

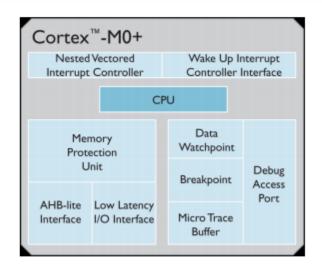
Introdução a família Kinetis K2 Freescale ARM Cortex M0+

Prof° Fernando Simplicio



Núcleo ARM cortex-M0+

- Processador ARM com a maior eficiência de consumo
- Performance de 32 Bits com preço de 8 Bits
- Conjunto de instruções otimizado, possibilitando uso eficiente de memória de programa
- Compatibilidade com núcleos ARM cortex-M3 e cortex-M4



Mais informações:

http://www.arm.com/products/processors/cortex-m/cortex-m0plus.php



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Reduced Instruction Set

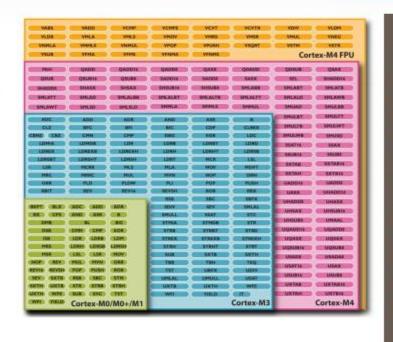
Cortex-M0+

Only 56 Instructions

Mostly coded on 16-bit

 Operate on the 32-bit registers

 Option for fast MUL 32x32 bit in 1 cycle



Fully upward compatible to Cortex-M3 and Cortex-M4



Confidential and Proprietary

Freezoite, the Freezoite topo, All Vinc, CA, Cush TEST, Cathell serus, Castiff-ley, CASF-ley, C-Ware, the Energy Efficient Solutions topo, Khoten, model CT, Posse Clastific C, Pessinson Engles, Castiff, Castiff



Market Evolution



Feature rich

Easy-to-use

Connectivity

Extended battery life

Sleek design

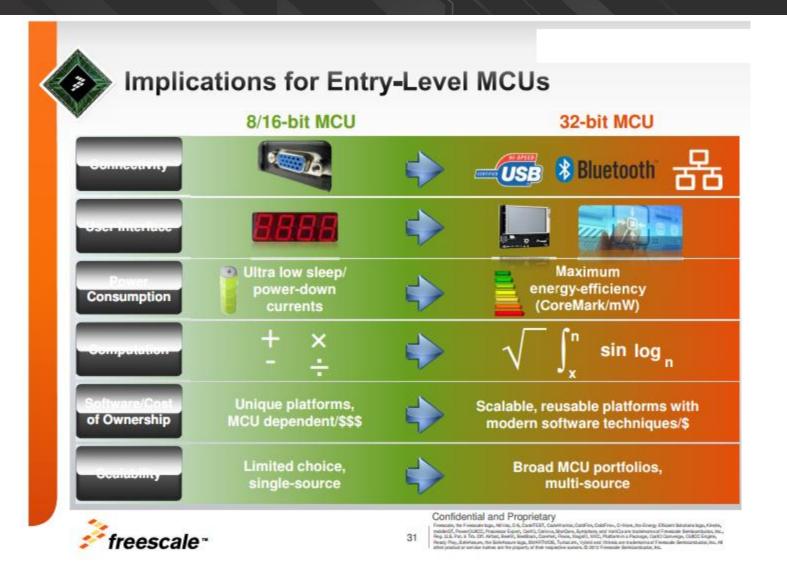


User expectations



Confidential and Proprietary

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Senai Anchieta

Kinetis L Series MCUs: Enabling Differentiation in Entry-Level Products

32-bit

Energy-efficiency

Class-leading Coremark/mW

Scalability & Integration

Kinetis L to K Series (Cortex™-M0+ to M4)

