

# LPC ROADMAP UPDATE

INNOVATION MADE EASY WITH LPC MCUS:  
A ROADMAP OVERVIEW AND DEEPER DIVE INTO  
LPC546XX MCU FAMILY POWER ADVANTAGES

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LPC MICROCONTROLLER TEAM

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FOR A SMARTER WORLD

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PUBLIC



# AGENDA

- WHO IS LPC?
- OUR FOCUS.
- ROADMAP
- LPC54000 & LPC800
- Q&A



# NXP LPC

Consumer and Industrial Microcontrollers  
for the Broad Market

# Welcome!

- Who is LPC and where did we come from?



# Welcome!

- Who is LPC and where did we come from?

Prof. Nitesh Ahir

## COMPANIES PRODUCING 8051

- ✦ Table :Some Companies Producing a Member of the 8051 Family

Company	Web Site
Intel	<a href="http://www.intel.com/design/mcs51">www.intel.com/design/mcs51</a>
Atmel	<a href="http://www.atmel.com">www.atmel.com</a>
Philips/Sigmetics	<a href="http://www.semiconductors.philips.com">www.semiconductors.philips.com</a>
Siemens	<a href="http://www.sci.siemens.com">www.sci.siemens.com</a>
Dallas Semiconductor	<a href="http://www.dalsemi.com">www.dalsemi.com</a>

## Criteria for Choosing a Microcontroller

- Availability of software development tools, such as compilers, assemblers, and debuggers
- Wide availability and reliable sources of the microcontroller
  - The 8051 family has the largest number of diversified (multiple source) suppliers
    - Intel (original)
    - Atmel
    - Philips/Sigmetics
    - AMD
    - Infineon (formerly Siemens)
    - Matra
    - Dallas Semiconductor/Maxim

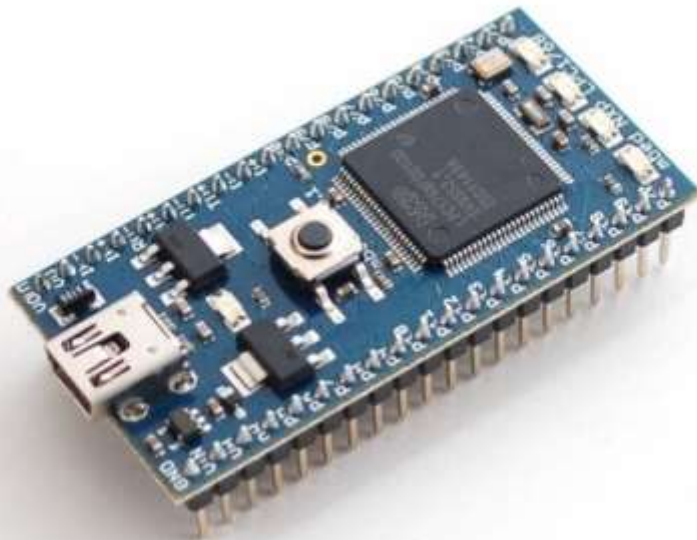
# Welcome!

- Who is LPC and where did we come from?



# LPC 32-bit Microcontrollers for the Mass Market

With over **1B Units Shipped**, and **140,000 developers** on the LPC1768 mbed™ enabled platform – and growing – LPC is proven popular among the global consumer and industrial markets.



