CEC Continuing Education Center

DesignNews

How to Select the Right Microcontrollers for an Application

DAY 3 : The Modern MCU Selection Process

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Webinar Logistics

- Turn on your system sound to hear the streaming presentation.
- If you have technical problems, click “Help” or submit a question asking for assistance.
- Participate in ‘Group Chat’ by maximizing the chat widget in your dock.
- Submit questions for the lecturer using the Q&A widget. They will follow-up after the lecture portion concludes.

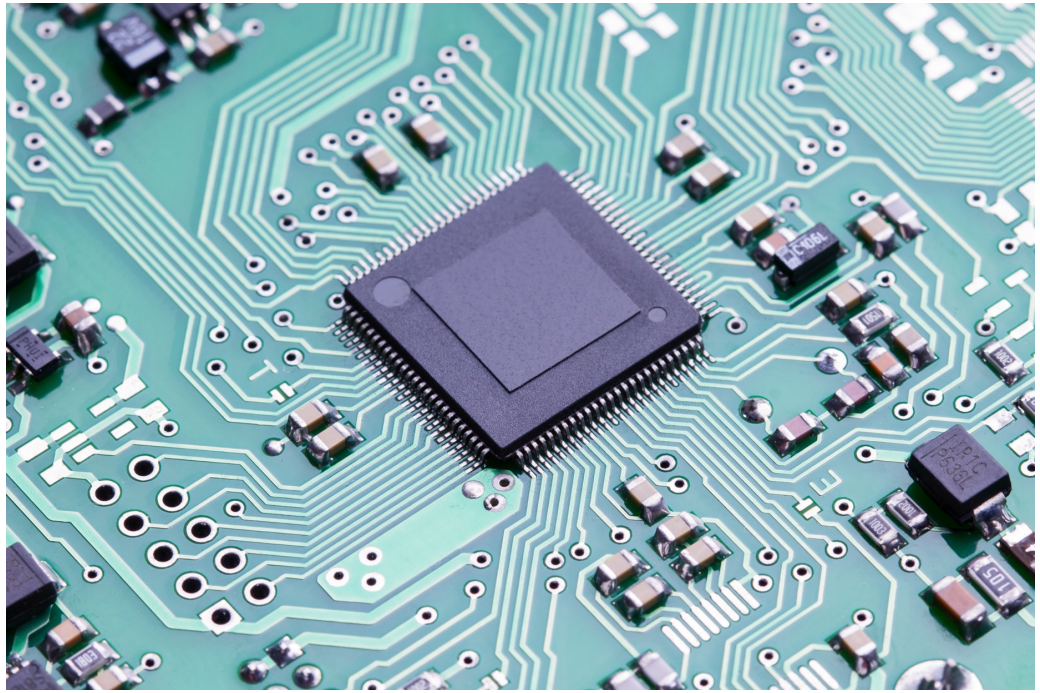
Course Sessions

- The Microcontroller Industry Today
- MCU Selection Criteria
- **The Modern MCU Selection Process**
- Microcontroller Selection Use Cases
- Microcontroller Selection Best Practices

1 The MCU Selection Process

Microcontroller Selection

Hardware



OR

Software

```
506         return 0;
507     }
508
509     int int_board_io(st_board *bio,char *
510     {
511         init_menu_text(bio);
512         bcm2835_init();
513         bcm2835_gpio_fsel(PIN_SW_CANCEL,
514         bcm2835_gpio_set_pud(PIN_SW_CANCE
515
516         bcm2835_gpio_fsel(PIN_SW_ENTER,
```

Which is more important to you in the selection process?