Enablement

Freescale bundle + ARM® ecosystem



Kinetis L Series
The evolution of the entry-level MCU

8-bit

Low Static Power

<1uA power modes

Low cost

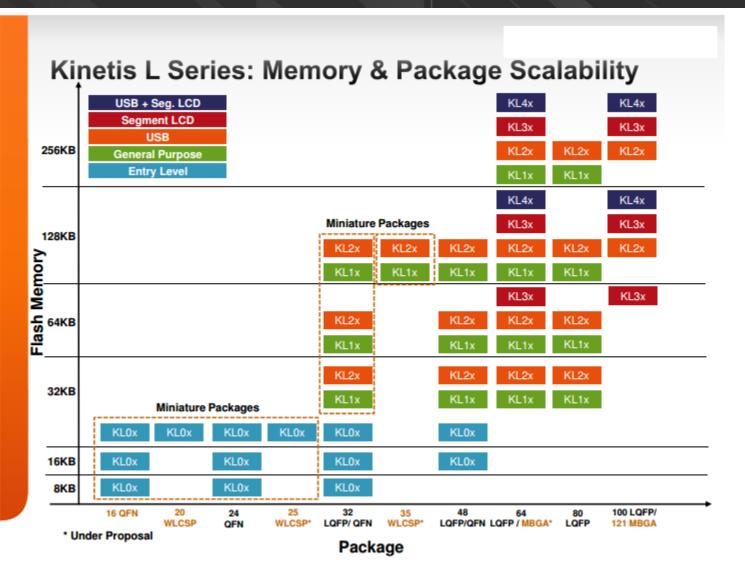
From <\$0.50 USD

Ease-of-use

Freedom Platform, Processor Expert & MCU Solution Advisor

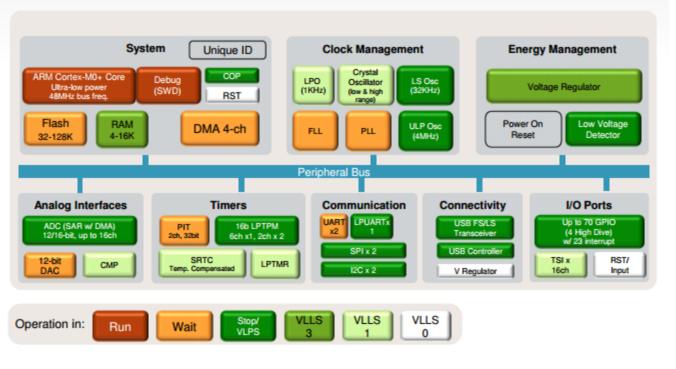


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Available 2012 Kinetis L Series: MCU Families Available 2013 Common Features **Optional Features Key Features** System Pin Family Flash SRAM ARM Cortex-M0+ Core, 48MHz USB Count DMA ADC DAC 128 TSI LCD OTG Multiple low-power modes & peripherals, low-power Boot, Clock Gating KL46 128-256KB 16-32KB 64-121 Y 16-bit 12-bit Ŧ Y 1.71-3.6V, -40 to 105°C [1] Memory KL36 64-256KB 8-32KB 64-121 16-bit 12-bit 90nm TFS Flash, SRAM KL34 64KB 8KB 64-100 12-bit Internal Memory Security/Protection **Analog Peripherals** KL26 128-256KB 16-32KB 64-121 ¥ Y 16-bit 12-bit Y 12/16-Bit ADC KL25 32-128KB 4-16KB 32-80 Y Y 16-bit 12-bit Y High-Speed Comparators KL24 32-64KB 4-8KB 32-80 Y Y 12-bit Serial Interfaces UART(Including 1 LPUART) **KL16** 256KB 16-32KB 64-80 16-bit 12-bit Y ¥ SPI, IIC KL15 32-128KB 4-16KB 16-bit 12-bit 32-80 Timers KL14 32-64KB 4-8KB 32-80 12-bit Real Time Clock [2] 16bit Low Power TPMs (GP Timer/PWM) KL05 8-32KB 1-4KB 24-48 12-bit 12-bit Low Power Timers KL04 8-32KB 1-4KB 24-48 12-bit 32bit Periodic Interrupt Timer KL02 8-32KB 1-4KB 16-32 12-bit [1] Feature not available on CSP packages [2] For KL02, use software to support Microcontrolador presente na Freedom Board (KL25) freescale*