# LPC 32-bit Microcontrollers for the Mass Market

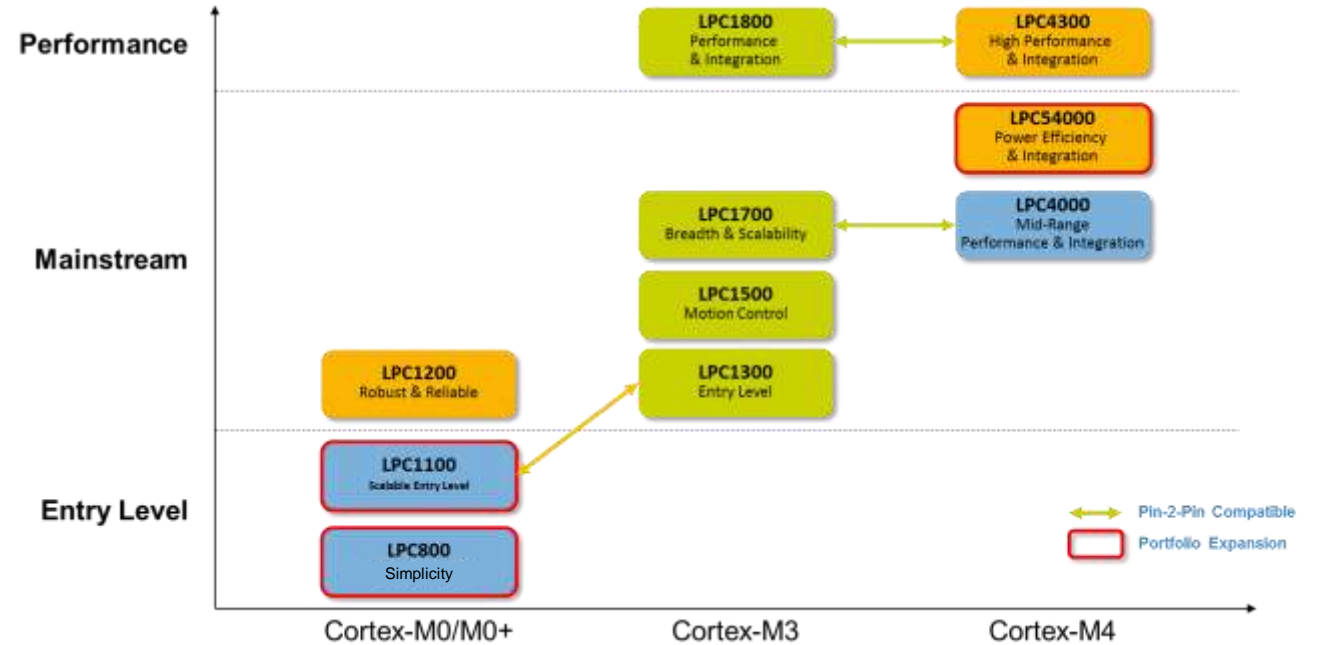
## Open Development Environment

- MCUXpresso IDE with SDK and Easy to Use Software Code Bundles
- Development, Debug & Expansion Boards
- Developer Community



Easy Development

## Complete Portfolio of Cortex-M MCUs



Scalable Expansion



# LPC Focus on Consumer & Industrial Markets



1

**Product Innovation.**

2

**Ecosystem & Partners.**

3

**Supply, Longevity, & Quality.**

4

**Local Support Network.**

5

**Extensive Software & Tools.**

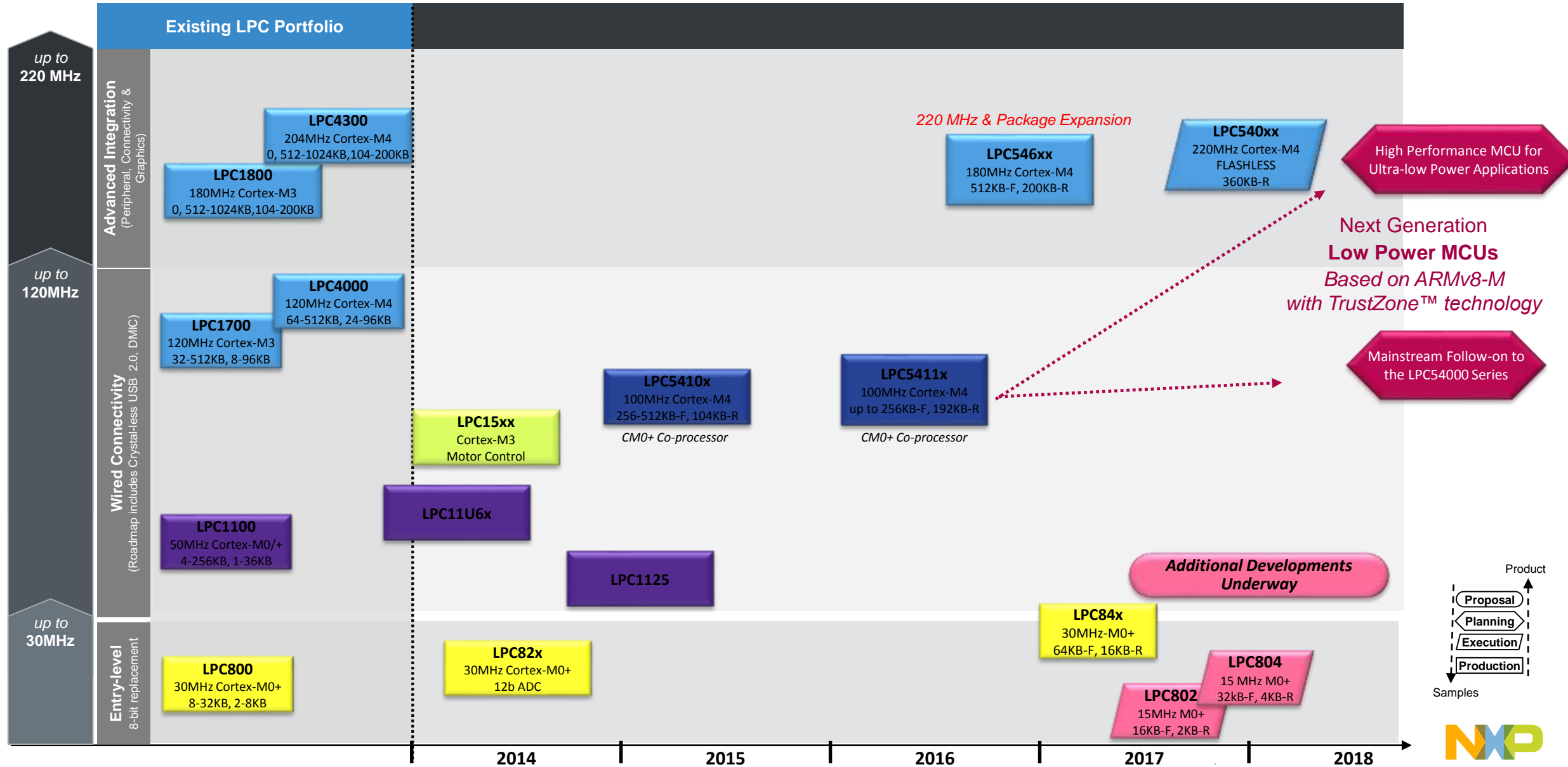
- » Accelerating Transition from 8-bit to **Entry-level Cortex-M0+ based MCUs**
- » **High Performance MCUs** for Energy Conscious Applications



