

XMC4000 Family

One Microcontroller Platform
Countless Solutions



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XMC4000 Family

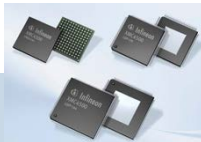
why it will be successful



Combination of Infineon key IP and know-how with all the benefits of an industry standard core

1st

µC Know-how



- Long-term Automotive and Industrial Microcontroller experience (> 25 years)
- Innovative Application Specific Peripherals
- Highly configurable and flexible set-up
- Complete portfolio from 8-bit up to 32-bit

2nd

Quality and Reliability



- Fast, safe & accurate peripherals in mass production
- Extended Temperature Range on selected products ($T_a = 125^{\circ}\text{C}$)
- Long product life time (> 15 years)

3rd

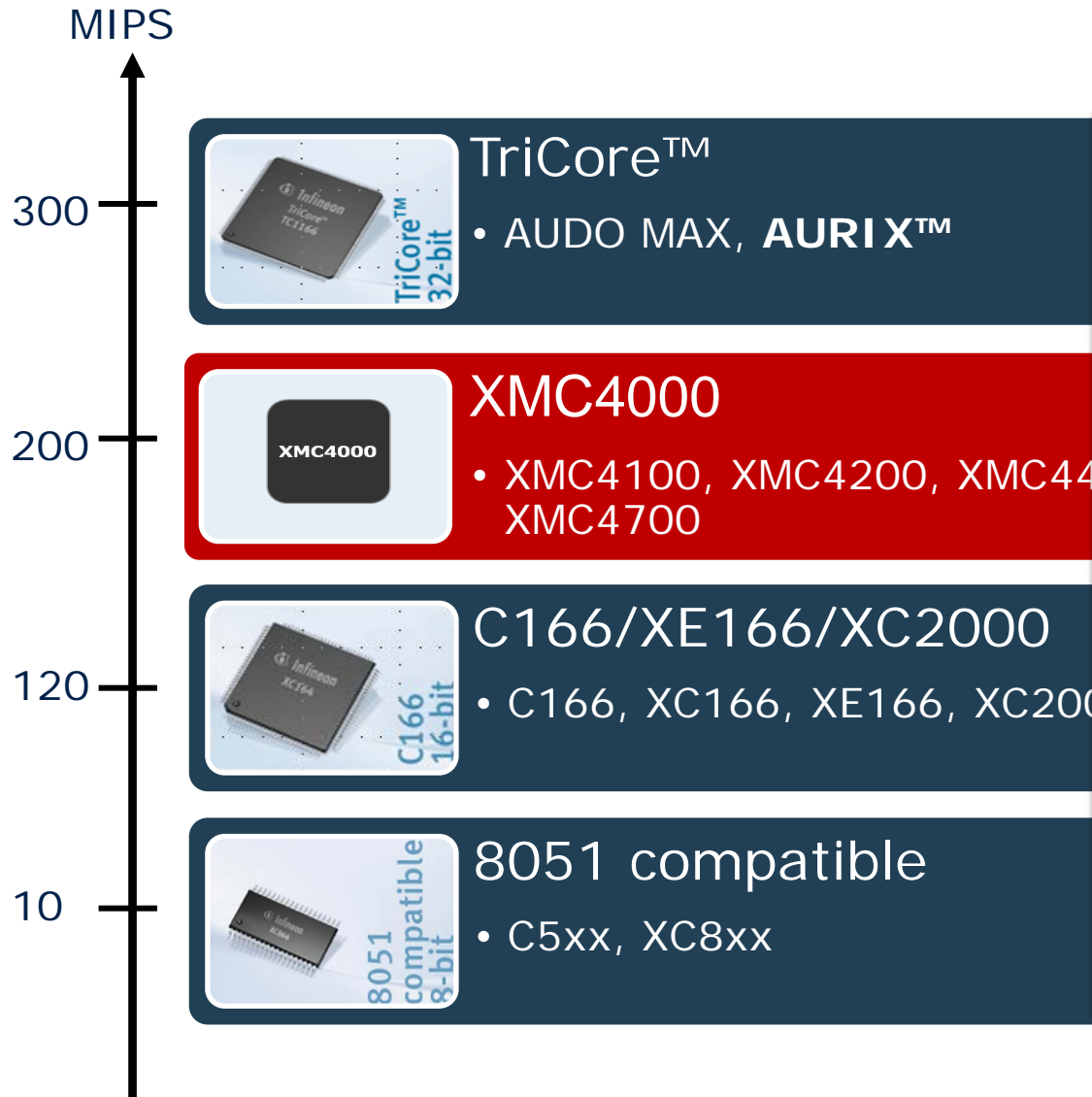
SW Tool DAVE™ 3



- DAVE™ 3 with enhanced functionality
- IDE & Auto-code generation making powerful hardware easy to use
- Open to 3rd parties
- Free-Of-Charge

XMC4000 Family

Extension of todays Portfolio



XMC4000 ...