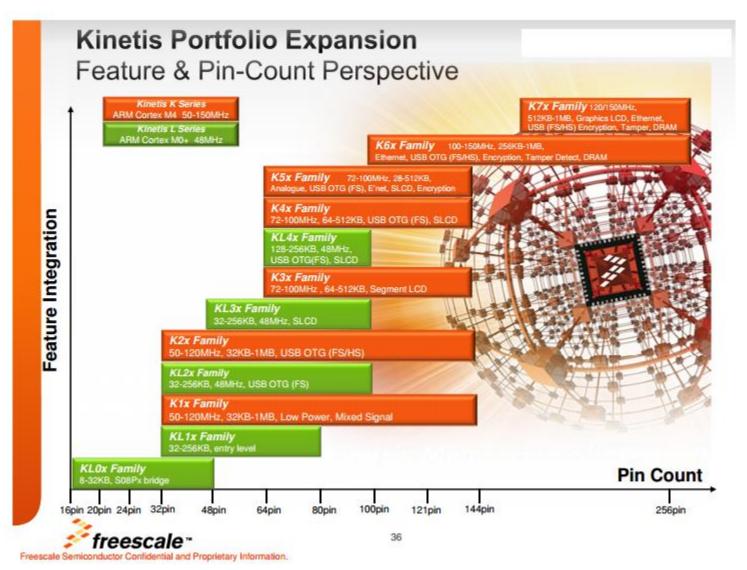
Kinetis L Series: KL24/25 Family Block Diagram



Packages: 32QFN, *35WLCSP, 48QFN, 64LQFP, *64MBGA, 80LQFP

* Under Proposal





Kinetis K/L Series: Packaging

Common Packages



32QFN 5 x 5 mm 0.5mm pitch (K10/20) (KL0/1/2)



48QFN 7 x 7 mm 0.5mm pitch (K10/20) (KL1/2)



32LQFP 7 x 7 mm 0.8mm pitch (K10/20) (KL0x)



48LQFP 7 x 7 mm 0.55mm pitch (K10/20) (KL0)



64LQFP 10 x 10 mm 0.5mm pitch (K10/20/30/40/50) (KL1/2/3/4)



Kinetis K Series Package

80LQFP 12 x 12 mm 0.5mm pitch (K10/20/30/40/50) (KL1/2)



*Proposed

100LQFP 14 x 14 mm 0.5mm pitch (K10/20/30/40/50/60) (KL2/3/4)



64MAPBGA 5 x 5 mm 0.5mm pitch (K10/20) (KL1*/2*/3*/4*)



121MAPBGA 8 x 8 mm 0.65mm pitch (K1/2/30/40/50/60) (KL2/3/4)

Kinetis K Series only

New





90CSP 4 x 4 mm 0.4mm pitch (K10*/20*)



121CSP 5 x 5 mm 0.4mm pitch (K10/20/60)



143CSP 6 x 6 mm 0.4mm pitch (K61)

Kinetis L Series only



25CSP 2.35 x 2.88 mm 0.4mm pitch (KL0*)



35CSP <3 x 3 mm 0.4mm pitch (KL1*/2*)



24QFN 4 x 4 mm 0.5mm pitch (KL0)



144LQFP 20 x 20 mm 0.5mm pitch (K10/20/30/40/50/60)



144MAPBGA 13 x 13 mm 1.0mm pitch



256MAPBGA 17 x 17 mm 1.0mm pitch (K60/70)

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The Freescale Tower System MCU/MPU Module: Tower controller board A modular development platform for Standalone or in Tower System 8/16/32-bit MCUs & MPUs Primary Elevator - Quickly combine Tower Modules to build a prototype of your application - Modules sold individually or in kits - Open Source: Build your own Tower Module to integrate your IP Board Cost-optimized hardware Connectors Secondary - Software support from Freescale and Elevator Peripheral Module: Third Parties Up to 3 per system: Serial, Memory, LCD,... - Growing community of Third Party Mix & match with different hardware support - On-line community: www.towergeeks.org Rapidly build a prototype of your end application



TWR-MEM

TWR-LCD

TWR-SENSOR-PAK

Build Your System (3 steps or less)



Tower System



1. Choose a Processor (MCU/MPU) Module



- 2. Choose Peripheral Modules and Tower Plug-Ins (TWRPIs)
 - Up to 3 peripheral modules
 - One additional side-mounting peripheral modules
 - Multiple TWRPIs