# WHERE ARE WE HEADED?

# NXP LPC 32-bit MCU Roadmap

(not a complete portfolio summary)





# POWER-EFFICIENT CORTEX-M4 MCUS





# Low Power and Flexibility

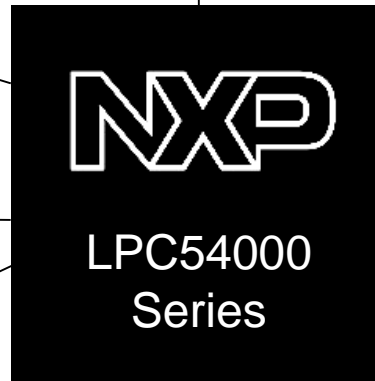
**Free Running Oscillator (FRO) from 12 MHz to 96 MHz**  
(±1% int. clock accuracy over entire voltage/temperature consuming 100 uA)

**Down to 7 µA keeping 64 Kbytes of SRAM active**  
in deep sleep mode

**Digital Microphone Subsystem**  
(Stereo interface and Hardware Voice Activity Detector)

**Leverage ROM for USB, I2C and SPI drivers**  
along with bootloader

**RTC available for all power modes**  
(from Active down to deep power down mode Consuming 390 nA)



**Crystal-less FS USB capable**

**Scalable RAM retention allowing further power reduction**  
With individual power down options

**Extended RAM for sensor and Digital Mic data buffering**  
Without requiring power to flash

**Leverage Asynchronous Peripheral Bus and DMA**  
collect and move data without CPU intervention

**Flash updates via USB supported**

# NXP's Power-Efficient Microcontrollers

## Range of Performance & Integration Options

### LPC5410x

#### Baseline

**Cortex-M4F at 100 MHz**  
1.62 V to 3.6 V  
256-512 KB Flash  
104 KB RAM

#### Differentiating Features:

- Optional Dual Core (Cortex-M0+)
- <100uA / MHz (Cortex-M4)
- Digital Mic Subsystem

**Available Now**

LQFP64  
CSP49

### LPC5411x

#### FS USB Large Internal SRAM

**Cortex-M4F at 100 MHz**  
1.62 V to 3.6 V  
128-256 KB Flash  
96-192 KB RAM  
FRO, FS USB

#### Differentiating Features:

- Optional Dual Core (Cortex-M0+)
- <80uA / MHz (Cortex-M4)
- Flexible Comm Interface
- Digital Mic Subsystem

**Available Now**

LQFP64  
CSP49

### LPC546xx

#### Performance & Integration

**Cortex-M4F up to 220 MHz**  
1.71 V to 3.6 V  
256-512 KB Flash  
136-200 KB RAM  
FRO, FS/HS USB

#### Differentiating Features:

- 100uA / MHz (Cortex-M4)
- Flexible Comm Interfaces
- TFT-LCD Controller
- External Memory Interface
- Ethernet PTP IEE1588 v2
- Dual CAN2.0 / CAN-FD
- Digital Mic Subsystem

