Infineon 250W 3-phase Motor control power card

for XMC™ Microcontrollers

XMC™: Infineon's 32-bit ARM Processor

Cortex® ARM® M Core

- √ Up to 48MHz internal CPU clock (XMC1000 – Cortex M0)
- √ Up to 144MHz internal M4F CPU clock (XMC4000 – Cortex M4F)
- √ 1.8 to 5V input voltage
- √ Up to T_A = -40 to 125°C

Application Specific Peripherals

- √ Motor Control
- √ Lighting
- √ Power Conversion
- √ Industrial Automation

Performance & Real Time

- √ Hardware Acceleration
- √ Multiple timers: CCU4, CCU8, POSIF & more
- √ USB, CAN, 12-bit ADCs, DAC

Availability until min.2031

XMC™
XMC1000
XMC4000

XMC™ 32-bit ARM® Cortex® M: full feature set family scalability!

XMC™ - the right **solution** for Industry

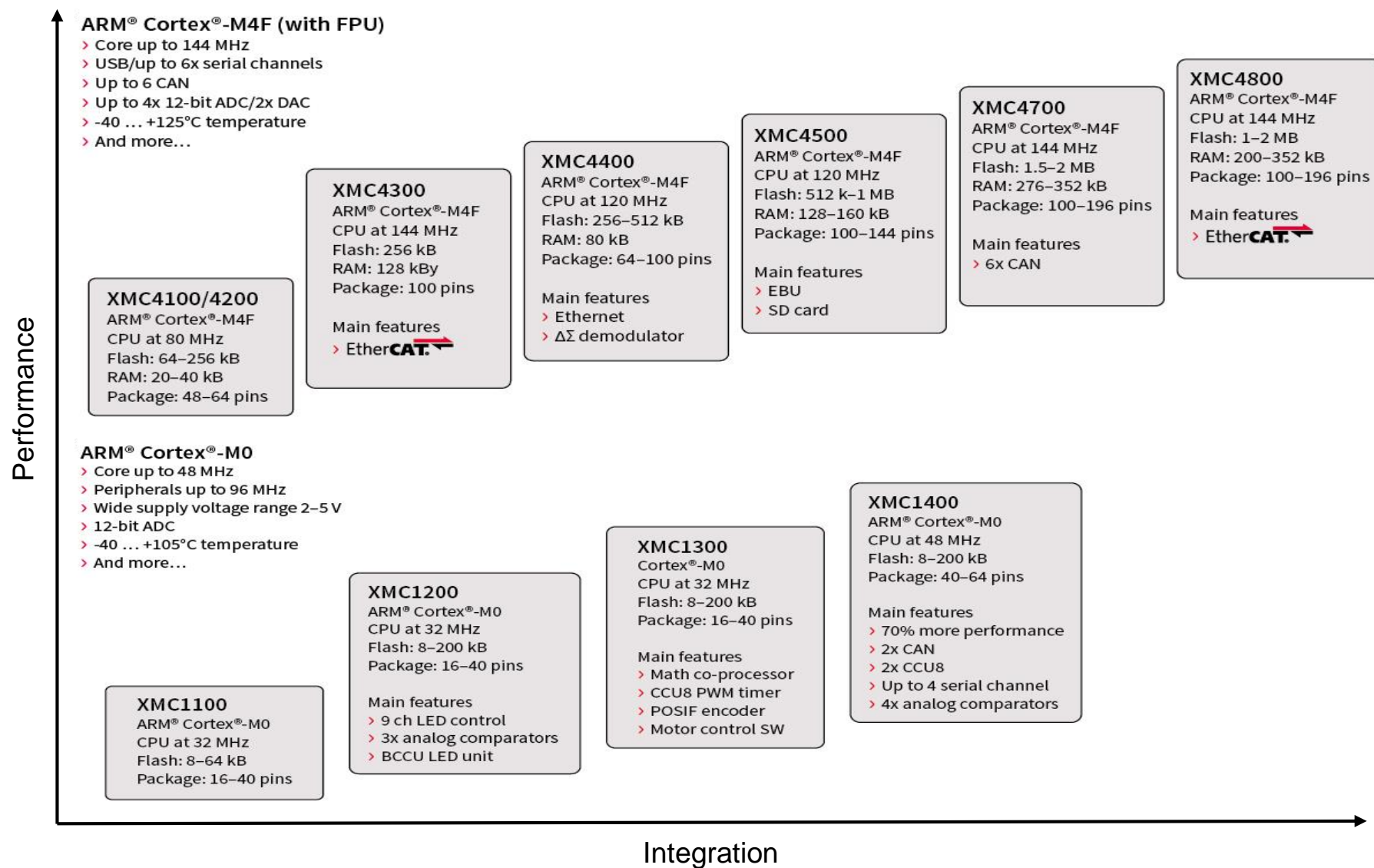| ENABLEMENT	› Excellent Know-How & Support › Highest Quality Standards and Longterm Supply Availability › Future Vision and real Infineon Commitment for Industry
PLATFORM CONCEPT	› XMC1000 (Cortex M0) & XMC4000 (Cortex M4F) › From value efficiency to high performance devices › Family scalability
RIGHT FEATURES	› Strong Real.Time Capability (Hardware Acceleration) › Strong Mixed Signal Capability: multiple ADCs & DS-ADC › High Resolution PWM › Multiple Motor-Feedback systems
APPLICATION SPECIFIC PERIPHERALS	› Automation: ETHERCAT › Lighting: BCCU, DAC › Motor Control: HRPWM, ADC, MATH Co-processor
CONNECTIVITY & SECURITY	› Secure Boot Loader: ensure IP protection › IEC 60730 Class B compliant library – free › USB, CAN, 12-bit ADCs, DAC, POSIF, ETHERNET & more
EXTENSIVE ECOSYSTEM	› Free and comprehensive toolchain to get started by DAVE › Extended partner tools compatibility