3. Connect each module to the **Elevator Boards**

Tower System: Your Prototyping Solution



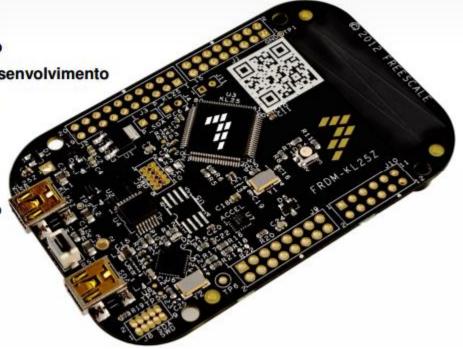
- More than 50 unique controller and peripheral modules
- Spans Freescale's MCU/MPU portfolio, including Kinetis (ARM® Cortex™-M4), Power Architecture®, ColdFire, 16-bit, DSC, 8-bit
- · Partner solutions add to the ecosystem

freescale.com/tower

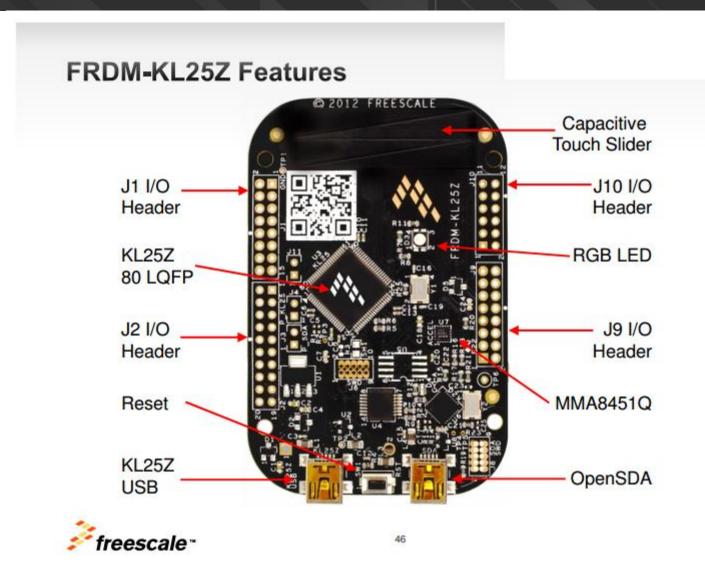


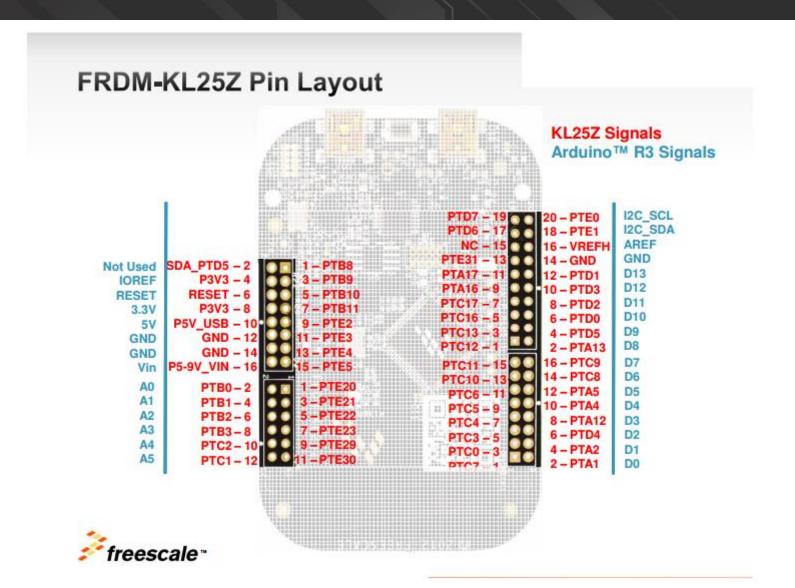
Freescale Freedom Development Platform FRDM-KL25Z

- Ferramenta de baixo custo
- · Facilidade e rapidez de desenvolvimento
 - Acesso fácil aos I/O's do MCU
 - Possibilidade de conexão de bateria.
 - Compatibilidade com Arduino
 R3
 - Moderna Interface de gravação e depuração OpenSDA
 - Flexibilidade de fontes de alimentação