- ...benefits of an industrial standard ARM® Cortex core
- ... brings higher Performance than C166
- ... offers additional Communication Interfaces
- ...offers brand new peripherals
- ... is an extension of the existing portfolio

Target Applications

some examples



Renewable Energy

- Solar Plants
- Windmills



Logistics

- Conveyor Belts
- Lifting Ramps
- Lift Trucks
- Barcode Readers
- Warehouse Management Systems



Factory Automation

- Machine Control
- Robotics
- Sense & Control



Building Automation

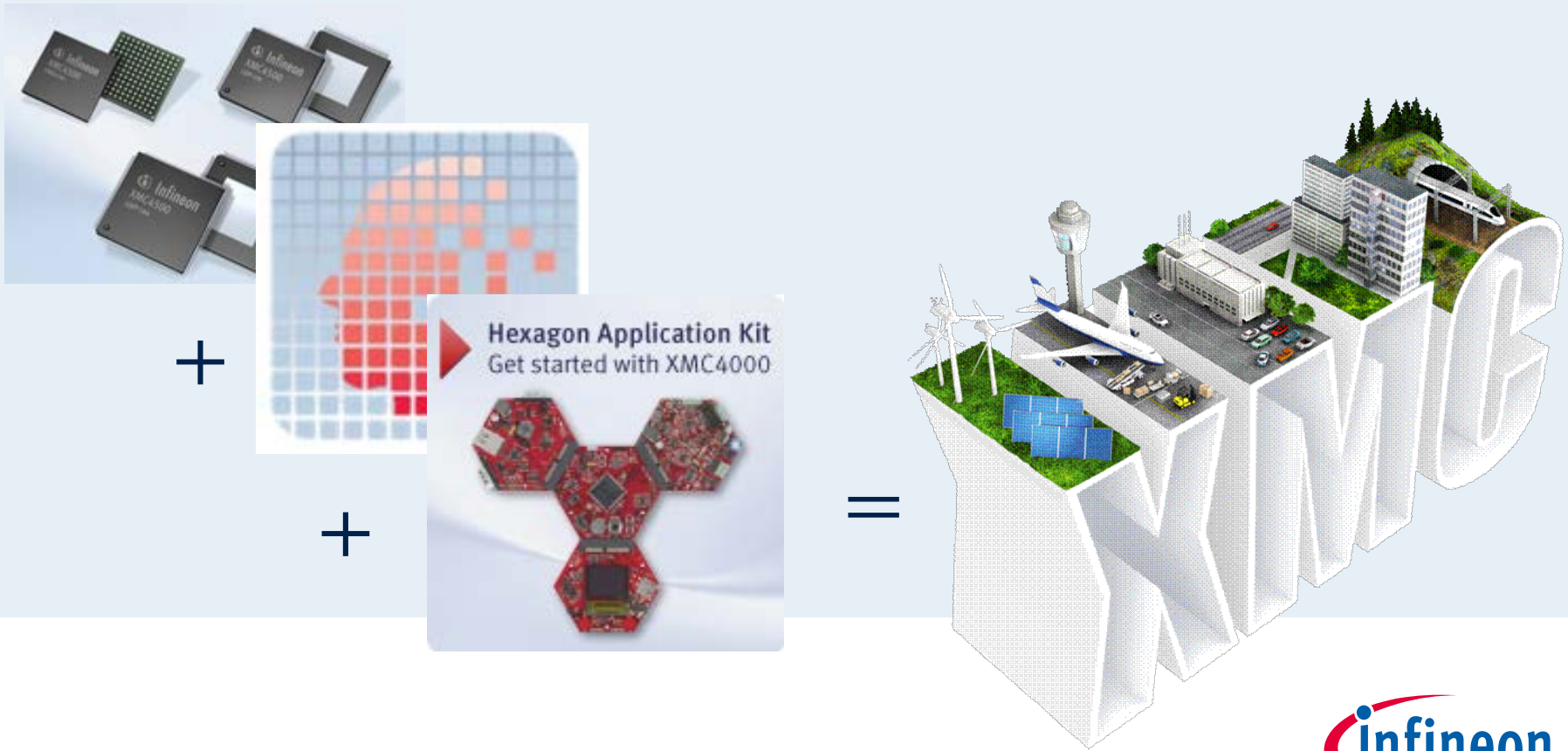
- Lighting
- Blind Control
- Elevators
- Door/Gate Control
- Access Control
- HVAC Systems



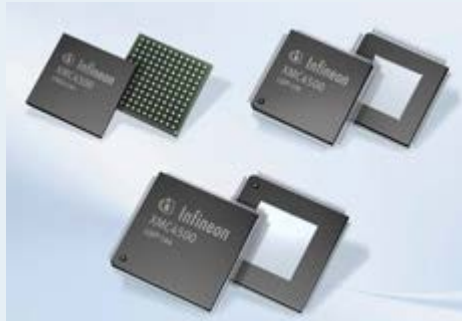
Transportation

- Agricultural Vehicle
- Construction Vehicle
- Municipal Vehicle
- Trains
- Public Transportation

The Bundle



The Hardware



XMC4000 Key Family Members

Strong Portfolio, Maximized Scalability



		XMC4700*	XMC4500	XMC4400	XMC4200	XMC4100
System Performance	Core	ARM® Cortex™-M4				
	CPU frequency (at 125°C)	180 MHz	120 MHz	120 MHz	80 MHz	80 MHz
	Co-proc	Floating Point Unit				
	Flash size up to	2.5 MB	1 MB	512 kB	256 kB	128 kB
	RAM size	512 kB	160 kB	80 kB	40 kB	20 kB
	Cache	6 kB	4 kB	4 kB	4 kB	4 kB

