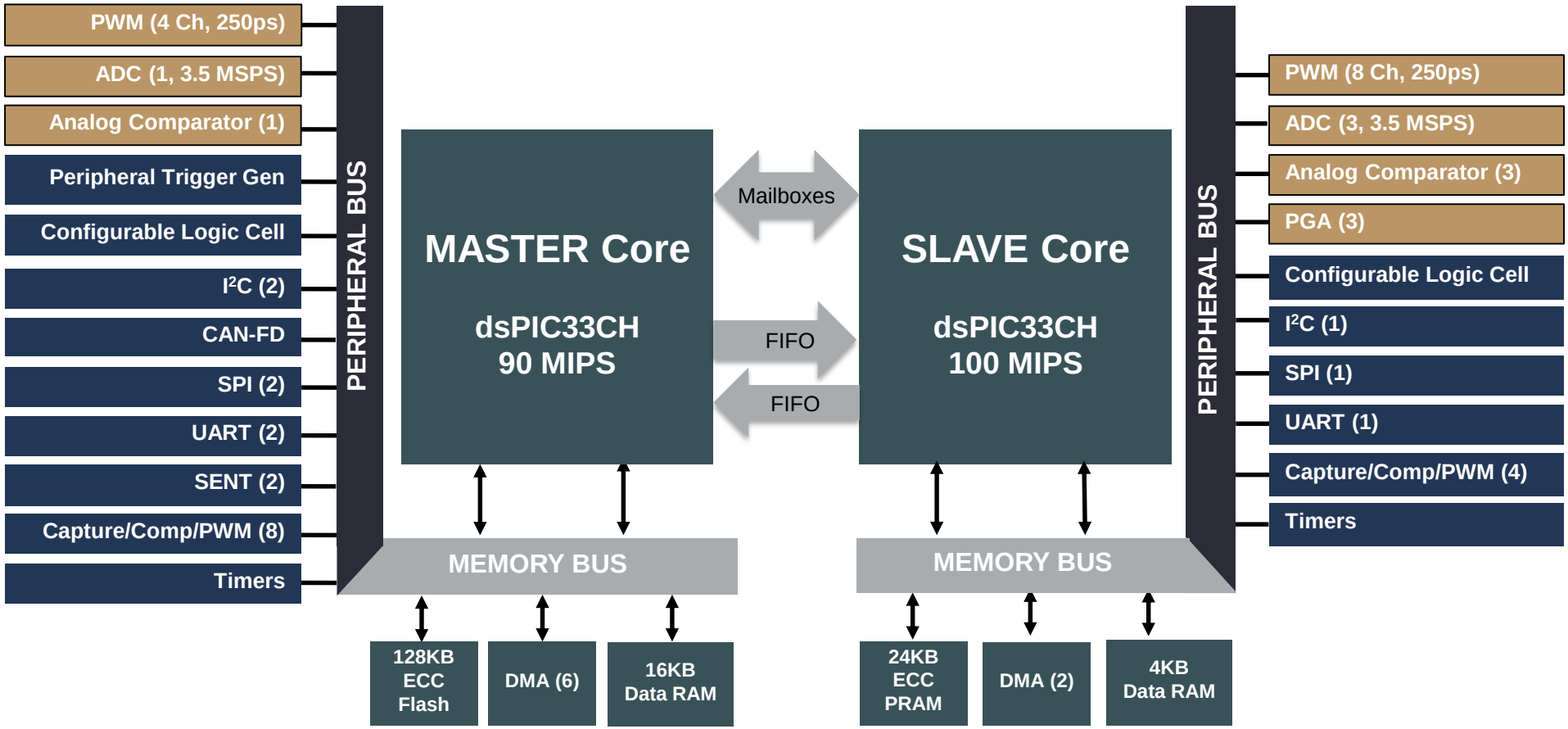


New Features / More Integration

New Features / More Integration

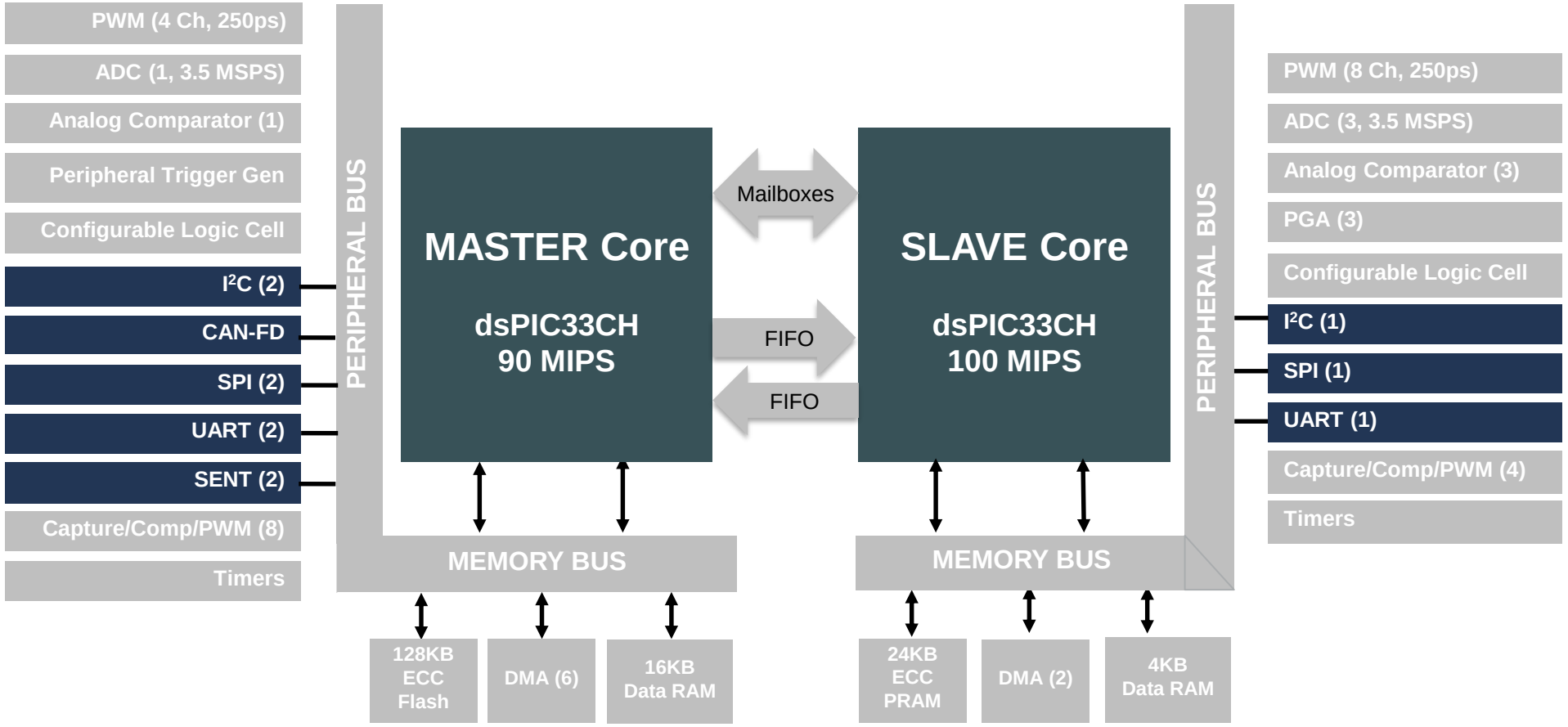
- **Unprecedented integration in 5x5mm package**
  - Dual cores and dual peripheral sets facilitate robust systems and improve functional safety
  - First dsPIC33 with CAN-FD
  - Maximum analog integration
  - PWM with 250ps resolution and advanced features