XMC™ MCU family offer this **multiple combination** of functionality across multiple compatible products

Infineon Proprietary

XMC™ MCU Product Portfolio

Performance (vertical axis)

ARM® Cortex®-M4F (with FPU)
> Core up to 144 MHz
> USB/up to 6x serial channels
> Up to 6 CAN
> Up to 4x 12-bit ADC/2x DAC
> -40 … +125°C temperature
> And more…

XMC4100/4200
ARM® Cortex®-M4F
CPU at 80 MHz
Flash: 64–256 kB
RAM: 20–40 kB
Package: 48–64 pins

XMC4300
ARM® Cortex®-M4F
CPU at 144 MHz
Flash: 256 kB
RAM: 128 kBy
Package: 100 pins

Main features
> EtherCAT.

XMC4400
ARM® Cortex®-M4F
CPU at 120 MHz
Flash: 256–512 kB
RAM: 80 kB
Package: 64–100 pins

Main features
> Ethernet
> ΔΣ demodulator

XMC4500
ARM® Cortex®-M4F
CPU at 120 MHz
Flash: 512 k–1 MB
RAM: 128–160 kB
Package: 100–144 pins

Main features
> EBU
> SD card

XMC4700
ARM® Cortex®-M4F
CPU at 144 MHz
Flash: 1.5–2 MB
RAM: 276–352 kB
Package: 100–196 pins

Main features
> 6x CAN

XMC4800
ARM® Cortex®-M4F
CPU at 144 MHz
Flash: 1–2 MB
RAM: 200–352 kB
Package: 100–196 pins

Main features
> EtherCAT.

ARM® Cortex®-M0
> Core up to 48 MHz
> Peripherals up to 96 MHz
> Wide supply voltage range 2–5 V
> 12-bit ADC
> -40 … +105°C temperature
> And more…

XMC1100
ARM® Cortex®-M0
CPU at 32 MHz
Flash: 8–64 kB
Package: 16–40 pins

XMC1200
ARM® Cortex®-M0
CPU at 32 MHz
Flash: 8–200 kB
Package: 16–40 pins

Main features
> 9 ch LED control
> 3x analog comparators
> BCCU LED unit

XMC1300
Cortex®-M0
CPU at 32 MHz
Flash: 8–200 kB
Package: 16–40 pins

Main features
> Math co-processor
> CCU8 PWM timer
> POSIF encoder
> Motor control SW

XMC1400
ARM® Cortex®-M0
CPU at 48 MHz
Flash: 8–200 kB
Package: 40–64 pins

Main features
> 70% more performance
> 2x CAN
> 2x CCU8
> Up to 4 serial channel
> 4x analog comparators

Integration (horizontal axis)

Infineon Proprietary

XMC™ XMC1xxx Series – Super set

XMC1000 microcontrollers bring together the ARM® Cortex®-M0 core and market proven and differentiating peripherals in a leading-edge 65nm manufacturing process.
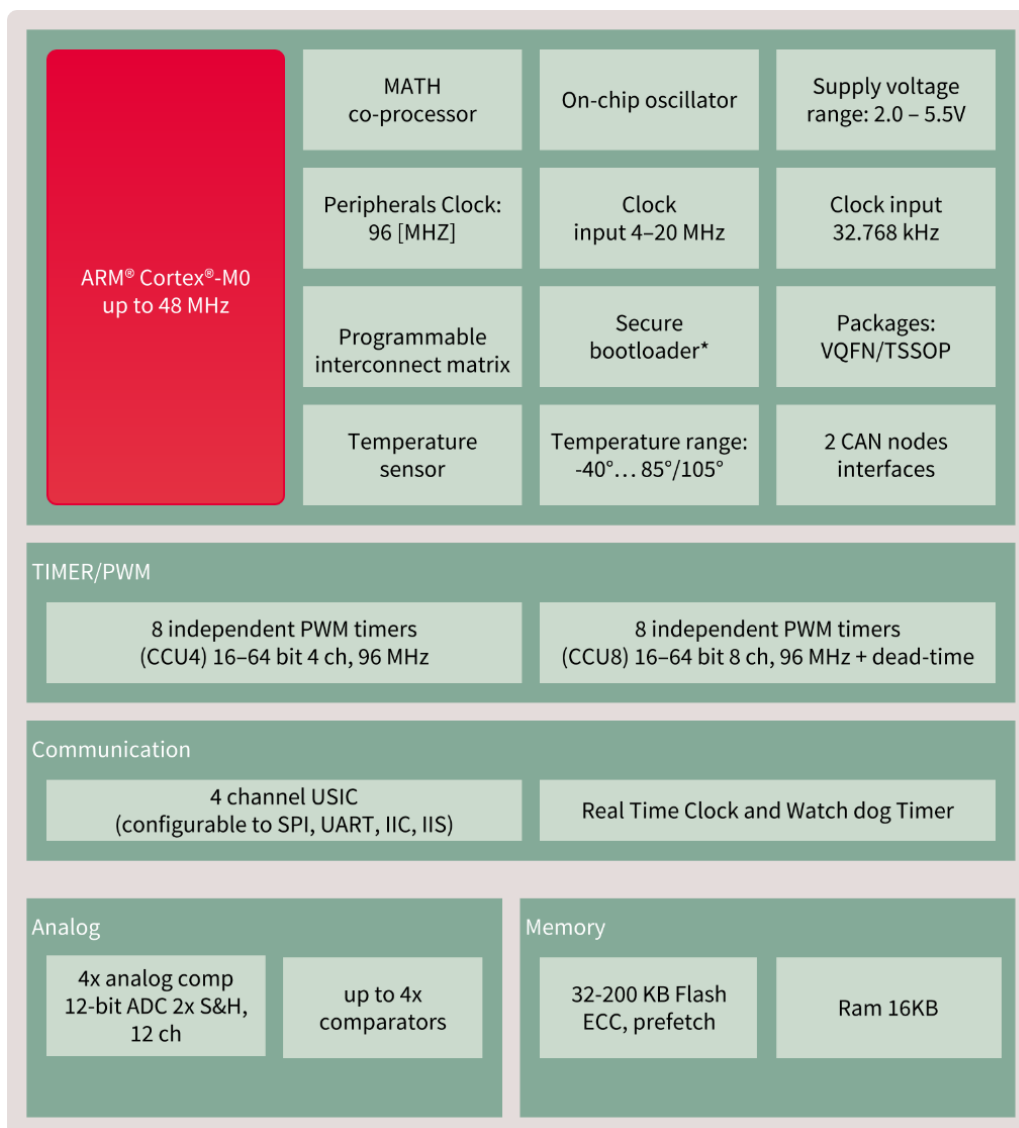
XMC1000 is the number one choice to bring traditional 8-bit designs to the next level.