- ARM® Cortex™-M4; Thumb-2 instruction set with DSP extensions
- MPU & ECC on Flash plus Parity Check on SRAM
- Floating Point Unit (FPU) in all family members
- Cached architecture
- Dhrystone 2.1 benchmark: >1.25 DMIPS/MHz

XMC4000 Key Family Members

Strong Portfolio, Maximized Scalability



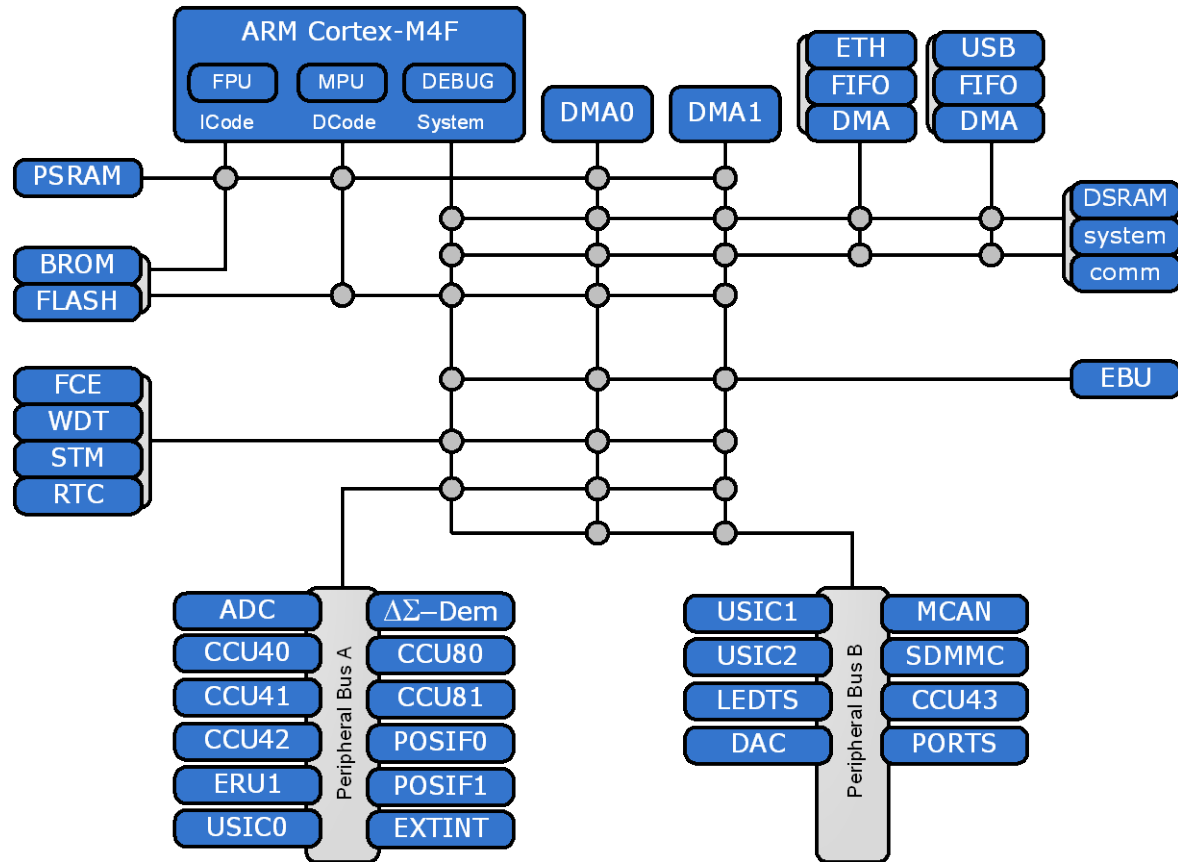
		XMC4700*	XMC4500	XMC4400	XMC4200	XMC4100
Timers	POSIF	2x	2x	2x	1x	1x
	CCU4 (4ch)	4x	4x	4x	2x	2x
	CCU8 (4ch)	2x	2x	2x	1x	1x
	High-resolution PWM (150ps)			1x	1x	1x
Communication	IEEE 1588 Ethernet MAC	2x	1x	1x		
	USB	HS OTG	FS OTG	FS OTG	FS DEV	FS DEV
	SD/MMC	✓	✓			
	Serial channels (UART, SPI, I ² C, I ² S)	6x	6x	4x	4x	4x
	Ext. Memory I/F	✓	✓			
	CAN	3x	3x	2x	1x	1x
	Touch Button	✓	✓	✓	✓	✓
Signal Gen	ADC 12-bit	4x	4x	4x	2x	2x
	Delta/Sigma Demodulator	4x	4x	4x		
	DAC 12-bit	2x	2x	2x	2x	2x

XMC4000

Optimized for Best-in-class Real-time Control



- DSP instructions
- Floating Point Unit (single precision)
- Bus matrix with separate busses for code, data, system
- Fast interrupt response time and task switching
- Intelligent peripherals for CPU offloading
- DMA for ETH & USB