**Available Now**

LQFP208, TFBGA180  
LQFP100, TFBGA100

# LPC546xx Family Introduction

Power-efficiency, Advanced HMI & Flexible Comms for next-generation IoT



- ✓ **Low Active Current with up to 220 MHz Performance**
  - ARM Cortex-M4F core running at 100  $\mu$ A / MHz
- ✓ **Advanced HMI & Flexible Communication Peripherals**
  - Up to 21 flexible communication peripherals to interface with memory, connectivity modules, and a variety of sensors
  - Numerous wake-up sources, ample timers
  - Integrated TFT control allows to keep the overall cost and complexity to a minimum
- ✓ **Comprehensive Enablement**
  - Complimentary MCUXpresso IDE and Software Development Kit (SDK)
  - Faster time to market with comprehensive development hardware and reference designs

# LPC546xx Target Applications

## Industrial, Building, Energy, General Embedded

- Diagnostic equipment
- Industrial control devices
- PLC
- Data aggregator & comms. hub
- Building control & automation
- HVAC control
- Multi-protocol bridge
- Data acquisition
- Medical/industrial grade scale
- Scanners / Mini printers



## Consumer, Smart Home & Automation

- Small Appliance
- White Goods HMI
- Thermostat
- In Home Display (IHD)
- IOT gateway
- Security monitoring
- High end gaming accessories
- Fitness equipment
- Audio accessories



## Automotive Aftermarket

- Satellite Radio
- Portable GPS Tracker
- Data aggregator for Infotainment/Navigation
- Fleet Management/Telematics
- Vehicle Diagnostic
- Tachograph
- OBD-II

