NXP数字信号处理器

DIGITAL SIGNAL CONTROLLER-DSC

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SECURE CONNECTIONS
FOR A SMARTER WORLD

PUBLIC

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NXP DIGITAL SIGNAL CONTROLLER (DSC) 20 YEARS!
… FOCUS ON MOTOR CONTROL AND POWER CONVERSION

16-b DSC DSP56F8xx

- Up to 40 MIPS
- 56800 core
- 12-ch PWMs
- 12-b ADCs
- Up to 128KB flash
- External memory interface
- **Starting from 2000 at Motorola**

16-b DSC MC56F8xxx

- Up to 60 MIPS
- 56800E core
- 12-ch PWMs, 520ps
- 12-b ADC, 600ns
- Integrated PGAs
- Up to 512KB flash
- External memory interface
- AEC-Q100

32-b DSC MC56F8xxxx

- Up to 100 MIPS
- 56800EX core
- 16-ch PWMs, 312ps
- 12-b ADCs, 300ns
- Integrated PGAs/opamp
- Enhanced crossbar (AOI+EVTG)
- Up to 256KB flash
- AEC-Q100

32-b DSC MC56F8xxxx

- Up to 320 MIPS
- Single/Dual 56800EX cores
- Integrated FPU, TMU
- 16-ch PWMs, 260ps
- 12-b ADCs, 200ns
- Industrial control interfaces
- Up to 512KB flash
- External memory interface
- AEC-Q100
- ASIL-B functional safety

Legacy ***Promotion*** ***Roadmap***

www.nxp.com/dsc

Expert of Power and Motor

–for the most efficient digital power conversion and advanced motor control applications.

高性能 DSC内核

- 56800EX Hawk V3 Core, 100 MHz of performance
- FIR Filter 6x faster than ARM Cortex-M3
- The highest number of operations per cycle of any MCU in its class
- Fractional arithmetic
- Superfast interrupt

超低功耗 DSC（同类产品的50%或更低）

- Less than 0.3mA/MHz at full speed run
- Concurrent operations offer best-in-class execution times and overall low power run rates.

智能外设, 高度集成

- eFlexPWM – Advanced timer with 312ps resolution
- EVTG/Cross-Bar - Directly connecting any input and/or output with logic functions
- High impedance cyclic ADCs to capture events real time.
- 125°C and AEC-Q100 for automotive applications

简便易用的工具链

- CodeWarrior - Highly visual, Eclipse based IDE
- MCUXpresso – IDE, SDK, CFG, SEC
- RTCESL - Run time library for easy development
- FreeMASTER - GUI debug oscilloscope
- Processor Expert & QuickStart - GUI config tools
- Plenty of Reference Designs for power and motor

DIGITAL SIGNAL CONTROLLER – TARGET APPLICATIONS

能源

- Switch-mode power supply and power management
- Power distribution systems
- Circuit Breaker
- Instrumentation
- UPS
- Wireless Charging
- Solar system
- ESS / PCS
- AC-DC
- DC-DC
- DC-AC

汽车

- EV Compressor
- EV Charger
- Power Module
- On Board Charger
- Wireless Charging for Auto

电机

- Home Appliance
- Motor Control (ACIM, BLDC, PMSM, SR, stepper)
- Industrial Motor
- Industrial Control

应用方向：能源转换

集中式

组串式

储能逆变器（离并网）

微逆变

优化器

汇流器

通讯交互

光伏水泵

光伏制氢

光热追日

光伏面板清扫

AC-DC/ DC-DC/ DC-AC

无线充电，充电桩模块，OBC，PCS，ESS，UPS等

应用方向：电机控制

BLDC

FOC风机/ 泵/ 电摩

家电

磁阻式洗衣机，空调户外机

步进

开环/ 闭环/ 多轴

伺服

交流/ 直流/ 行业/ 通用

体积受限产品

小型化，便携化

PMSM

高能效电机

低功耗，高能效，内置运放，安全启动，快速响应和保护

32-BIT DSC FAMILY
... FOCUS ON MOTOR CONTROL AND POWER CONVERSION

www.nxp.com/dsc

Entry Level

100/50MHz
8ch Hi-Res eFlexPWM
2x 1.6MSPS LP 12-b ADC w/ PGA
12-b DAC, 4x ACMP
2x OPAMP, DSASS
128K Flash
20K RAM
3V I/O
-40~105C / -40~125C