**Standard core coupled with specialized peripherals.
SW-configurable to application-specific requirements**

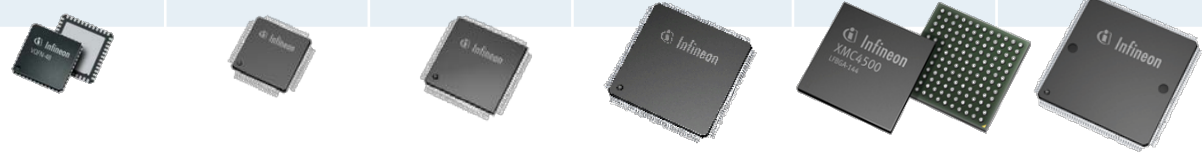
XMC4000 scalability

5 Product Series # 8 Packages # 64kB to 2.5MB Flash



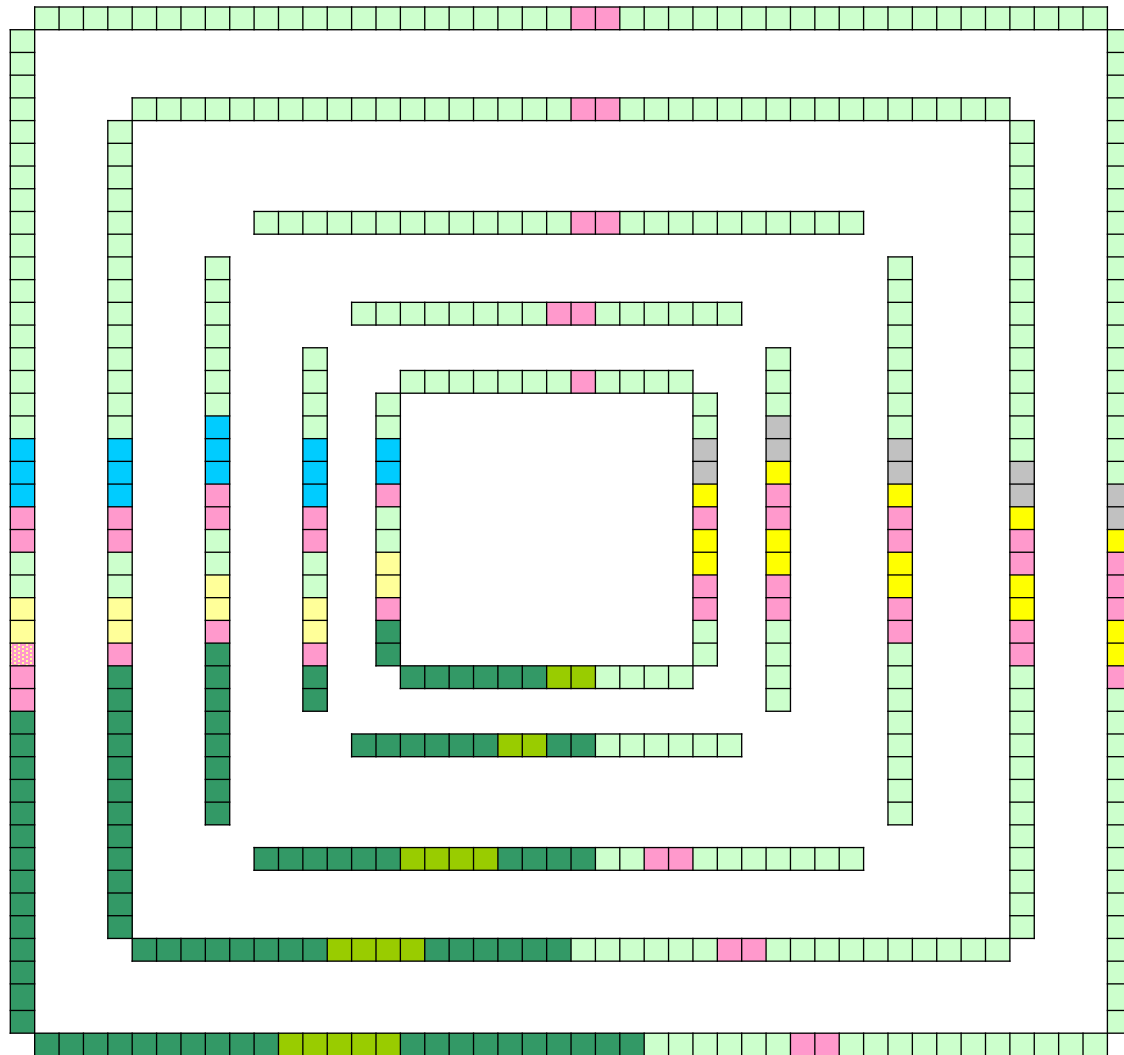
Clock	Flash	SRAM							
180 MHz	2.5 MB	512 kB							XMC4700 *
120 MHz	1 MB	160 kB					XMC4500	XMC4500	XMC4700 *
120 MHz	768 kB	160 kB				XMC4500			
120 MHz	512 kB	80 kB				XMC4400			
120 MHz	256 kB	80 kB			XMC4400				
80 MHz	256 kB	40 kB			XMC4200				
80 MHz	128 kB	20 kB		XMC4200	XMC4100				
80 MHz	64 kB	20 kB		XMC4100					
			VQFN48 (7x7)	LQFP64 (12x12) LFBGA64 * (5x5)	LQFP100 (16x16)	LQFP144 (22x22)		LFBGA144 (10x10)	LQFP176 (26x26) LFBGA225 (13x13)