Key features of XMC1000 family:

- ARM® Cortex®-M0 core, up to 48MHz
- Control peripherals like PWM timers run on up to 96MHz
- The MATH co-processor boosts standard Cortex®-M0 computing performance enabling divisions and trigonometric operations like SIN and COS
- The BCCU eases digital LED dimming and color control applications
- 30ns comparators enable AC-DC and low voltage DC-DC SMPS control e.g. up to 4 channel buck converters
- The ERU is a programmable hardware interconnect matrix that provides on-chip connectivity for real-time control and offloads the CPU
- The CCU PWM-timers feature rich and application oriented configurability like for motor control, SMPS or combustion engine control
- Hall sensors and optical encoders can be connected to POSIF, a position interface for motor position control
- With a 1Msps 12-bit ADC, XMC1000 microcontrollers are outstanding in their price / performance class
- MultiCAN provides connectivity with 2 nodes and 32 message objects

Packages:

- TSSOP16 / TSSOP28 / TSSOP 38
- VQFN24 / VQFN40 / VQFN48 / VQFN64
- LQFP64

ARM® Cortex®-M0 up to 48 MHz

MATH co-processor	On-chip oscillator	Supply voltage range: 2.0 – 5.5V
Peripherals Clock: 96 [MHZ]	Clock input 4–20 MHz	Clock input 32.768 kHz
Programmable interconnect matrix	Secure bootloader*	Packages: VQFN/TSSOP
Temperature sensor	Temperature range: -40°… 85°/105°	2 CAN nodes interfaces

TIMER/PWM

| 8 independent PWM timers (CCU4) 16–64 bit 4 ch, 96 MHz | 8 independent PWM timers (CCU8) 16–64 bit 8 ch, 96 MHz + dead-time |

Communication

| 4 channel USIC (configurable to SPI, UART, IIC, IIS) | Real Time Clock and Watch dog Timer |

Analog

| 4x analog comp 12-bit ADC 2x S&H, 12 ch | up to 4x comparators |

Memory

| 32-200 KB Flash ECC, prefetch | Ram 16KB |

XMC™ XMC1000 portfolio
optimized peripherals for real-time success

| ARM® Cortex®-M0 | Co-processor | Clocks | | Memory | ADC 12 bit / S&H | Analog | | | Timer/PWM | | | | Connectivity | | Package |
		Frequency [MHz]	Peripherals [MHz]			Number of channels	Analog comparators	CCU4	CCU8	POSIF	BCCU	USIC	CAN2.0B	
XMC11x	–	32	64	Flash 8–64 kB RAM 16 kB	1/1	up to 12	–	1x	–	–	–	2x	–	VQFN-24/40 TSSOP-16/38
XMC12x	–	32	64	Flash 16–200 kB RAM 16 kB	1/2	up to 12	up to 3	1x	–	–	●	2x	–	VQFN-24/40 TSSOP-16/28/38
XMC13x	●	32	64	Flash 8–200 kB RAM 16 kB	1/2	up to 12	up to 3	1x	1x	●	●	2x	–	VQFN-24/40 TSSOP-16/28/38
XMC14x	●	48	96	Flash 32–200 kB RAM 16 kB	1/2	up to 12	up to 4	2x	2x	●	●	4x	2x	TSSOP-38 VQFN-40/48/64 LQFP-64
Supply voltage range 1.8–5.5 V														
Temperature range -40 °C … 85 °C/105 °C														