Production

Entry Level

100/50MHz
8ch Hi-Res eFlexPWM
2x 1.25MSPS LP 12-b ADC w/ PGA
2x 12-b DAC, 4x ACMP
CAN
64K Flash
8K RAM
5V-tolerant I/O
-40~105C / -40~125C

Production

Performance

100MHz
16ch Hi-Res eFlexPWM
2x 3MSPS LP 12-b ADC w/ PGA
2x 12-b DAC, 4x ACMP
CAN FD, USB FS+PHY
256K Flash, Dual Bank, ECC
64K RAM
5V-tolerant I/O
-40~105C / -40~125C
AEC-Q100, PPAP

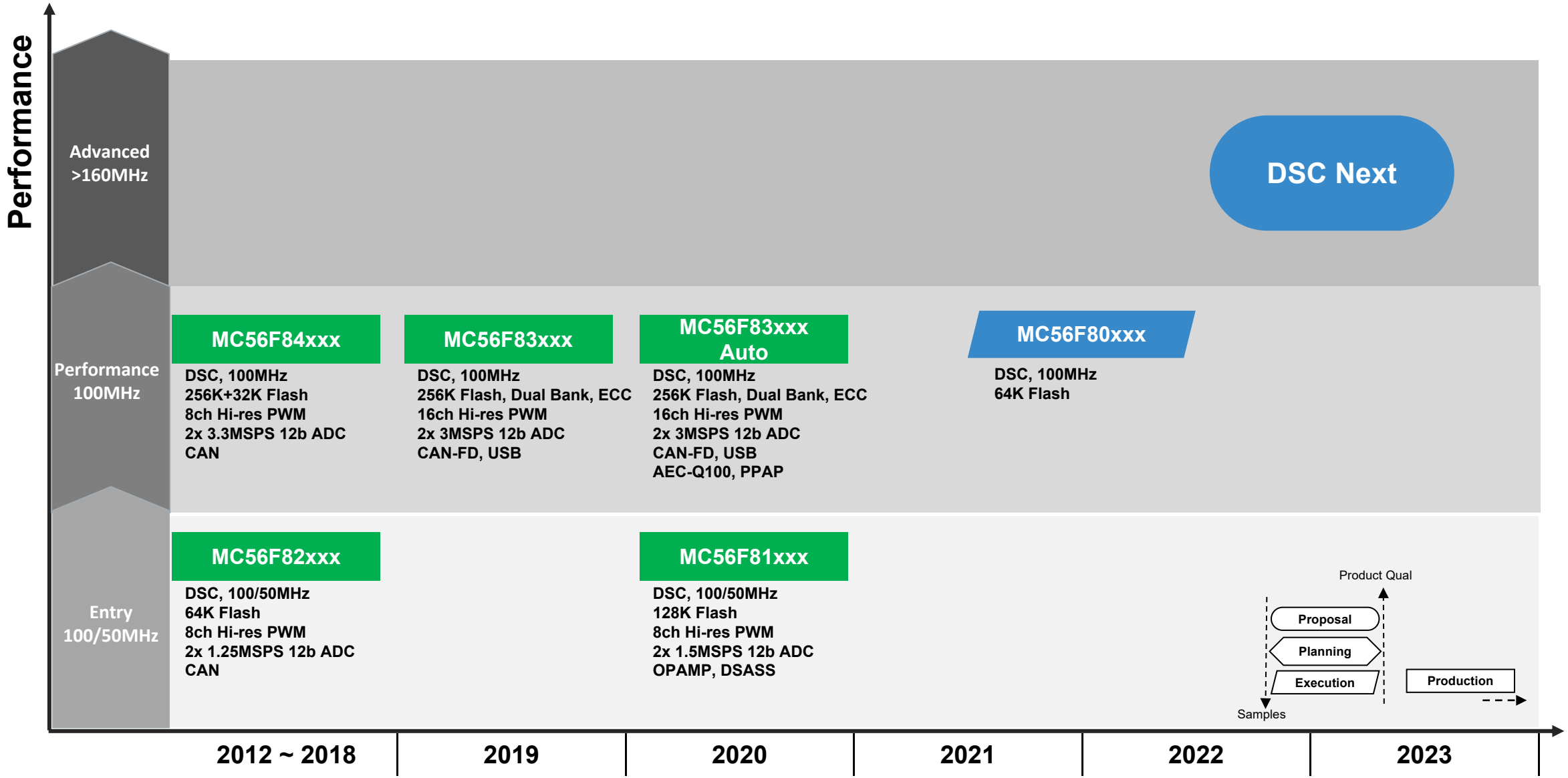
Production

Performance

100MHz
8ch Hi-Res eFlexPWM
2x 3.3MSPS 12-b ADC w/ PGA
12-b DAC, 4x ACMP
CAN, 16-b SAR ADC
256K Flash, 32K FlexMem
32K RAM
5V-tolerant I/O
-40~105C

Production

DIGITAL SIGNAL CONTROLLER ROADMAP



MC56F81系列主要特点

存储空间	高集成度	优化成本
• Up to 128KB Flash, 128 / 64 / 32 KB option • Up to 20KB RAM, running at the same speed as CPU • Added Boot ROM to support code update from UART and I2C	• Integrated two Operational Amplifier • Dual ADC up to 1.6MSPS each • Upgraded I2C to support PMBus • Digital Signature Authentication (DSASS)	• Price reduction on MC56F82xxx • 818xx with DSASS • 817xx for digital power • 816xx for motor control

For cost efficient digital power conversion and motor control applications

MC56F83系列主要特点

存储空间

- Up to 256KB flash with ECC/64KB RAM
- Dual flash bank supports live update
- Added Boot ROM to support code update from UART, I2C and CAN

高集成度

- Up to 16-ch high resolution PWM with 312ps resolution
- Dual low power ADC up to 3MSPS each
- Crossbar with Event Generator (EVTG) integration
- USB 2.0 FS OTG with PHY
- CAN-FD