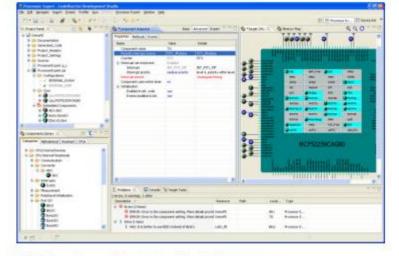




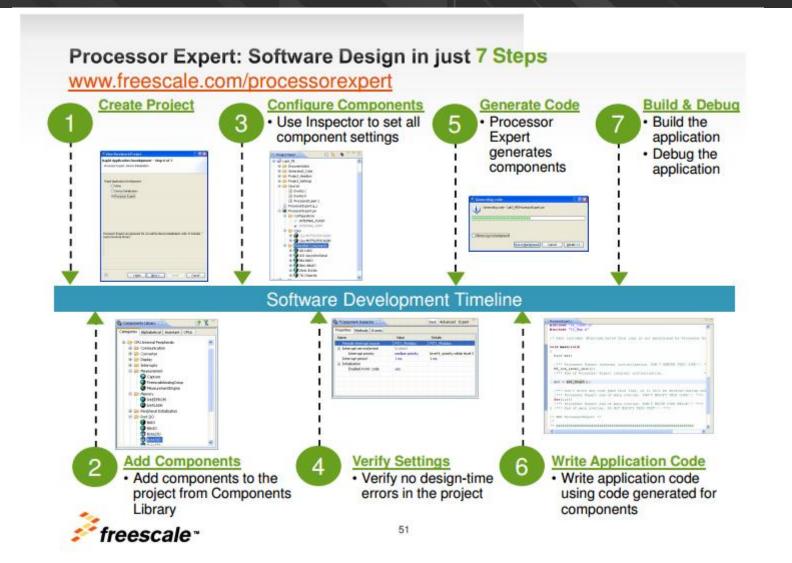


Processor Expert Software

- Silicon configuration, and so much more
- A software system to
 - Create...
 - Configure...
 - Optimize...
 - Migrate...
 - Deliver...
- Reusable components
 - Drivers and libraries
- For Freescale silicon
 - Kinetis, S08, S12, ColdFire, DSC, some Power Architecture
- Integrated in CodeWarrior but MCU support is also available standalone as the Microcontroller Driver Suite





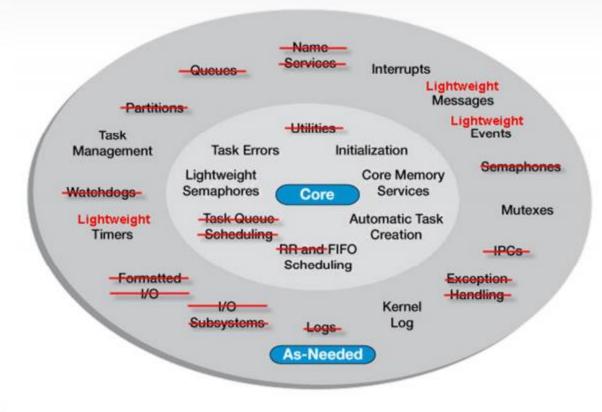


MQX Lite RTOS: Overview

- Very light MQX kernel for resource-limited MCUs
 - Targeted at the Kinetis L family initially
 - Packaged as a Processor Expert component
- I/O capability provided by Processor Expert
 - USB via FSL bare-metal stack, also a Processor Expert component
 - No POSIX-like drivers or file access
- Programming model allows upward code migration
 - It is a true subset of the full MQX RTOS
 - Code built with MQX Lite will move to full MQX RTOS easily
 - Same task templates, same API some very minor differences



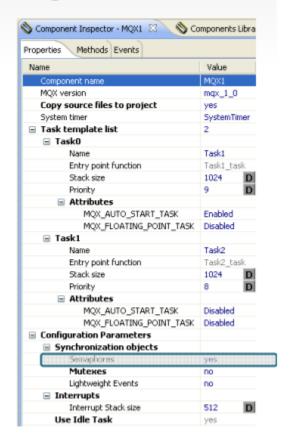
MQX Lite RTOS: Overview





MQX Lite and Processor Expert Integration

- MQX Lite delivered as an RTOS adapter
 - Interrupt mechanism in MQX is unchanged
 - Processor Expert LDDs work with the RTOS
- All peripheral drivers provided by Processor Expert LDD components
- Set up and configure tasks in Component Inspector
- Easy to add MQX Lite to existing app
 - Just drop in the MQX Lite component