XMC™ XMC4000 portfolio
optimized peripherals for real-time success

ARM® CORTEX®M4F	Frequency [MHz]	Memory		Analog			Timer/PWM					Connectivity							Package
				ADC12bit / S&H	Number of channels	DAC 12Bit	CCU4 (4ch)	CCU8 (4ch)	HRPWM(150ps)	POSIF	ΔΣDemodulator	USIC	CAN2.0B	USB	Ethernet	EtherCAT®	SDIO/SD/MMC	ExternalBusUnit(EBU)	
XMC41x	80	Flash 64-128 kB RAM 20 kB		2/2	up to 9	2ch	2x	1x	●	●	-	4x	up to 2	-	-	-	-	-	VQFN-48 TQFP-64
XMC42x	80	Flash 256 kB RAM 40 kB		2/2	up to 9	2ch	2x	1x	●	●	-	4x	2x	●	-	-	-	-	VQFN-48 TQFP-64
XMC43x	144	Flash 256 kB RAM 128 kB		2/2	14	2ch	2x	1x	-	-	-	4x	2x	●	●	●	●	-	LQFP-100
XMC44x	120	Flash 256-512 kB RAM 80 kB		4/4	up to 18	2ch	4x	2x	●	●	●	4x	2x	●	●	-	-	-	TQFP-64 LQFP-100
XMC45x	120	Flash 512 kB-1 M RAM 128-160 kB		4/4	up to 26	2ch	4x	2x	-	2x	4ch	4x	up to 3	●	●	-	●	●	LQFP-100/144 LFBGA-144
XMC47x	144	Flash 1,5 - 2 MB RAM 276-352 kB		4/4	up to 26	2ch	4x	2x	-	2x	4ch	6x	6x	●	●	-	●	●	LQFP-100/144 LFBGA-196
XMC48x	144	Flash 1 - 2 MB RAM 276-352 kB		4/4	up to 26	2ch	4x	2x	-	2x	4ch	6x	6x	●	●	●	●	●	LQFP-100/144 LFBGA-196

Supply Voltage Range 3.13 to 3.63 V

Temperature Range -40 °C … 85 °C / 125 °C

XMC™ XMC4xxx Series – Super set

All XMC4000 devices are powered by ARM® Cortex®-M4 with a built-in DSP instruction set. The Single Precision Floating Point Unit, Direct Memory Access (DMA) feature and Memory Protection Unit (MPU).
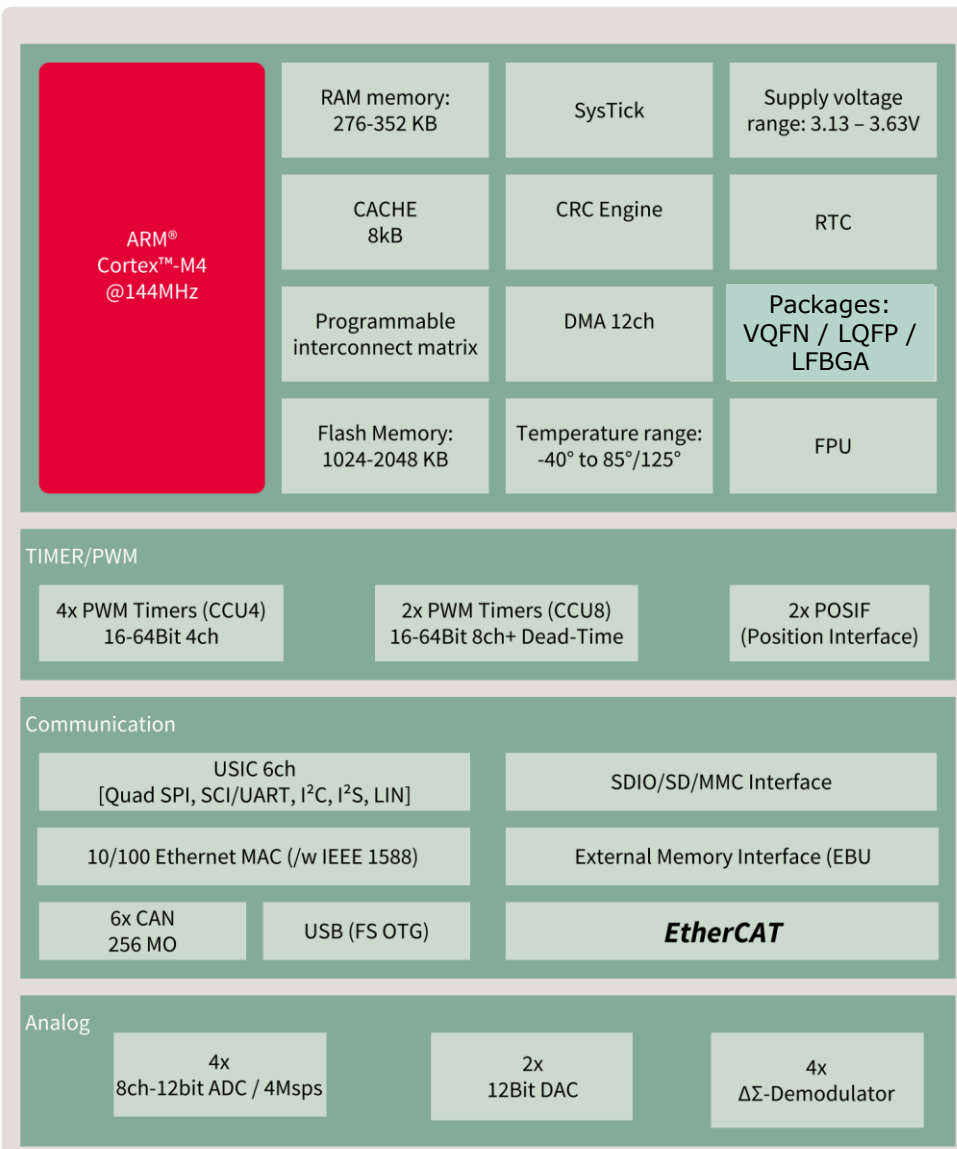
The XMC4000 family addresses industrial market needs and is ideal in particular for digital power conversion, motor control, sense & control, and IO applications.