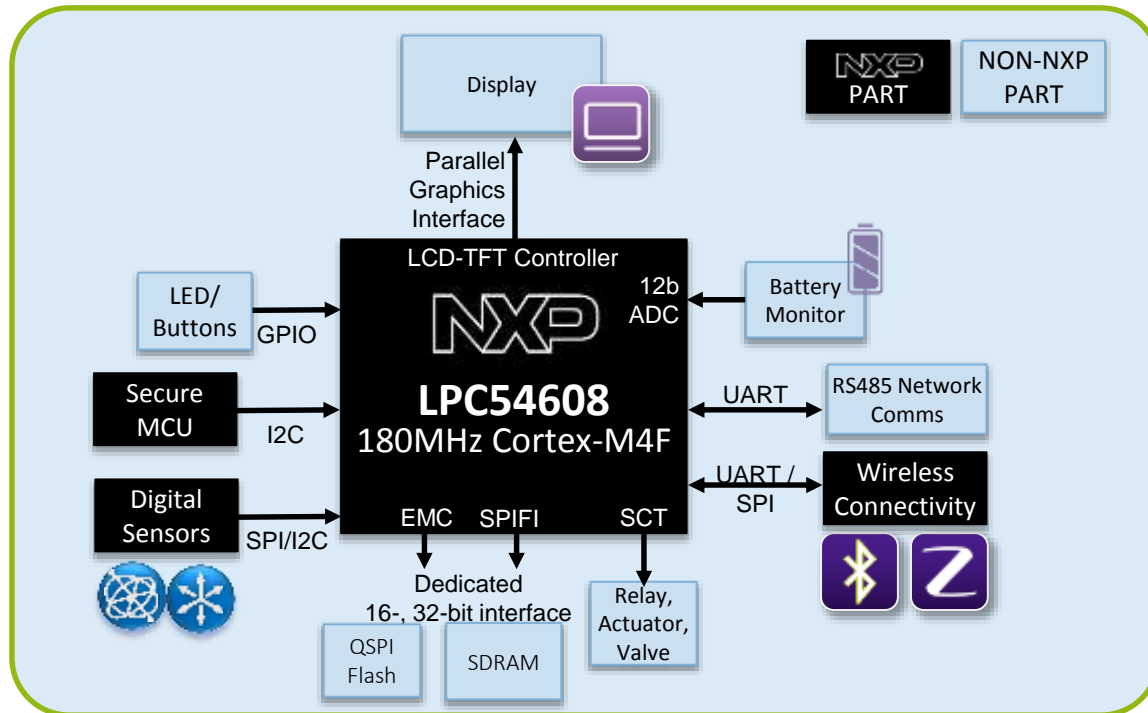




# Typical Application

## Connected, HMI Control Panel/Edge Node in Industrial Applications

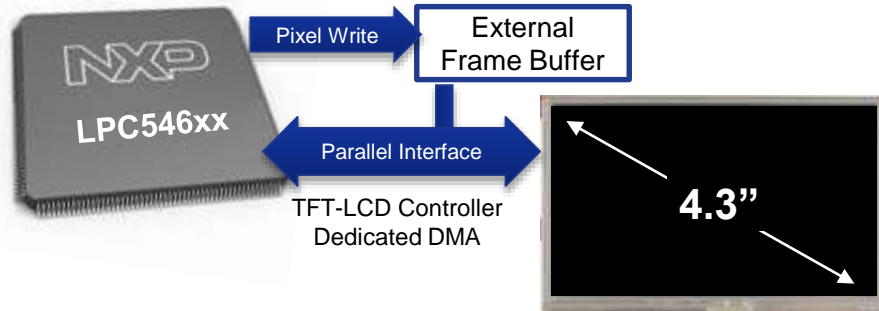
**LPC546xx Family of MCUs** Combine a 180MHz Cortex-M4, for real-time performance, with its unique architecture for outstanding power-efficiency.



### Key Features:

- 30 channel Direct Memory Access (DMA)
- Fast wake-up & mode transitions with 12 MHz Free Running Oscillator (FRO) trimmed to +/- 1% accuracy
- Multiple Levels of Code Read Protection (eCRP) with a 128 bit unique identification
- Powerful, feature rich 32-bit timers, including State Configurable Timer (SCT/PWM)
- Flexible communication interface with up to 10x USARTS, I2C (supporting FM+) and SPI, along with up to two I2S
- Large availability of GPIOs (up to 171) with fast access (on AHB), DMA support of GPIO ports
- Ethernet with IEEE1588 PTP, Dual CAN supporting CAN-FD and CAN2.0
- FS & HS USB with integrated PHY
- Flexible wake-up & clock sources

# Graphics – 24-bit LCD Interface Supports up to XGA



## Features and Advantages

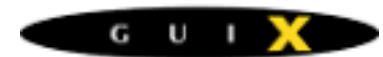
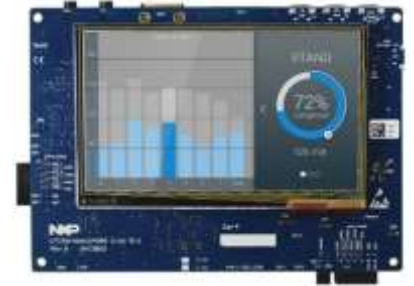
- Up to 1024x768 resolution
- 24-bit LCD interface supports 24bpp (16M colors)
- Palette table allows display of up to 256 of 64K colors
- Dedicated LCD DMA controller
- Hardware cursor support

## Enablement and Third Parties

- Free MCUXpresso IDE with SDK, configuration tools
- LPCXpresso54608 Development Board
- LCD App notes and Design recommendation
- Complementary Segger emWIN to develop GUI applications
- Additional GUI solutions from industry leading partners

## Target Applications

- Thermostat
- Appliance/White Goods HMI
- Fitness equipment
- Industrial Panel



# LPC's Complete Offering of Graphics Solutions

## Segger emWIN Provided Complementary with NXP's MCUXpresso SDK

- Offered as Library + API in C language, compatible with any RTOS (although not required)
- GUI tool builder available
- Source Code from Segger available with a per product license fee
- Free/no royalty required



Provider / Product	Type	Language	GUI Tool Builder	Business model	RTOS Required
TARA / Embedded Wizard	Source code generator	C Javascript	Yes	Developer seats Volume based product line license	Optional (any)
Draupner / TouchGFX	Library + API	C++	Yes	Free developer tools Volume based product line license	Recommended (any)
MicroEJ	Library + API	C/C++ Java	Yes	Part of MicroEJ platform Developer seat licenses Volume based licenses	Yes (MicroEJ)
expresslogic / GUIX	Library + API	C	Yes	Source code per product license	Yes (ThreadX)



# Enablement: LPC546xx Development Board

**OM13092**  
**Base Development Board**  
**On-board Display**

**OM13094**  
**CAN-FD Enabled Kit**  
**CAN Physical Transceiver Shield**  
*(no display)*

Ported to **LPC546** Platform

**ODB Experts**  
**Software Stack**

**Available Graphics Library**  
Draupner TouchGFX,  
Segger emWIN,  
Tara Embedded Wizard,



## **Additional (new) on-board features:**

- 16MB Micron SDRAM (required for graphics)
- Ethernet (PHY, magnetics & connector)
- DMIC (Knowles Morello)
- I<sup>2</sup>S connected CODEC with Line In/Out
- SD/MMC card (SDIO)
- Accelerometer on I<sup>2</sup>C
- 16MB Micron QSPIFI with XIP