* Under definition



XMC4000 scalability

Scalable Port Mapping across Family



■ Ease layout generation for PCB variants with placement options

- Analog
- Analog Ref.
- Debug
- USB
- XTAL, RESET
- Supply

The Software



DAVE™ 3

Free IDE plus Code Generator

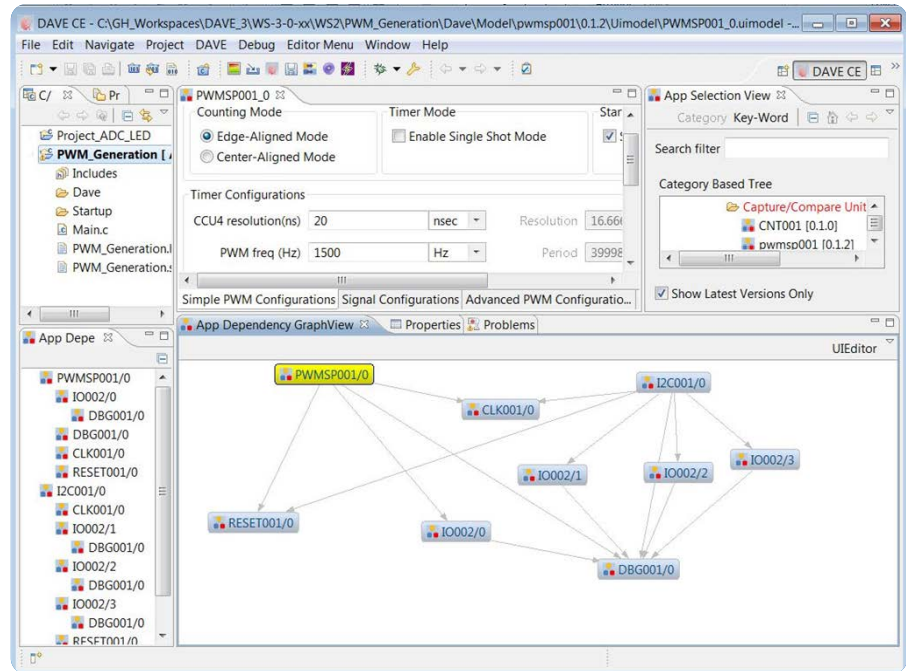
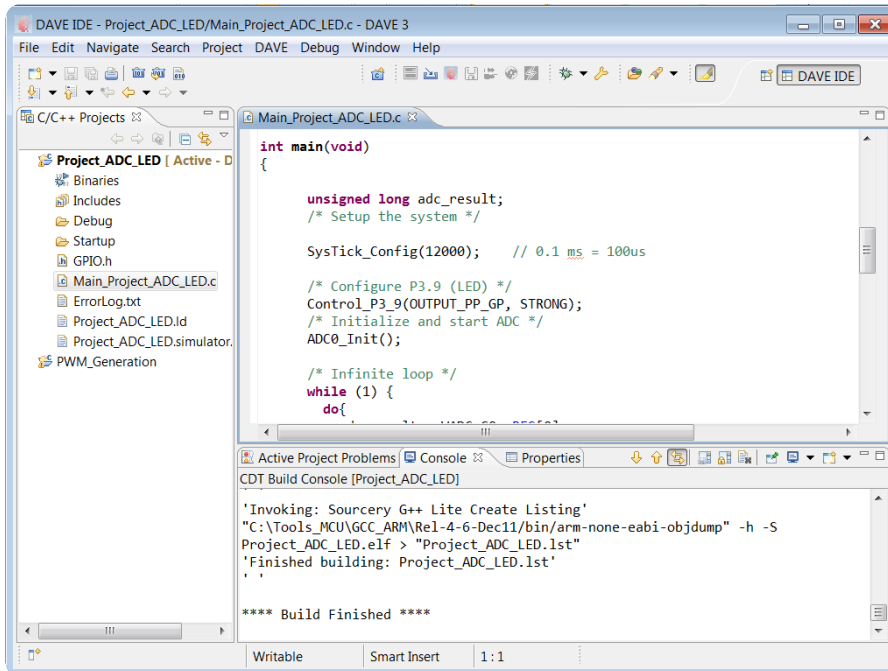


Integrated Development Environment (IDE)

- Eclipse based
- Free GNU Compiler, Debugger, Flash Loader
- Free data visualization utilities
- Open for 3rd party tools (Compiler, Debugger) and Software (Operating Systems, Stacks) as plug-in

Auto-code generator

- Easy selection of peripheral and application oriented DAVE™ Apps
- Configuration via graphical user interface
- Generated code can be used via well documented APIs (like a library)
- Extendable by user or 3rd party Apps