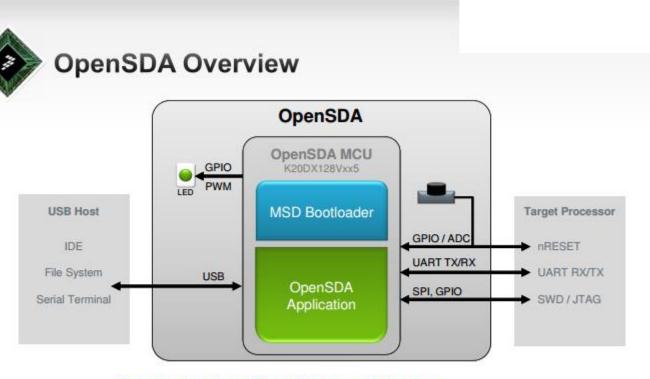


Kinetis L Series: IDE Support

	Freescale CodeWarrior CodeWarrior	Keil (MDK) An ARM® Company	IAR (EWARM) IAR SYSTEMS	Code Red (RedSuite)	Atollic (TrueSTUDIO) a atollic
Kinetis L Basic Device Support	Yes, 10.3 Public Beta 9/25 Production 11/30	Yes v4.54 avail. now V4.60 9/28	Yes, v6.40.3 avail. now V6.50 10/25	First release date TBD (~Oct)	Yes, v3.2.0 avail. now
Eclipse Version	Indigo	Not Eclipse	Not Eclipse	Juno	Indigo
Processor Expert Support	Fully Integrated	Stand-alone Driver Suite (Eclipse) w/ MDK Eclipse Plug-in	Stand-alone Driver Suite V6.50 EWARM or (Eclipse) IAR Integrated	Integrated	Not available in current products
MQX Task Awareness	Yes (Professional Edition)	Yes	Yes	No	No
MTB Trace	Yes (Production Release)	Yes – with CMSIS- DAP and ULINK2	v6.50 w/ I-Jet only (no OpenSDA support)	Yes	Coming in a 2013 release
Low-power Mode Debug	Yes	Coming Soon (v4.60?)	Available only w/ IAR I-Jet Debug Interface	No; coming in a future release	Not available in current products
Free Version Limitations	Special Edition 64KB Debug	Lite 32KB	KickStart 16KB	Kinetis Edition 64KB	Lite 8KB
Download Size	~950MB	~500MB	~800MB	~300MB	~500MB



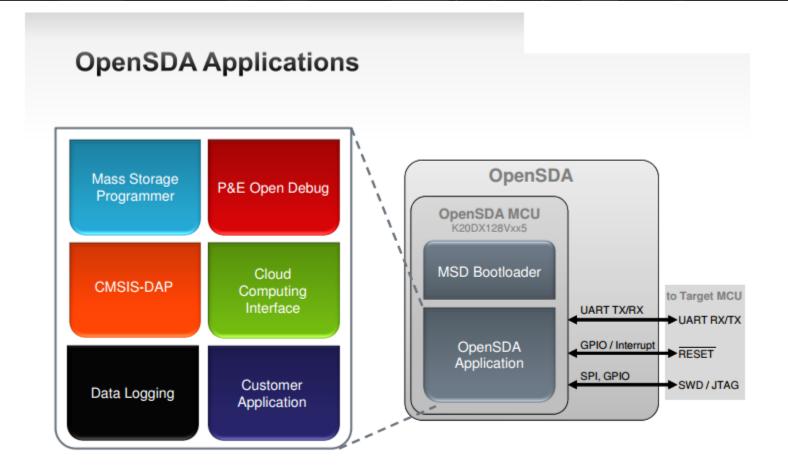
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Open-standard Serial Debug Adapter

- Suporte aos protocolos de depuração SWD e JTAG
- Porta serial virtual (UART)
- Mass-storage bootloader utilizado para carregar uma nova aplicação no microcontrolador





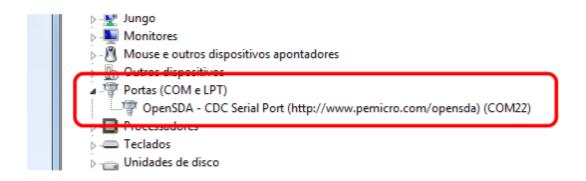


Conectar a Freedom Board (FRDM-KL25Z) ao computador, através da porta USB e interface OpenSDA e verificar a instalação dos drivers necessários.





Verificar se todos os drivers foram instalados, inclusive o da classe USB "CDC", que cria uma porta virtual COM.