- **LPC54608 in BGA180 package**
  - Cortex-M4F@180MHz
- **Standard LPCXpresso features:**
  - Link2 OBD / external debug
  - Wake, ISP, Reset buttons
  - HS micro USB AB connector
  - FS micro USB AB connector
- **4.3" cap touch display (parallel interface)**
- **2 x PMod expansion connectors**
- **Expansion connectors**
  - Can support Arduino shields such as WiFi modules





# ENTRY-LEVEL

Cortex-M0+ MCUs



# LPC Entry-Level 32-bit Microcontrollers

**Exponential Growth Driven by Need**  
to Sense, Monitor, Connect & Control the World Around



## LPC800 MCU Series

- Cortex-M0+ w/ 15MHz (planned) & 30 MHz platforms
- From 8 to 64KB flash
- Scalable differentiated peripheral options
- Flexible Packages Options
  - TSSOP, LQFP, QFN, XSON (tiny)

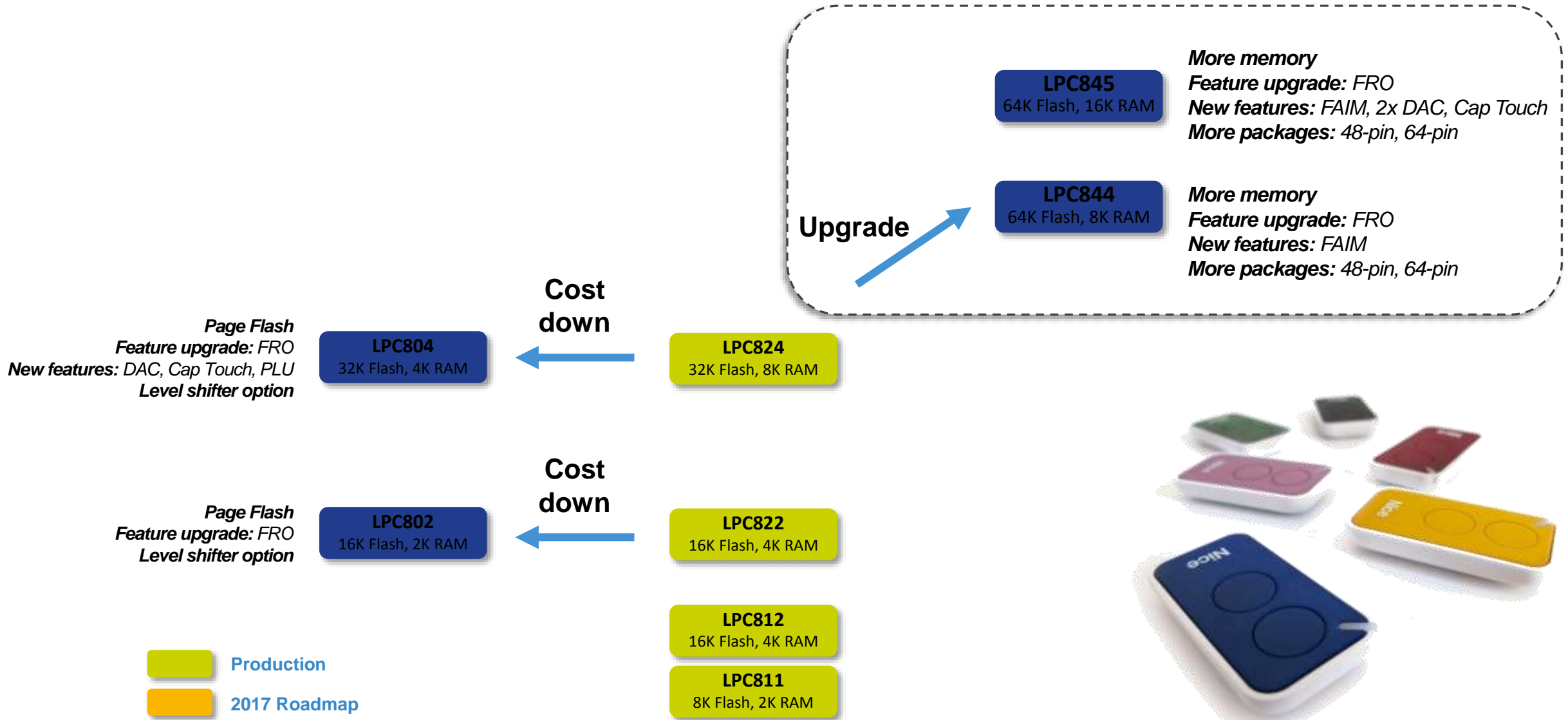
## LPC1100 MCU Series

- 50 MHz Cortex-M0+ platform
- Up to 256K Flash, 36KB SRAM
- Options with FS USB, CAN, EEPROM
- LQFP package scalability with small QFN/BGA options