DAVE™ 3 Component based Programming Example PWM

Generate C code project

6

Choose the desired Apps from library

1

Configure the Apps as needed

5

Define constraints e.g. on IO pins

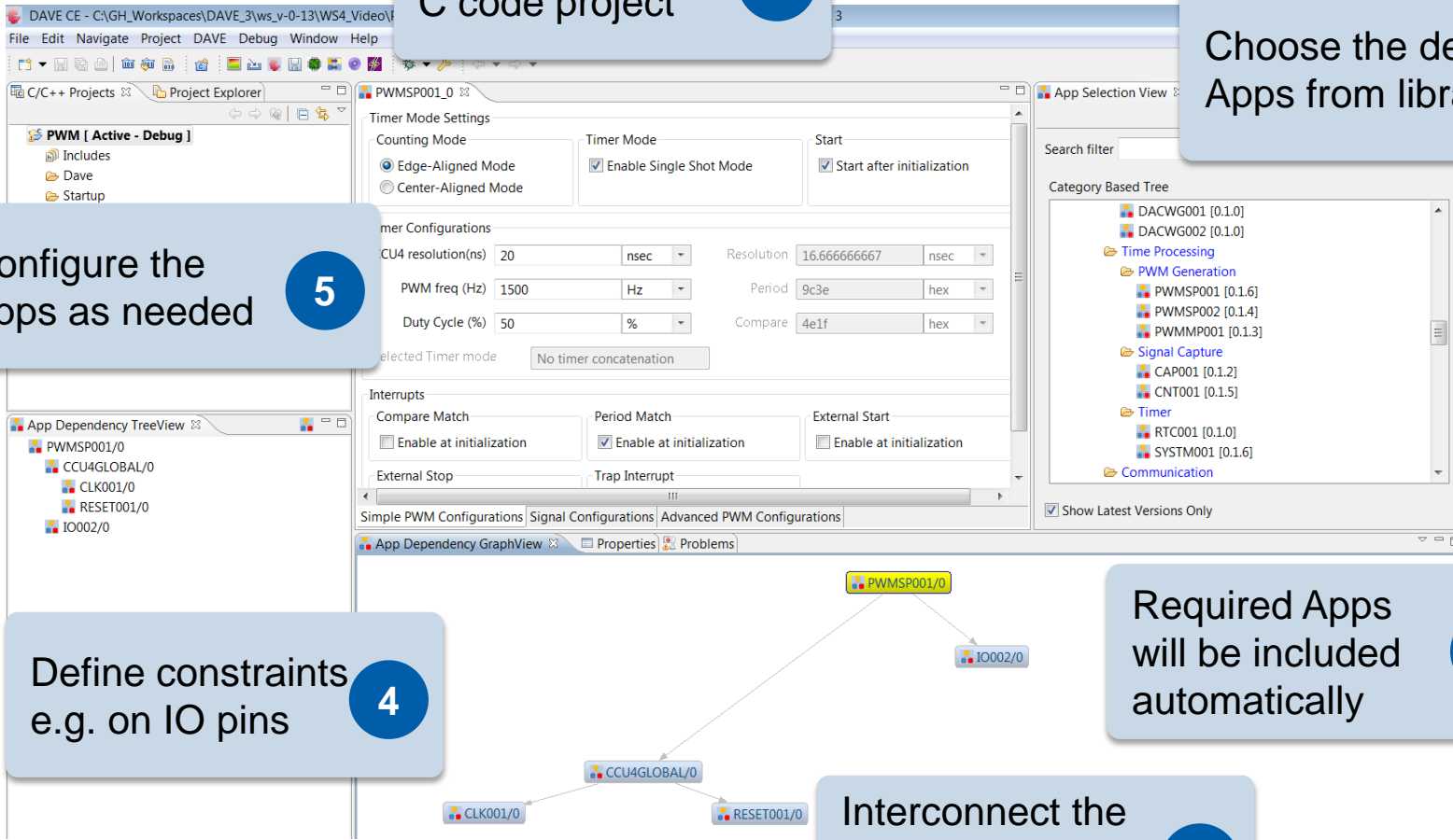
4

Required Apps will be included automatically

2

Interconnect the required Apps with signals

3



DAVE™ 3 Component based Programming

Example PWM



The screenshot shows the DAVE IDE interface. On the left, the Project Explorer displays the project structure for PWMSP001_0, including folders for Includes, Dave, Generated, inc, and src. The src folder contains sub-folders for CCU4GLOBAL, CLK001, DAVESupport, IO002, LIBS, PWMSP001, and RESET001. The PWMSP001 folder contains files PWMSP001_Conf.c and PWMSP001.c. A yellow box labeled "Generated Code" points to the PWMSP001 folder.

The main editor window shows the source code for Main.c. The code includes headers for XMC4500.h and DAVE3.h, and defines a main function that initializes the DAVE APIs and sets the PWM duty cycle. A yellow box labeled "API to control the PWM signal" points to the `PwMSP001_SetDutyCycle` function call.

```
#include <XMC4500.h> //SFR declarations of the selected device
#include <DAVE3.h> //Declarations from DAVE3 Code Generation

int main(void)
{
    status_t status; // Declaration of return variable for DAVE3 APIs

    DAVE_Init(); // Initialization of DAVE Apps

    status = PwMSP001_SetDutyCycle(&PwMSP001_Handle0, 79);

    while(1)
    {
```

Service Apps

- DMA
- NVIC
- I/O
- EBU
- Flash
- CRC
- Debug Log
- CMSIS RTOS
- ...