Key features of the XMC4000 family:
- ARM® Cortex®-M4 with floating point unit (FPU), single-cycle DSP MAC, 80-144MHz CPU frequency
- Up to 2MB embedded Flash with 22ns access time and error correction unit
- Up to 352kB embedded RAM
- EtherCAT ® node
- 12-channel DMA (XMC4500), 8-channel DMA (XMC4400, XMC4200, XMC4100)
- Comprehensive set of timers, Delta sigma Demodulator, Position Interface, PWM with emergency shutdown and ADC trigger, Quadrature Encoder Interface
- 4-channel high-resolution, PWM (150ps) (XMC4400, XMC4200, XMC4100)
- Up to 4x 12-bit ADC achieving 4 Mega samples per second (interleaved mode
- 2x 12-bit DAC
- Up to 6 multi-functional serial interface modules configurable to SPI, I2C, I2S, UART
- Up to 6xCAN
- External bus interface supporting SDRAM, SRAM, NOR-/NAND-Flash and memory-mapped IO devices (e.g. LCD)
- SD/MMC interface
- Touch interface and LED Matrix
- Battery-backed real-time clock with calendar function and time-based or external wake-up capabilities
- Extended temperature range up to 125°C ambient temperature

Packages:
- VQFN48
- LQFP64 / LQFP100 / LQFP144
- LFBGA196

ARM® Cortex™-M4 @144MHz	RAM memory: 276-352 KB	SysTick	Supply voltage range: 3.13 – 3.63V
	CACHE 8kB	CRC Engine	RTC
	Programmable interconnect matrix	DMA 12ch	Packages: VQFN / LQFP / LFBGA
	Flash Memory: 1024-2048 KB	Temperature range: -40° to 85°/125°	FPU

TIMER/PWM

| 4x PWM Timers (CCU4) 16-64Bit 4ch | 2x PWM Timers (CCU8) 16-64Bit 8ch+ Dead-Time | 2x POSIF (Position Interface) |

Communication

USIC 6ch [Quad SPI, SCI/UART, I²C, I²S, LIN]	SDIO/SD/MMC Interface
10/100 Ethernet MAC (/w IEEE 1588)	External Memory Interface (EBU
6x CAN 256 MO	USB (FS OTG)	*EtherCAT*

Analog

| 4x 8ch-12bit ADC / 4Msps | 2x 12Bit DAC | 4x ΔΣ-Demodulator |

Infineon Proprietary

XMC for Motor Control Solutions
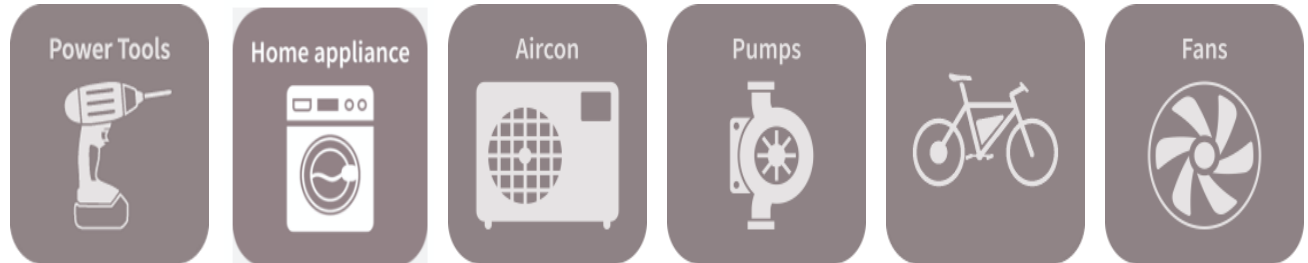*Flexible solutions*