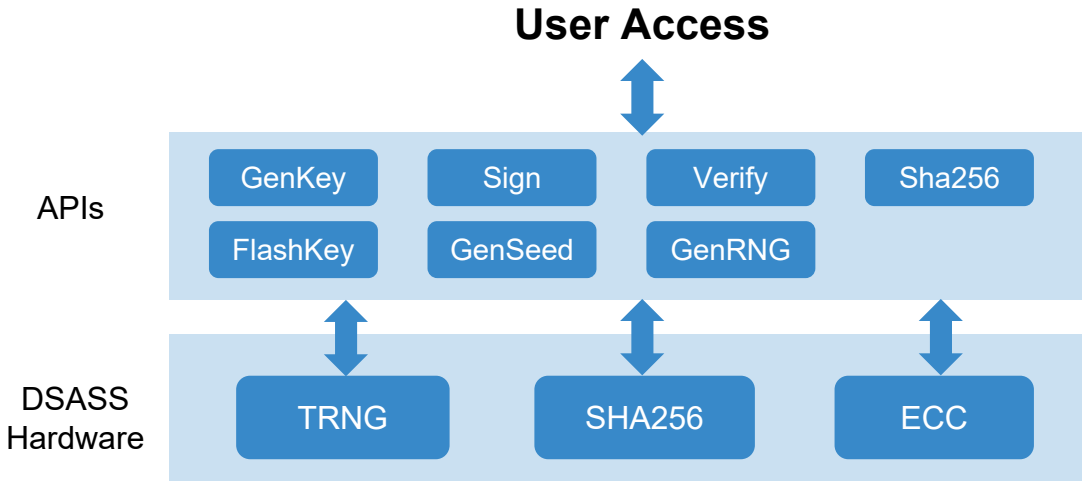
汽车级认证

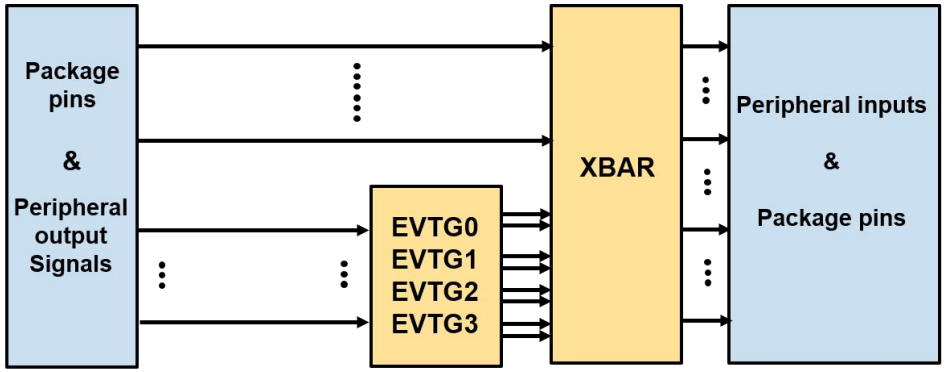
- Temperature range: -40~105C (V-grade), -40~125C (M-grade)
- AEC-Q100 qualification, PPAP

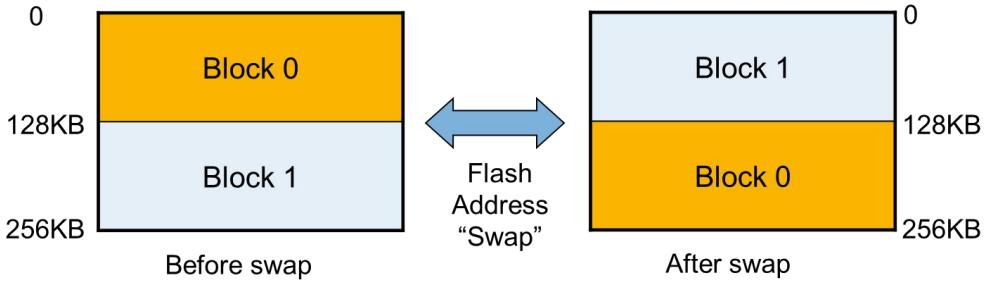
Target applications: Onboard Charger (OBC), DC/DC, HVAC, Inverter, Charging Pile, LSEV etc.

NXP DSC PERIPHERALS

- 312ps High Resolution PWM
- High Speed Cyclic ADC (low power)
- Multi-mode OPAMP
- Dual bank Flash, support live update
- Event Generator (EVTG)