Peripherals Specific Apps

Basic Applications

- Timer
- CAN
- USIC (I2S, I2C, UART, SPI)
- Simple ADC
- Complex ADC
- Delta Sigma Demodulator
- DAC
- Resolver
- PWM
- Capture
- Counter
- POSIF
- Ethernet
- Touch
- ...

Middle Ware

- USB stack, class drivers
- TCP/IP stack plus HTTP, FTP, SNMP
- SD/MMC, file system,...
- GUI lib plus driver for intelligent LCD
- FOC motor control
- Touch / HMI
- Modbus
- ...

Complete Solutions

- Web server
- Motor control
- HMI Demos
- ...

The ECO System



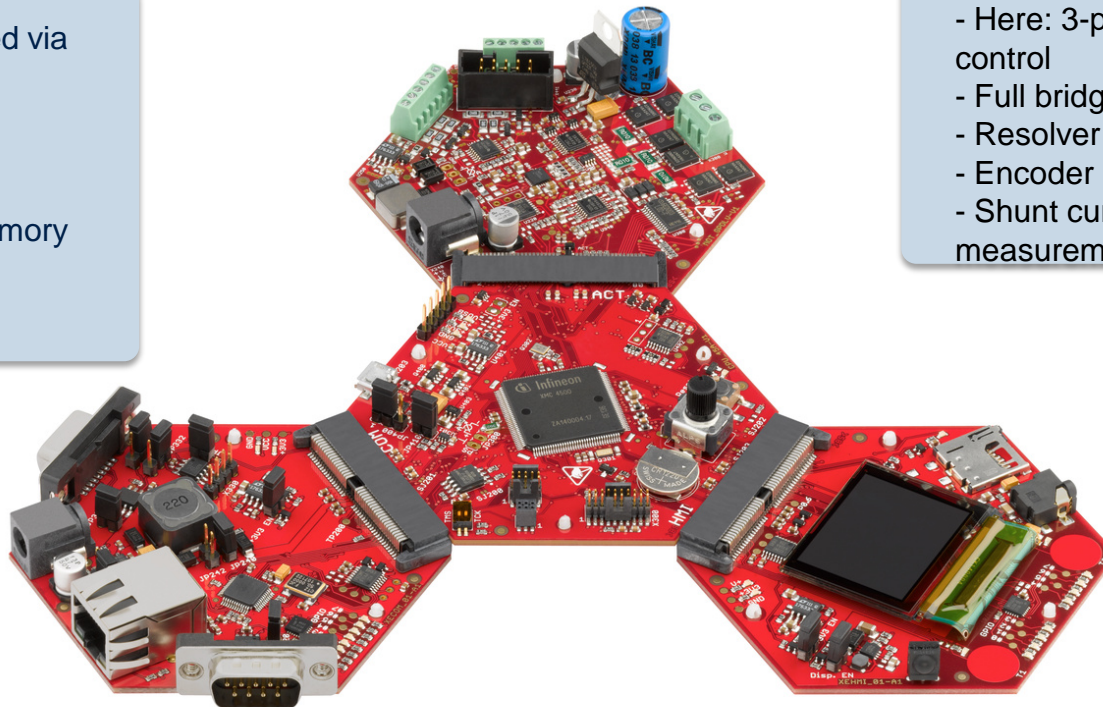
Hexagon Application Kit

CPU- and Satellite Boards



CPU-Board

- XMC4500 MCU
- Stand-alone powered via USB
- 2 Cortex debug connectors
- USB OTG
- Quad-SPI Flash memory
- RTC battery
- COM / ACT / HMI connector



ACT-Satellite

- Actuator board
- Here: 3-phase motor control
- Full bridge power stage
- Resolver circuit
- Encoder interface
- Shunt current measurement