Caso ocorra algum problema, instalar o drive CDC com o arquivo "PEDrivers_install.exe", presente no DVD, após a instalação conectar novamente a placa.

Verificar se todos os drivers foram instalados, inclusive o da

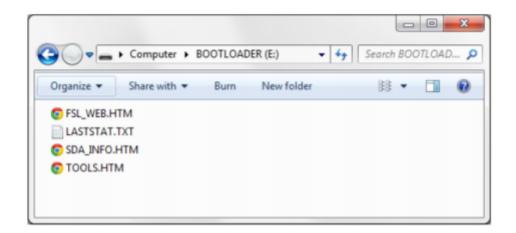
Verificar se o computador reconheceu um "drive virtual", existem 2 nomes possíveis:

- FRDM-KL25Z (X:)
- · BOOTLOADER (X:)

Caso ocorra algum problema, instalar o drive CDC com o arquivo "PEDrivers_install.exe", presente no DVD, após a instalação conectar novamente a placa.

MSD Bootloader:

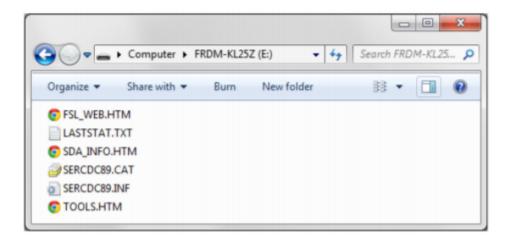
 Realiza gravação de aplicações ou atualização no microcontrolador que controla a interface (K20), não no microcontrolador alvo!!!





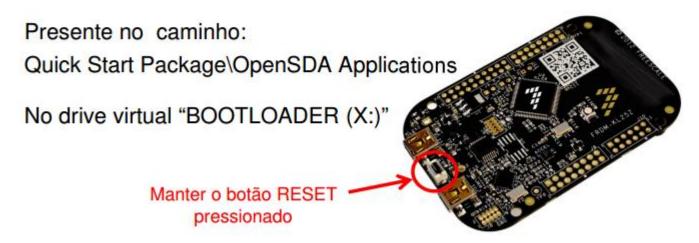
MSD Flash Programmer:

 Realiza gravação de aplicações no microcontrolador alvo.





Ativar o modo bootloader da interface OpenSDA, para isto desconecte o cabo USB da placa, pressione o botão de RESET e com este botão pressionado, conecte o cabo USB, agora vamos configurar a aplicação "MSD Flash Programmer", inserindo o arquivo "MSD-FRDM-KL25Z_Pemicro_v105.SDA"





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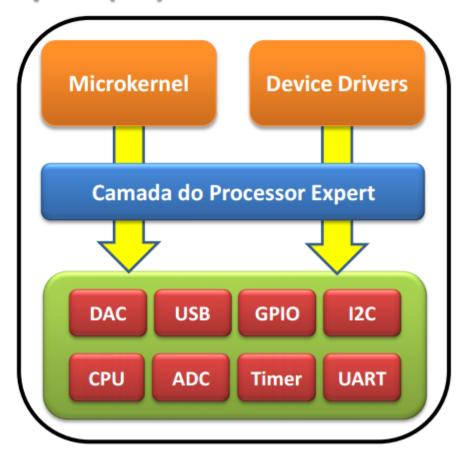
Processor Expert

- Utiliza como conceito um grau de abstração maior
- Possibilita criação de aplicações sem muito conhecimento do microcontrolador alvo
- Permite inserção de objetos (Beans) que se relacionam com os recursos de hardware e periféricos internos do microcontrolador
- O acesso dos recursos de hardware n\u00e3o \u00e9 direto e sim por meio de bibliotecas de fun\u00f3\u00f3es