dsPIC33CH128MP508 Block Diagram



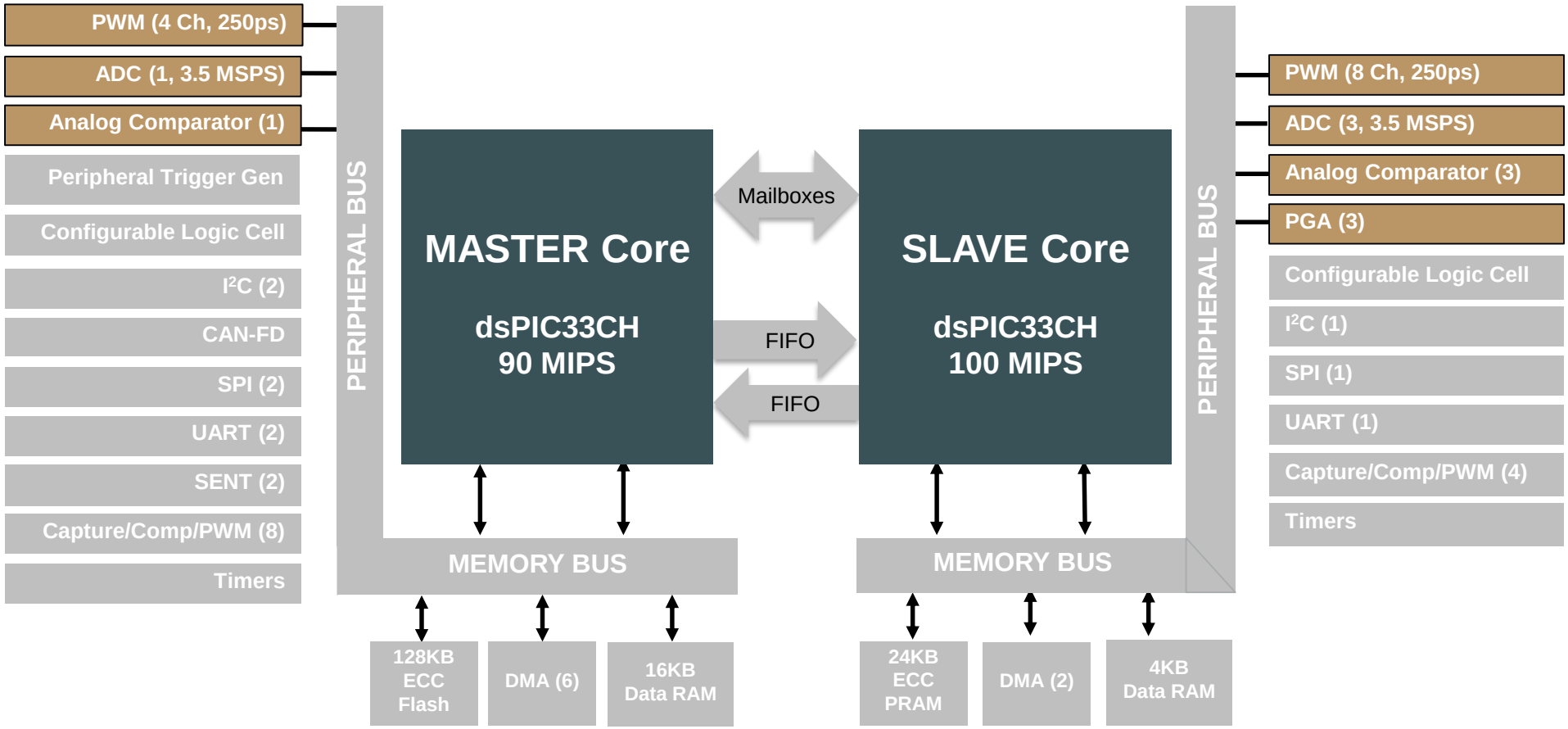
Communication Peripherals

Master equipped with more communication peripherals



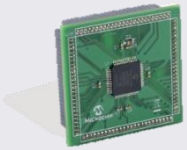
Analog Peripherals and PWMs

Slave equipped with more analog peripherals and PWMs



Development Tools

dsPIC33CH Development Boards

dsPIC33CH Curiosity Development Board (Part Number DM330028)		Includes digital power features and click board™ interfaces
Motor Control Plug-In Module (Part Number MA330039)	 	Plugs into Motor Control Development Boards: MCLV-2, MCHV-2/3 and Low Voltage Motor Control Bundle
General Purpose Plug-in Module (Part Number MA330040)	 	Plugs into Explorer 16/32 Development Board