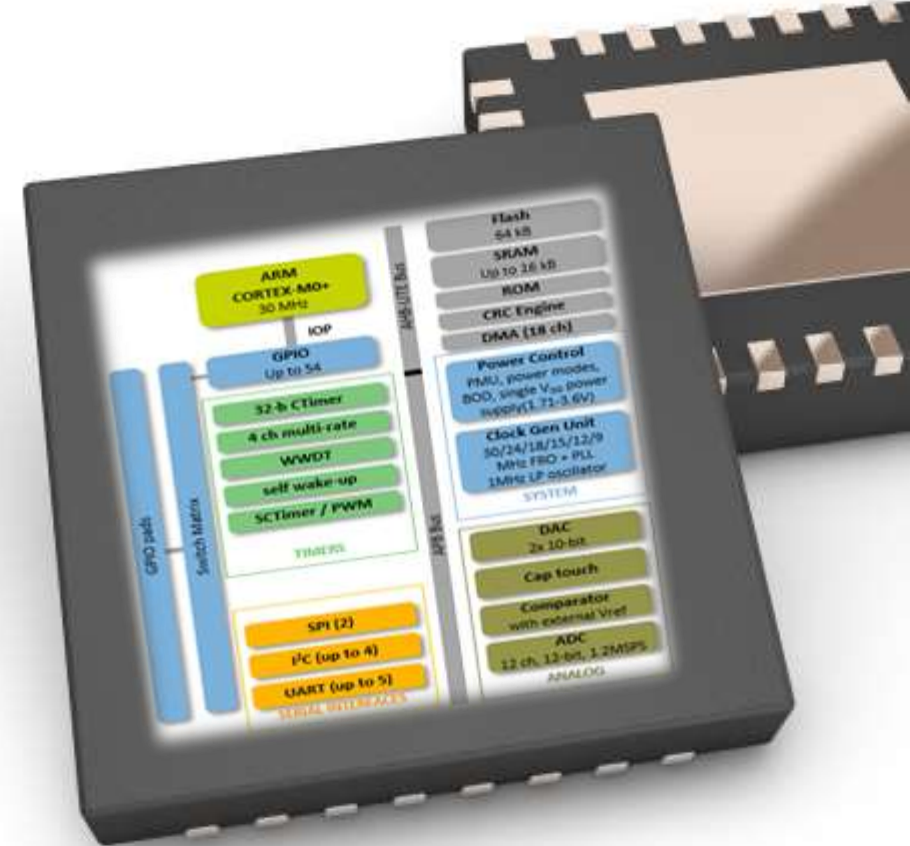
# LPC84x Part of NXP's Rapid Expansion of the LPC800 Series



# New LPC84x Family

## Builds on LPC800 Series Power Efficiency & Flexibility

- **Exceptional power efficiency, down to 90  $\mu$ A/MHz (active) in the clock source**
  - 30-MHz Cortex-M0+ ARM core
  - Free Running Oscillator (FRO) with +/- 1% accuracy
  - Five power modes
  - Power profile APIs for simple runtime power optimization
- **More memory**
  - 64 kB Flash, small 64 B page size suitable for EEPROM emulation
  - 16 kB RAM (Logic for Bit banding across all of SRAM)
- **FAIM** is used to configure the part at start-up
  - Pin configuration including direction and pull- up or pull-down
  - Clocks and PMU for low-power start-up
- **Full range of timing features from basic to advanced (SCTi)**
  - Flexible triggers to optimize power use