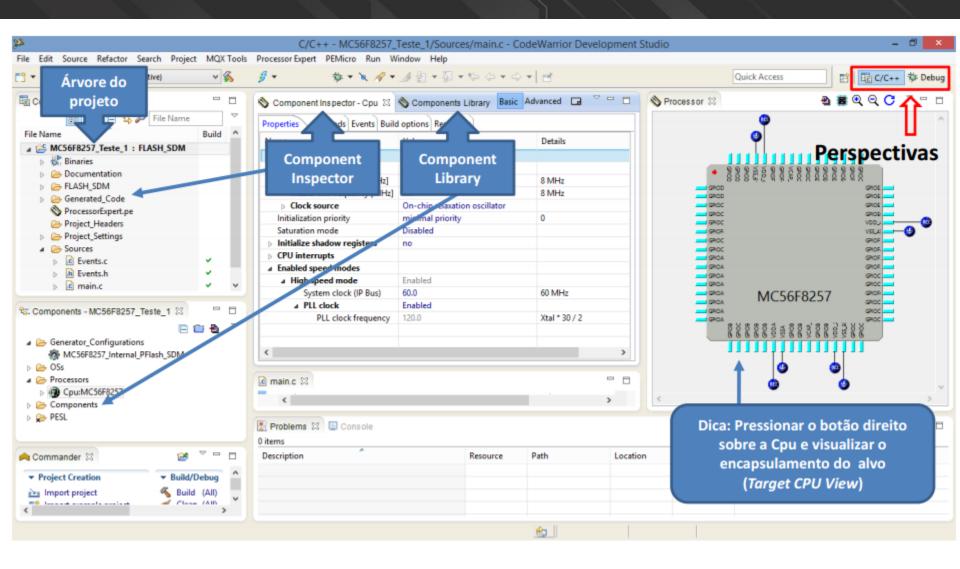


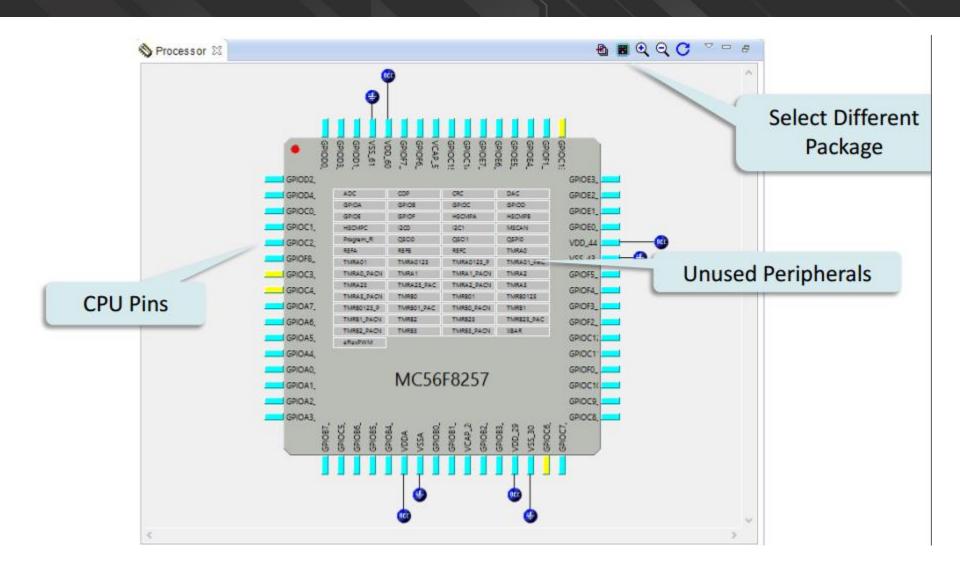
Conceitos do Processor Expert (PE)

Aplicação do usuário com acesso ao hardware via **Processor Expert Camada do Processor Expert** Microcontrolador Periféricos Internos Núcleo



- Componentes (Beans) e Camadas.
- □ High Level Components.
- Logical Device Drivers (LDD Components)
- □ Low Level Components.
- Peripheral Initialization Components.
- PDD Physical Device Drivers:
- □ Apenas disponível para Kinetis e Coldfire+.
- Camada de software para acessar os registradores dos periféricos.
- Necessita de inclusão de arquivo de cabeçário (.h).
- Implementados em grande parte com "macros".





- Propriedades
- Métodos
- Eventos

Properties Methods Events Build options Resources					
lame	Value	Details			
CPU type	MC56F8257				
Clock settings					
Oscillator frequency [MHz]	8.0	8 MHz			
Master clk. frequency [MHz]	8.0	8 MHz			
Clock source	On-chip relaxation oscillator				
Initialization priority	minimal priority	0			
Saturation mode	Disabled				
Initialize shadow registers	no				
CPU interrupts					
Enabled speed modes					
A High speed mode ■ A High speed mode	Enabled				
System clock (IP Bus)	60.0	60 MHz			
	Enabled				
PLL clock frequency	120.0	Xtal * 30 / 2			

Componentes (Beans)