- Security – DSASS (**D**igital **S**ignature **A**lgorithm **S**ecurity **S**ubsystem)







REFERENCE PLATFORMS

MC56F81000-EVK
/MC56F83000-EVK

FRDM-MC-LVBLDC
FRDM-MC-LVPMSM

FRDM-MC-LVMTR

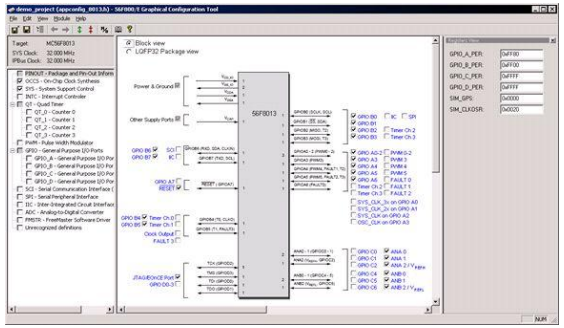
Low-Voltage, 3-Phase Motor Control for BLDC and PMSM design

Enables 3-phase PMSM, BLDC and ACIM motor control and PFC solutions

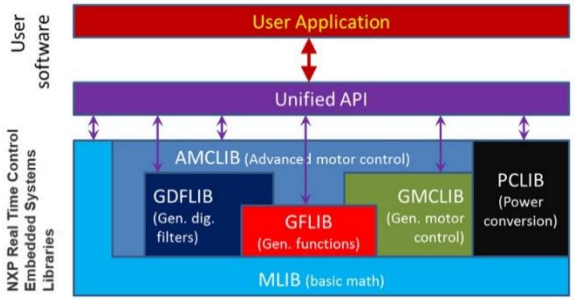
HVP-MC3PH高压驱动板，和HVP-56F81768控制子卡

SW TOOLS – ALL FREE FOR 32-BIT DSC!