COM-Satellite

- Communication interface
- Ethernet (RMII)
- MultiCAN
- RS485

HMI-Satellite

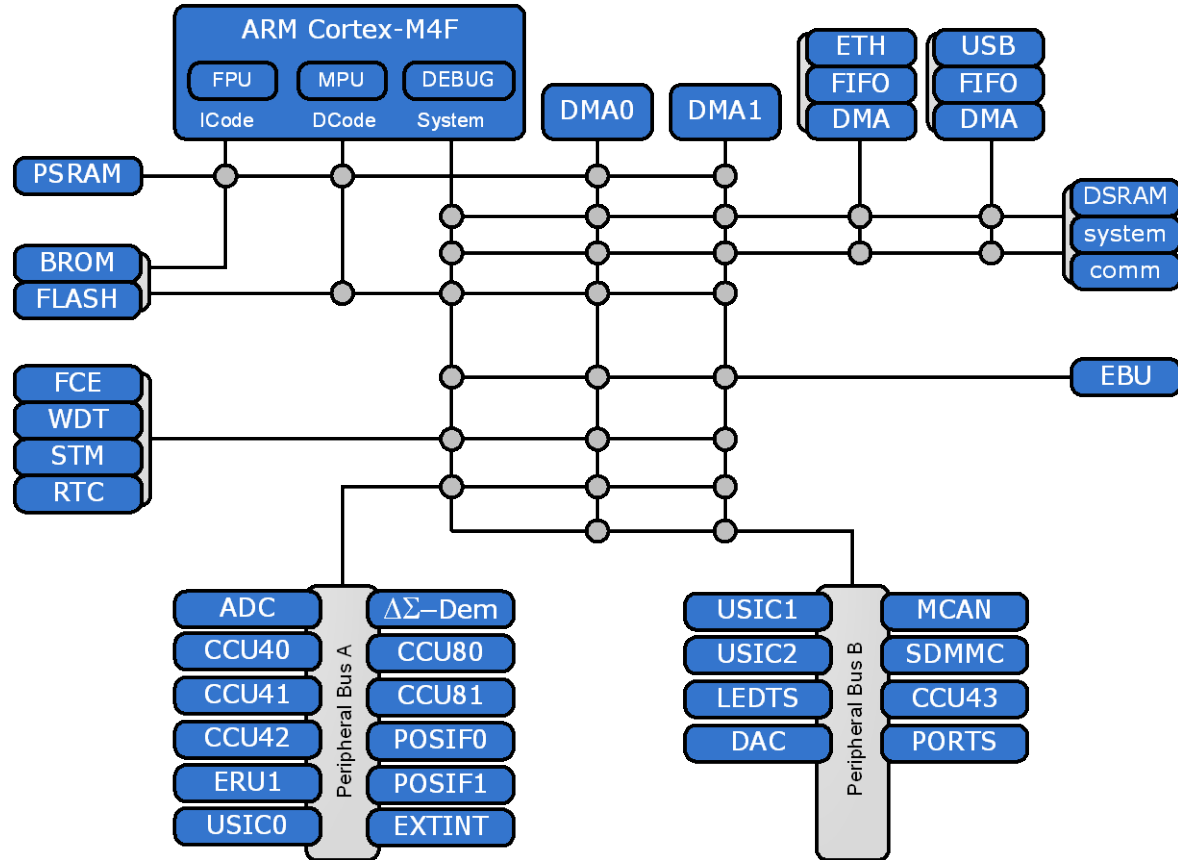
- Color OLED (160 x 128)
- SD/MMC card IF
- Audio encoder (I2S)
- Touch sense buttons

XMC4000 Family to keep in mind

Key Features:

- ARM® Cortex™-M4
- **FPU** (Floating Point Unit)
- **MPU** (Memory Protection Unit) & **ECC** (Hardware Error Correction on Flash) & **Parity** on SRAM
- Fastest **Flash** (20-22 ns access time)
- **ERU for Real Time** (Event Request Unit)
- Up to **four** 12-bit ADC with < 500 ns conversion time
- Two 12-bit DAC
- **Powerful PWM units** (up to 4 CCU4 & up to 2 CCU8)
- **Delta/Sigma Demodulator**
- **POSIF (Position Interface)**
- **DAVE™ 3**

- Up to **+125°C ambient**
- **Long Term Availability** > 15 years



- **Bold** = Outstanding Feature
- **RED** = Unique Feature

The Commercial Aspect



Commercial Info

Development Kits



Hexagon Application Kits Content			CPU Board	Satellite / Extension Boards			Debug	Accessoires / Documentation			Price	
Kits Edition	Kit ISAR Number	Kits Name	CPU_45A-V2-002	HMI_OLED-V1-001	COM_ETH-V1-001	AUT_ISO-V1-001	UNI_EXT01-V2	J-Link Lite CortexM	Power Supply 24V/ 2A	USB cable	Getting Started Flyer	MSRP
Basic	KIT_XMC45_BE1_002	XMC4500 Basic Kit	X				X			X	X	55,00 €
Enterprise	KIT_XMC45_EE1_001	XMC4500 Enterprise Kit	X				X	X		X	X	89,00 €
Application	KIT_XMC45_AE1_001	XMC4500 Automation Kit #1	X	X	X	X	X	X	X	X	X	299,00 €
	KIT_XMC45_AE4_001	XMC4500 HMI&COM Kit #1	X	X	X		X	X	X	X	X	229,00 €
Satellite	KIT_XMC4x_HMI_OLED-001	Standard Human Interface		X								89,00 €
	KIT_XMC4x_COM_ETH-001	Ethernet/CAN/RS485 Interface			X				X			79,00 €
	KIT_XMC4x_AUT_ISO-001	Automation I/O Satellite				X			X			79,00 €

XMC4000 Family Key Milestones



XMC4500

- First Products
- Mid- to High-End
- Package options:
LQFP-100/144,
LFBGA-144

XMC4400/4200/4100

- 1st Portfolio Extension
- Low-to Mid-End
- Package options:
VOFN-48
LQFP-64/100

XMC4700

- 2nd Portfolio Extension
- High-end
- Package options:
LQFP-176
LFBGA-144/225

Feb
2012

Samples

May
2012

SOP

Nov
2012

Samples

Feb
2013

SOP

Feb
2014

Samples

April
2014

SOP

- Use DAVE 3 to generate a PWM signal with a varying duty cycle.
- One CCU4 Slice to drive a port pin with a frequency of 50KHz.
- A second CCU4 Slice to trigger an interrupt to modify the duty cycle.
- Build and run code on Hexagon Board