dsPIC33CH Family Summary

- **Simplified Firmware Development with Dual Cores**
  - Flexibility to separate time-critical closed-loop feedback control from system management and communication software

- **Performance Optimized for Digital Power & Motor Control**
  - Enables advanced algorithms to improve efficiency and responsiveness
  - Performance to control two motors running at 100K RPM

- **New Features / More Integration**
  - Reduces system cost & size and provides for Live Updates

Design Separately, Integrate Seamlessly

www.microchip.com/dsPIC33CH

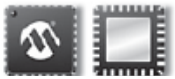
Thank You

Backup Materials

dsPIC33CH Packages

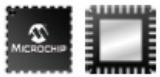
Pin-outs optimized for analog performance

Package Types



28-lead uQFN (2N)
6 x 6 x 0.5 mm
with stress relief pads
(Lead Pitch: 0.65 mm)

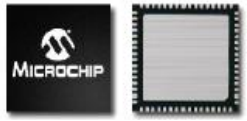
28-lead SSOP (SS)
10.2 x 5.3 x 2 mm
(Lead Pitch: 0.65 mm)



36-lead uQFN (M5)
5 x 5 x 0.5 mm
with stress relief pads
(Lead Pitch: 0.4 mm)

48-lead uQFN (M4)
6 x 6 x 0.5 mm
(Lead Pitch: 0.4 mm)

48-lead TQFP (PT)
7 x 7 x 1 mm
(Lead Pitch: 0.5 mm)



64-lead QFN (MR)
9 x 9 x 0.5 mm
(Lead Pitch: 0.5 mm)

64-lead TQFP (PT)
10 x 10 x 1 mm
(Lead Pitch: 0.5 mm)

80-lead TQFP (PT)
12 x 12 x 1 mm
(Lead Pitch: 0.5 mm)