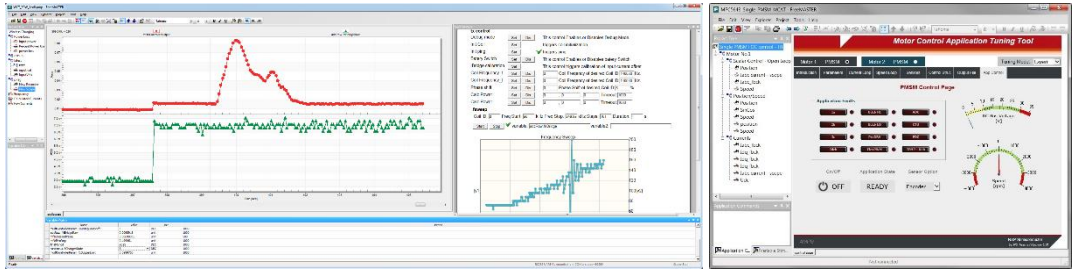
- **IDE - CodeWarrior Development Studio for DSC v11.x** (Compiler optimization ongoing!)
  - **License free for DSC,** Eclipse Front End for industry standard interface
- **Software Development Kit – MCUXpresso SDK**
  - Production-grade software
  - Includes driver for each peripheral, transactional APIs, peripheral driver usage examples, application demos, etc
- **Config GUI - MCUXpresso Config Tools**
  - Pins, Clocks, and Peripherals tools generate initialization for custom board support.
  - Much easier to config low level intricacies without having to know everything about hardware
- **Config GUI - Processor Expert / QuickStart**
  - Processor Expert is integrated with CodeWarrior, GUI operation
  - Quick Start has standalone software package.
  - Much easier to config low level intricacies without having to know everything about hardware
- **Run Time Control Embedded Software Library – RTCESL**
  - For motor control and power conversion common APIs
  - Include Math / General Function / General Motor Control / General Digital Filter / Advanced Motor Control / Power Control library
- **Run-time Debugging Tool – FreeMASTER**
  - Non-intrusive monitoring of variables on a running system
  - Oscilloscope-like display
- **PMSM/BLDC Tuning Wizard - MCAT**
  - FreeMASTER plugin
  - Tunning PI control parameters for sensorless PMSM motor
- **IEC60730 Safety Library**
  - IEC60730 Class B safety: to prevent unsafe operation of the controlled equipment