More efficiency drives the motor control towards brushless DC

All kinds of low-end motors:
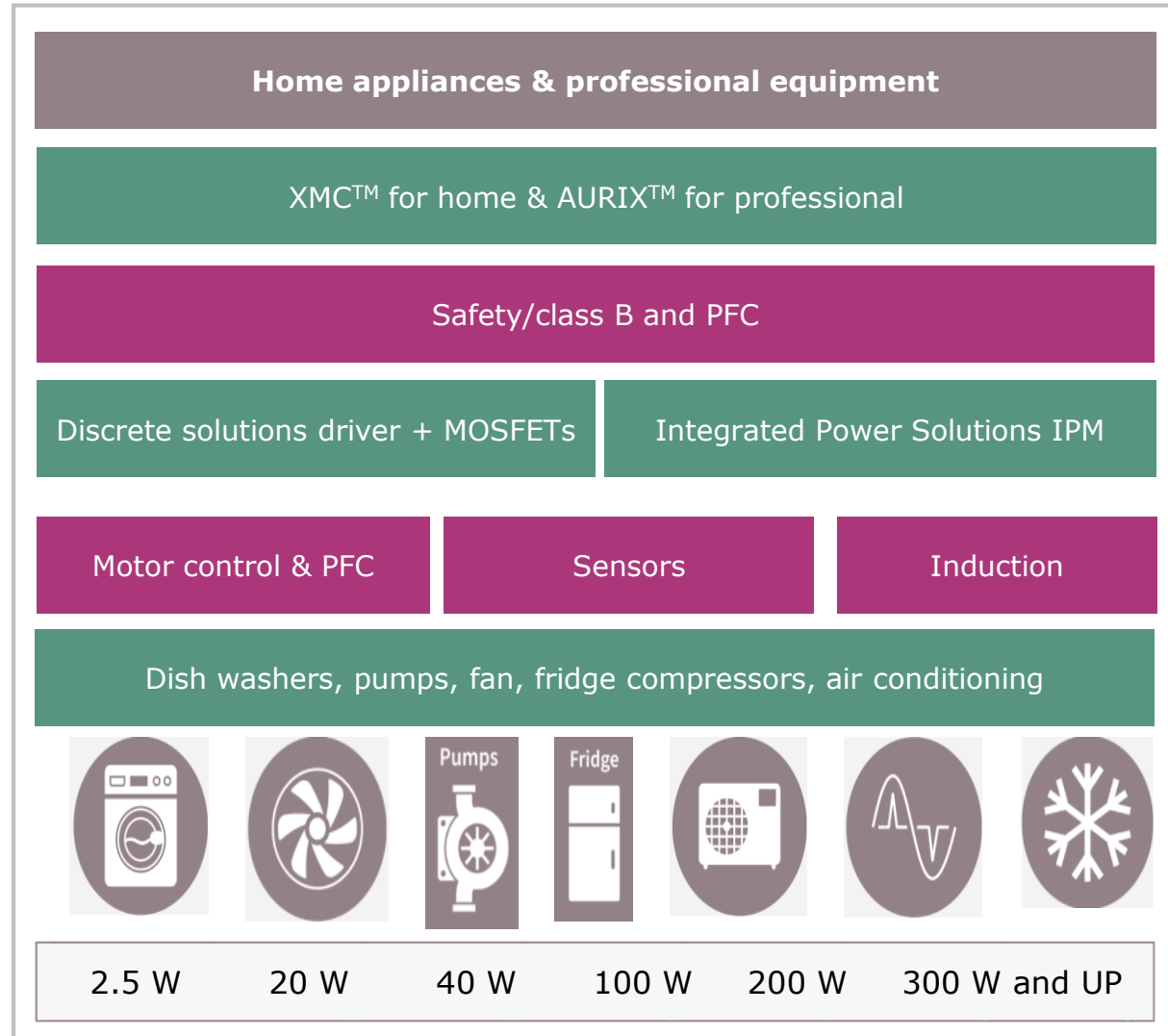

Power Tools | Home appliance | Aircon | Pumps | (bicycle) | Fans

Application specific peripherals for motor control:

PWM
Pulse Width Modulation

POSIF
Position Interface

MATH
Co-processor

ERU
Event Request Unit
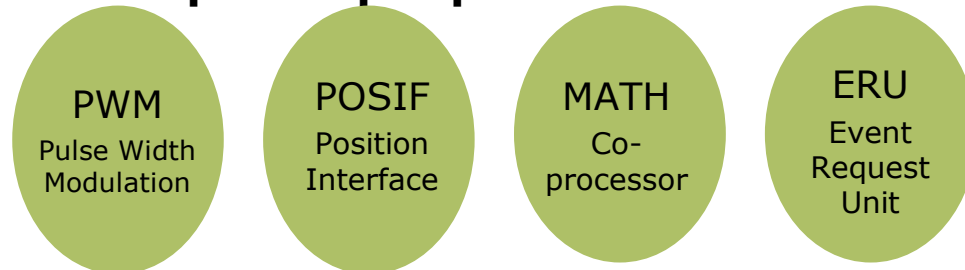
XMC allows most advanced and cost optimized motor control in Cortex M0 and M4F

XMC™ for Motor Control Solutions
Home & professional appliances

Home appliances needs:
Very cost sensitive
High scalability
Flexibility
Robust
Extended temperature
Reliable
Home & professional
Safety & class B

Home appliances & professional equipment

XMC™ for home & AURIX™ for professional

Safety/class B and PFC

Discrete solutions driver + MOSFETs	Integrated Power Solutions IPM

Motor control & PFC	Sensors	Induction

Dish washers, pumps, fan, fridge compressors, air conditioning

2.5 W	20 W	40 W	100 W	200 W	300 W and UP

XMC™ - class B safety certification
available and Free of charge

Class B enable

All XMC devices:
XMC1xxx: ARM Cortex® M0
XMC4xxx: ARM Cortex® M4F

Safety enable

› Extended documentation and pre-certified software libraries to XMC™ Cortex® ARM® based controllers **free of charge**

› **Includes: user manual, source codes, examples for DAVE, Keil and IAR, certificates**

› Infineon and Hitex close partnership enables your design for household electrical appliances (Class B – IEC 60335-1) – mandatory for home appliances start on 2019!

› Aim of the standards is to reduce the risks of a system to a tolerable amount:

– Systematical and statistical failures: software and hardware

– VDE (EUROPE) certified and UL (NAFTA/CHMT) on CYQ2/2018

Find more at: www.hitex.com/classb

hitex
EMBEDDED TOOLS & SOLUTIONS

250W 3-phase Motor control power card
Hardware Overview
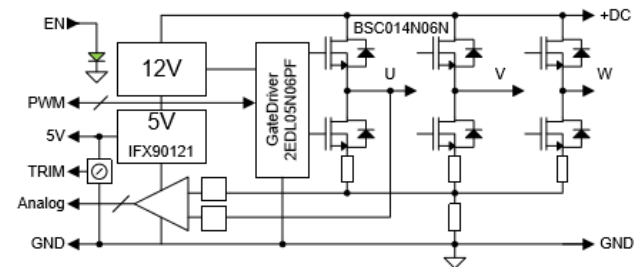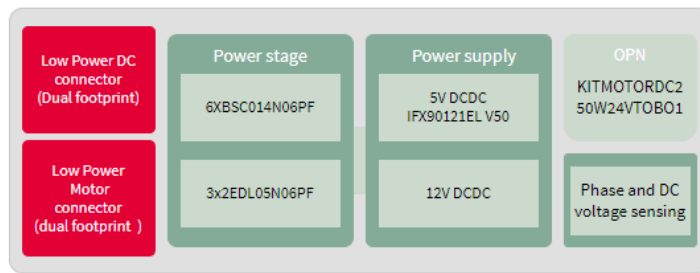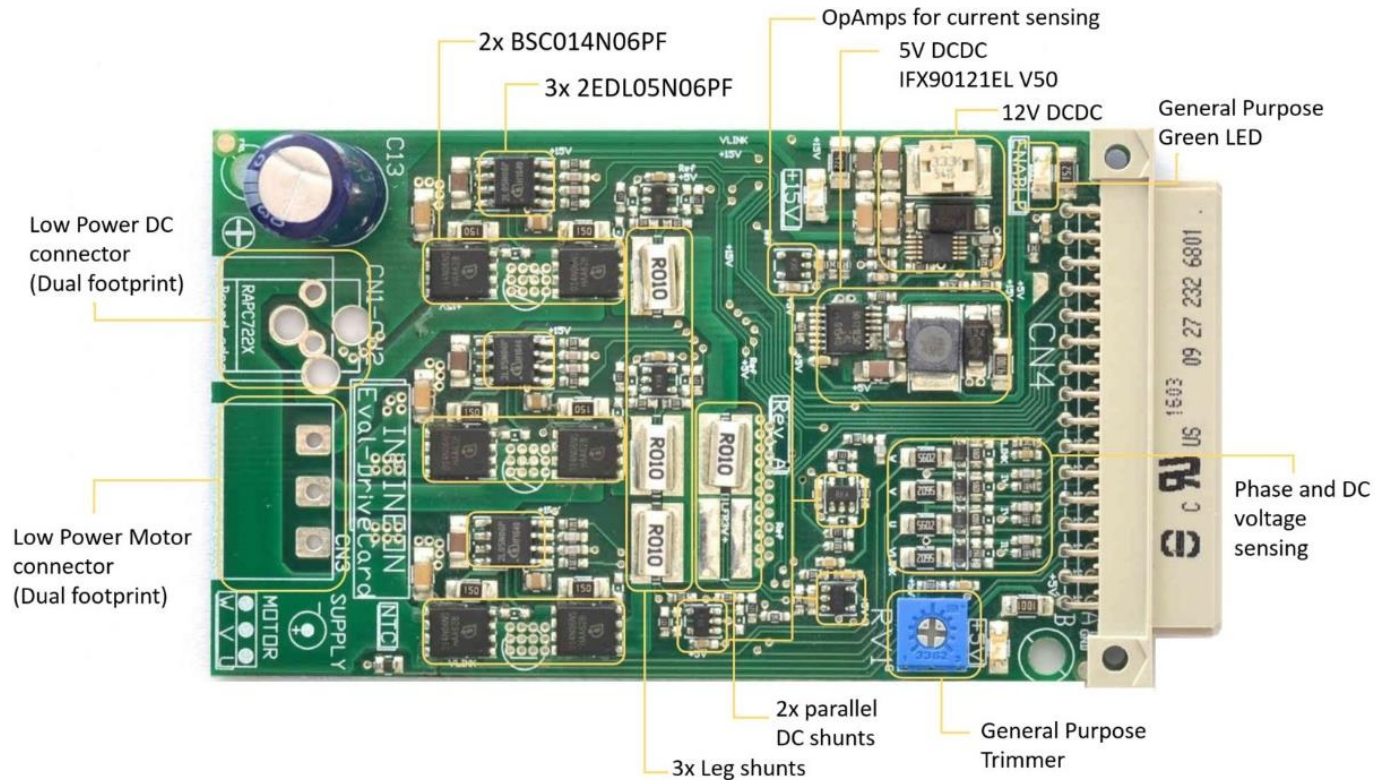
Orderable Part Number: KIT_MOTOR_DC_250W_24V

Infineon Proprietary

250W 3-phase Motor control power card
Full feature set

› Low-voltage motor drive system either in H-Bridge or in 3-Phase full bridge configuration.250W @ 24V

› Shunts to sense leg currents and DC-link current, with OpAmps for conditioning to XMC

› 3-phase motor control Power Card:

  – 3 Half-Bridges with SO8 gate driver IC and SSO8 power MOSFETs

› LV input from 13V to 60V

› Max motor voltage 48V (due to 60V mosfet)

› Target 300W @ 24V › 3 shunt + 1 single shunt

› BEMF measurement

› twice DC/DC stage (60→12V, and 12→5V)

  – Switched Mode DC/DC buck converter IFX90121EL V50 for 5V supply
  – Switched Mode DC/DC buck converter for 12V supply

› 2ED driver (easy reuse schematics for H-bridge)

› OBD J-link on board debugger isolated (on controller card)