28 to 80 pins

dsPIC33CH Family Product Variants

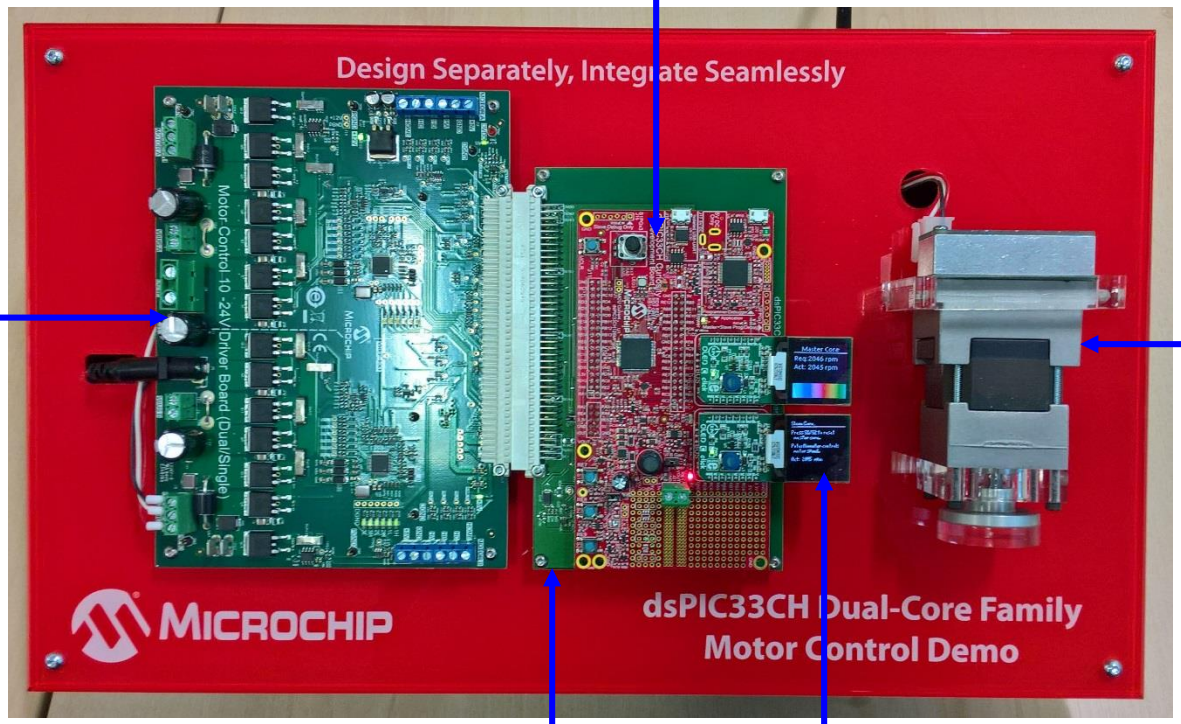
Package	Part Number	Flash
80-pin TQFP (12 x 12 mm) – PT	dsPIC33CH128MP508 dsPIC33CH128MP208 dsPIC33CH64MP508 dsPIC33CH64MP208	128 KB 64 KB
64-pin QFN (9 x 9 mm) - MR 64-pin TQFP (10 x 10 mm) - PT	dsPIC33CH128MP506 dsPIC33CH128MP206 dsPIC33CH64MP506 dsPIC33CH64MP206	128 KB 64 KB
48-pin uQFN (6 x 6 mm) – M4 48-pin TQFP (7 x 7 mm) - PT	dsPIC33CH128MP505 dsPIC33CH128MP205 dsPIC33CH64MP505 dsPIC33CH64MP205	128 KB 64 KB
36-pin uQFN (5 x 5 mm) – M5	dsPIC33CH128MP503 dsPIC33CH128MP203 dsPIC33CH64MP503 dsPIC33CH64MP203	128 KB 64 KB
28-pin SSOP (10.2 x 5.3 mm) - SS 28-pin uQFN (6 x 6 mm) – 2N	dsPIC33CH128MP502 dsPIC33CH128MP202 dsPIC33CH64MP502 dsPIC33CH64MP202	128 KB 64 KB

Prices start at less than $2.00 in high volume
Available June 25th
Tape & reel options available

Embargo until June 25, 2018

dsPIC33CH Demo Hardware

dsPIC33CH Curiosity Development Board (DM330028)



Motor Control Drive Board - sold as part of the Low Voltage Motor Control Dev Bundle (DV330100)

Hurst 24-Volt 3-phase Brushless DC motor with Hall-Effect sensors (AC300020)

Custom adapter board (not for sale, Gerber files available)

mikroElektronika OLED Click Boards™ (MIKROE-1585)

Glossary

- 3P3Z – Three pole three zero (a type of compensator used in digital power)
- Compensator – Closed-loop feedback filter controlling power conversion
- Dual-core – two independent digital signal controllers
- DSC – Digital Signal Controller
- FIFO – First in first out hardware queue for efficient movement of data values
- FOC – Field Oriented Control, control method for BLDC & PMSM motors
- IPL – Interrupt priority level
- ISR – Interrupt service routine
- MSPS – Mega samples per second (ADC conversion rate)
- PFC – Power factor correction to cancel inductive or capacitive effects of the load
- PGA – Programmable Gain Amplifier (analog amplifier)
- Powertrain / Plant – Transformers, inductors, capacitors and switching devices that implement a power conversion stage
- PRAM – RAM memory from which the slave core fetches program instructions