QuickStart GUI

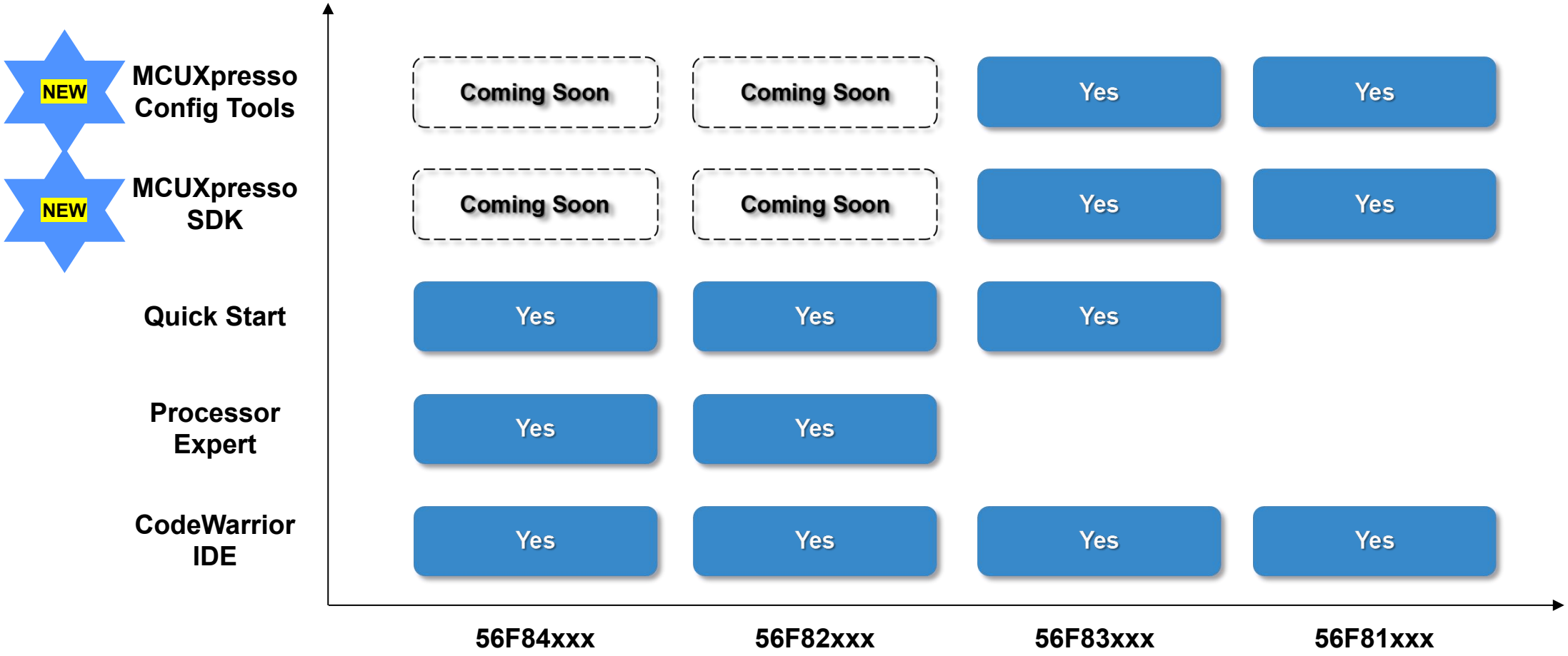


RTCESL



FreeMASTER + MCAT

DSC IDE & CONFIG TOOLS ROADMAP

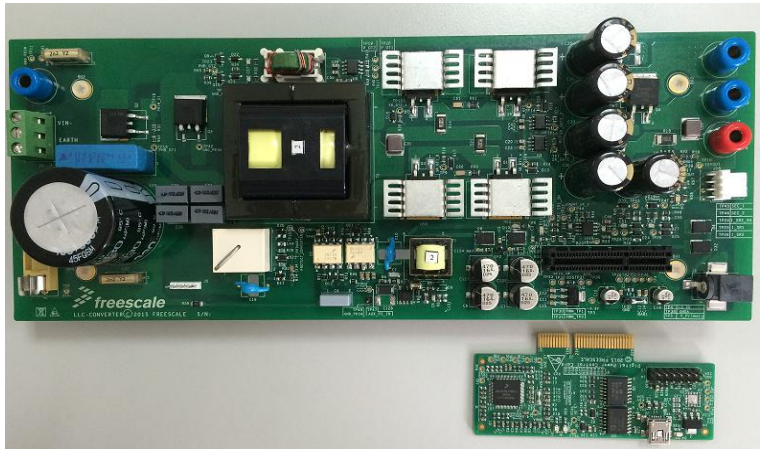


参考设计

- Totem-Pole Bridgeless PFC Converter *Link!*
- LLC Resonant Converter with Sync Rectifier *Link!*
- 3in1 Air-Conditioner Outdoor Unit *Link!*
- Refrigerator Compressor *Link!*
- Simple Servo Motor Control Solution *Link!*
- Micro-Step Stepper Motor Control Solution *Link!*
- Sensorless FOC Washing Machine *Contact NXP*

- 访问 www.nxp.com/dsc, 找到更多开发资源

Totem-Pole PFC



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