Infineon Proprietary

XMC for Motor Control Solutions
Flexible solutions

These boards are sold separately

XMC1302 Driver Card

XMC1402 Driver Card

XMC4400 Driver Card

XMC1302 Driver card

XMC1402 Driver card

XMC4400 Driver card

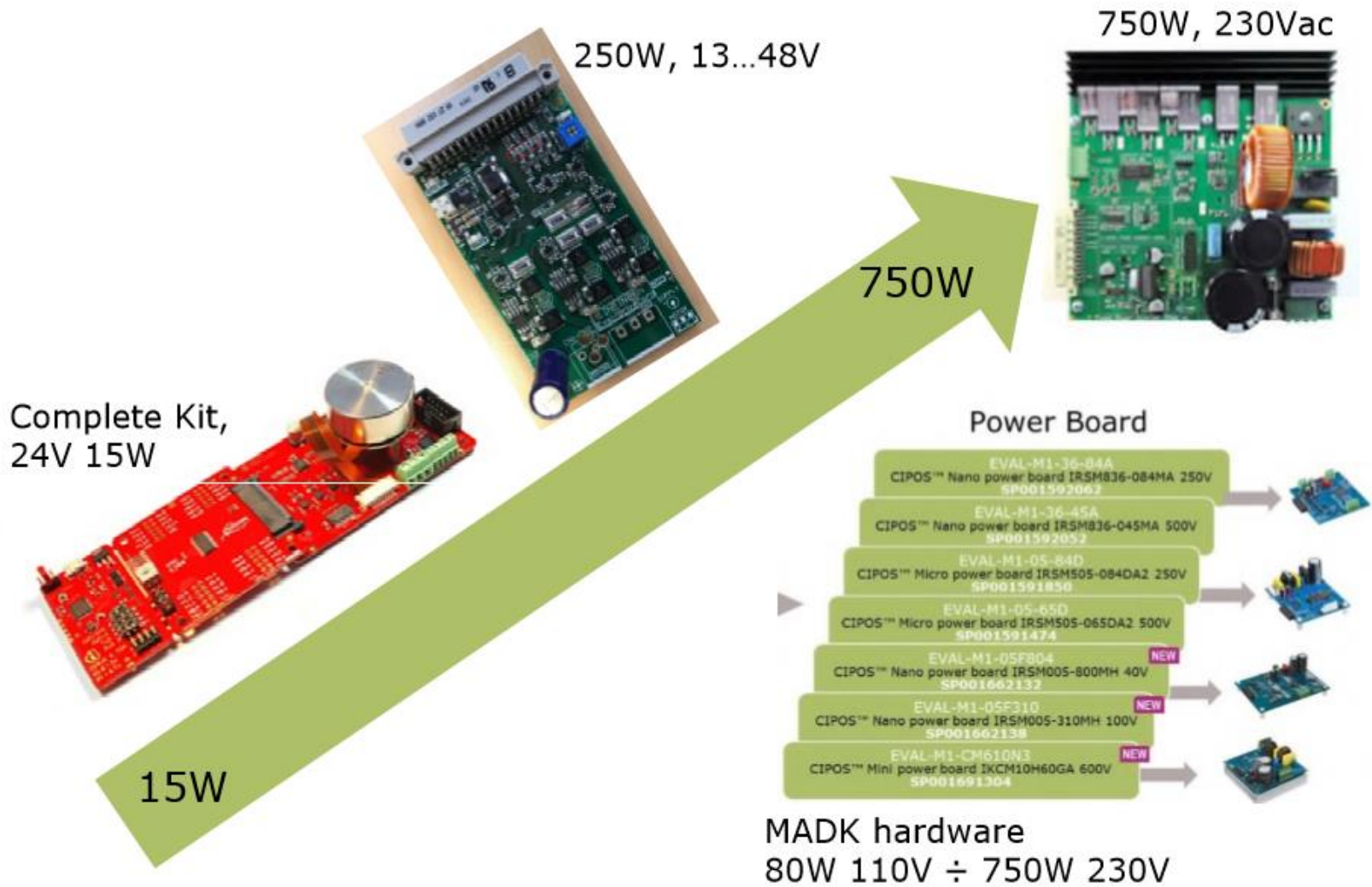Infineon 250W 3-phase Motor control power card

Infineon Proprietary

XMC for Motor Control Solutions
Flexible solutions

750W, 230Vac

250W, 13...48V

750W

Complete Kit,
24V 15W

15W

Power Board

EVAL-M1-36-84A
CIPOS™ Nano power board IRSM836-084MA 250V
SP001592062

EVAL-M1-36-45A
CIPOS™ Nano power board IRSM836-045MA 500V
SP001592052

EVAL-M1-05-84D
CIPOS™ Micro power board IRSM505-084DA2 250V
SP001591856

EVAL-M1-05-65D
CIPOS™ Micro power board IRSM505-065DA2 500V
SP001591474

EVAL-M1-05F804   NEW
CIPOS™ Nano power board IRSM005-800MH 40V
SP001662132

EVAL-M1-05F310   NEW
CIPOS™ Nano power board IRSM005-310MH 100V
SP001662138

EVAL-M1-CM610N3   NEW
CIPOS™ Mini power board IKCM10H60GA 600V
SP001691304

MADK hardware
80W 110V ÷ 750W 230V

More info:

www.infineon.com/XMC

www.Infineon.com/makers

https://www.infineon.com/cms/en/product/evaluation-boards/kit_motor_dc_250w_24v/

https://www.infineon.com/cms/de/product/evaluation-boards/kit_xmc1300_dc_v1/

https://www.infineon.com/cms/en/product/evaluation-boards/kit_xmc1400_dc_v1/

https://www.infineon.com/cms/en/product/evaluation-boards/kit_xmc4400_dc_v1/

Part of your life. Part of tomorrow.

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