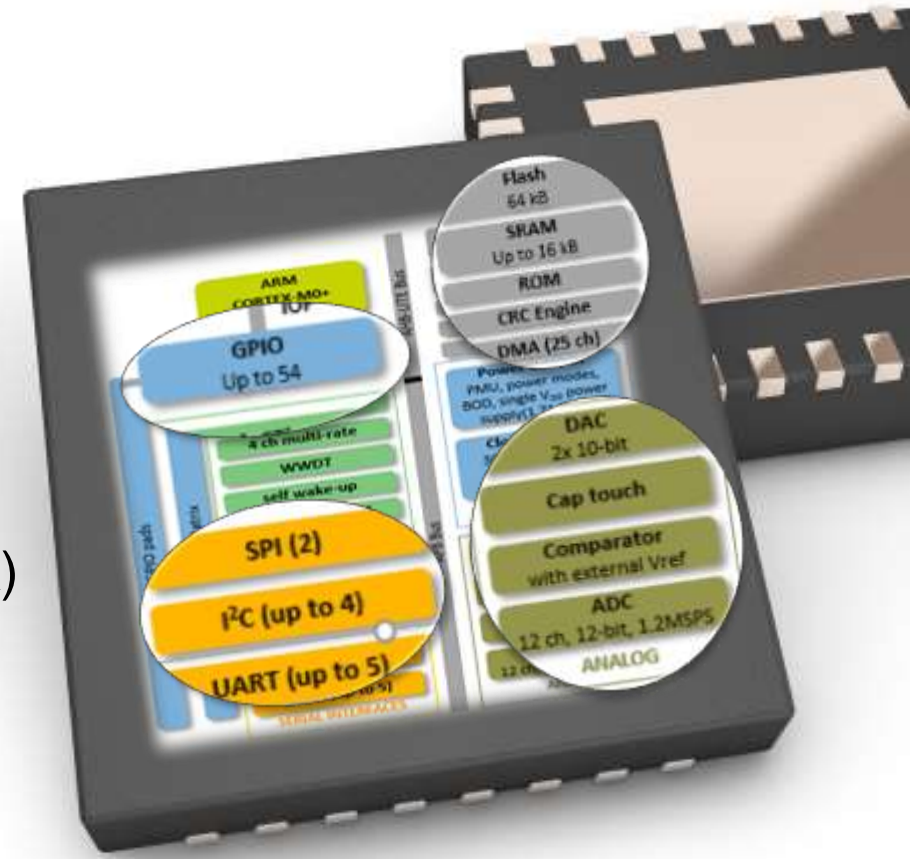




# New LPC84x Family

With Features to Extend Application Versatility ...

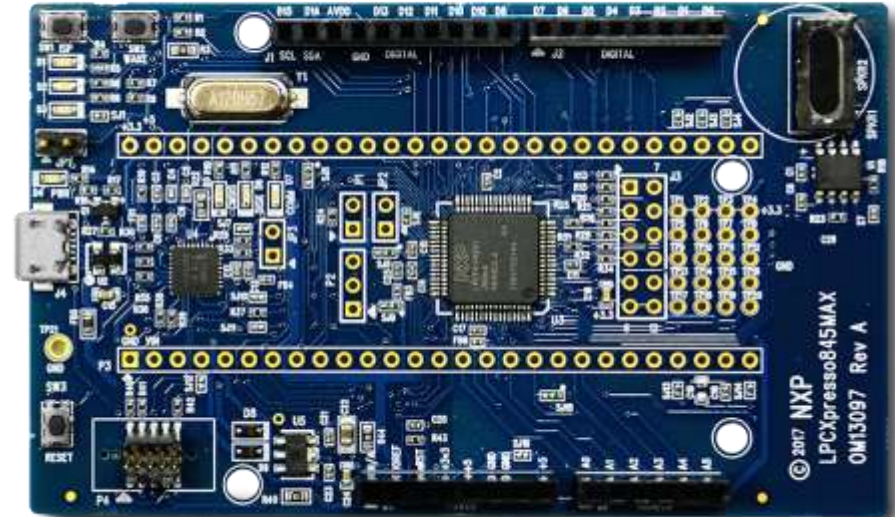
- **Accurate 1.2-Msps ADC: 12 ch, 12-bit**
  - Ideal for oversampling to improve conversion accuracy
  - Flexible triggers to optimize power use
- **Digital-to-Analog Converter (DAC) : 2 ch, 10-bit**
- **Capacitive touch interface : 9 ch**
- **More serial connectivity** (w/ added baud rate & individual clock)
  - 4 I<sup>2</sup>C for digital sensor interface and more
  - 2 SPI, 5 UART
  - 54 GPIO with switch matrix, support input pattern match engine
- **Simplified board layout with flexible I/O pin configuration** (switch matrix)
- **25-ch DMA** offloads core for better throughput and power efficiency
- **ISP supports via UART, SPI and I2C**
- **105 °C temp rating**





# LPCXpresso845-MAX Board (OM13097)

- ✓ **NXP Software Code Bundle**
- ✓ **Free MCUXpresso IDE & 3<sup>o</sup> Party Options**
  - LPC845 in LQFP64 package
  - On-board CMSIS-DAP debug interface
    - Supported by MCUXpresso IDE and popular 3<sup>rd</sup> party IDEs
    - Includes VCOM support (UART bridged via USB to host)
  - Expansion options
    - Arduino UNO R3-compatible connectors
    - LPCXpresso and Pmod<sup>®</sup> options
    - Prototyping area
  - User application test features
    - Red, Green and Blue user LEDs for test & debug
    - On board speaker with driver
    - User button
    - Easily configured for LPC845 power measurement
  - USB powered
  - UART, SPI, I2C ISP boot-capable



Orderable Part Number: **OM13097UL**  
<http://www.nxp.com/demoboard/OM13097>





**THANK YOU**



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