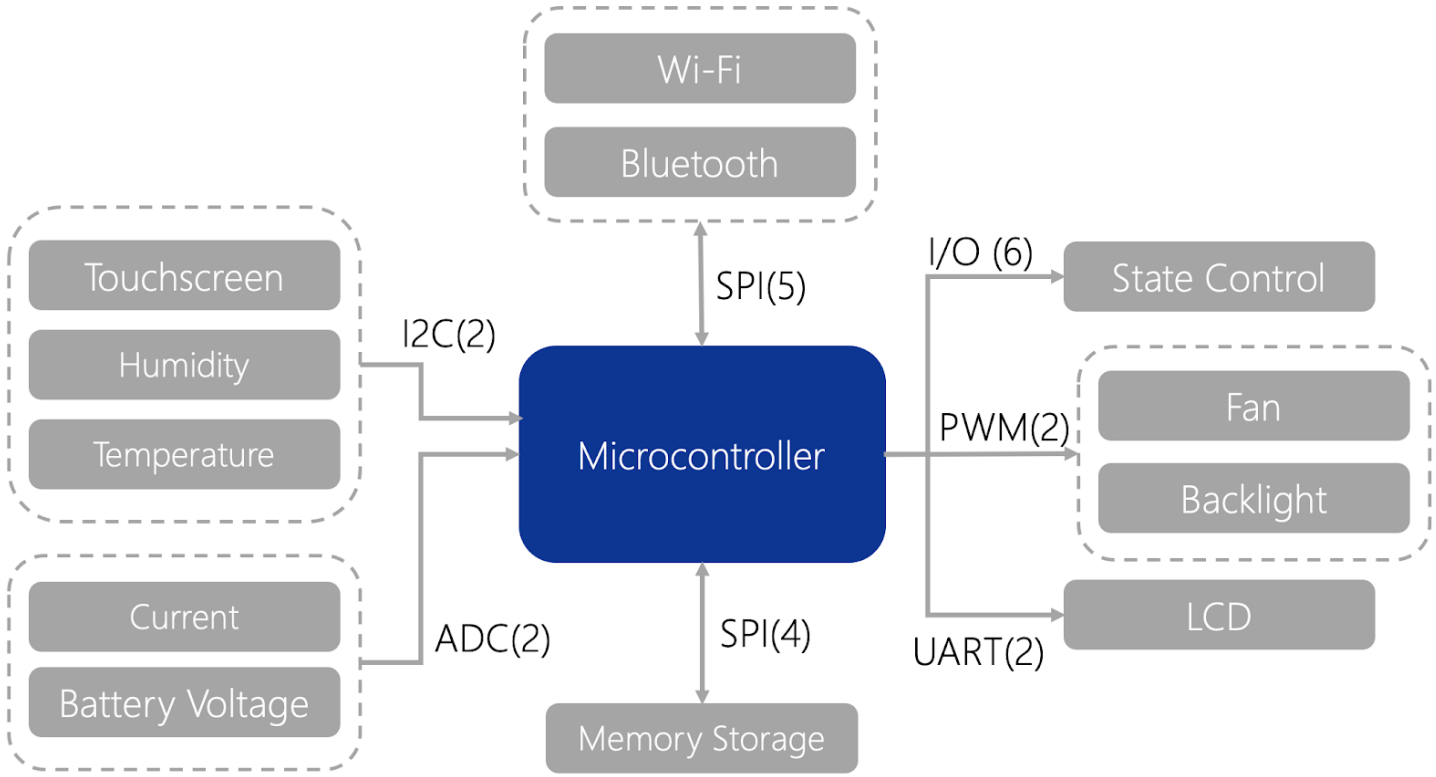
- Hardware
- Software
- Other

1

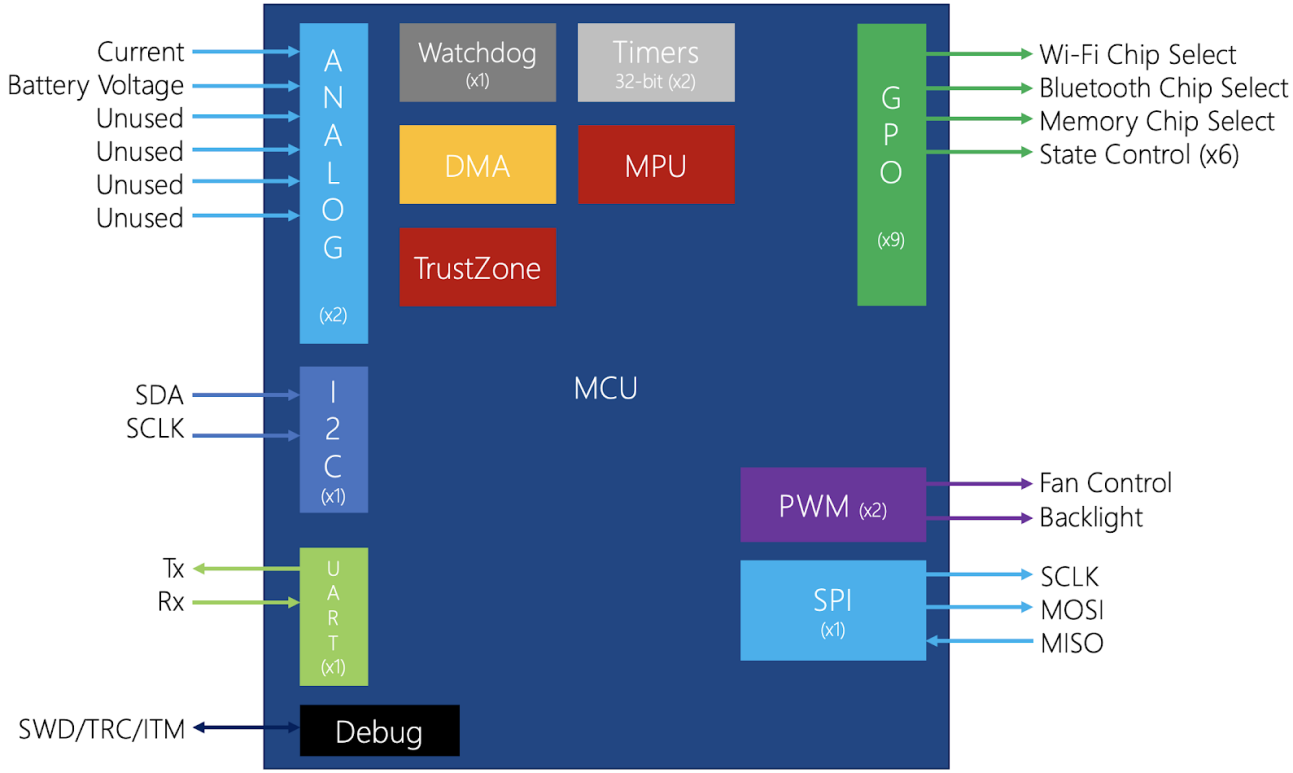
The MCU Selection Process - Take 2

Selecting a modern microcontroller is more than just an electrical process, it's a systems process!

Step #1 – Create a Hardware Block Diagram



Step #1 – Create a Hardware Block Diagram



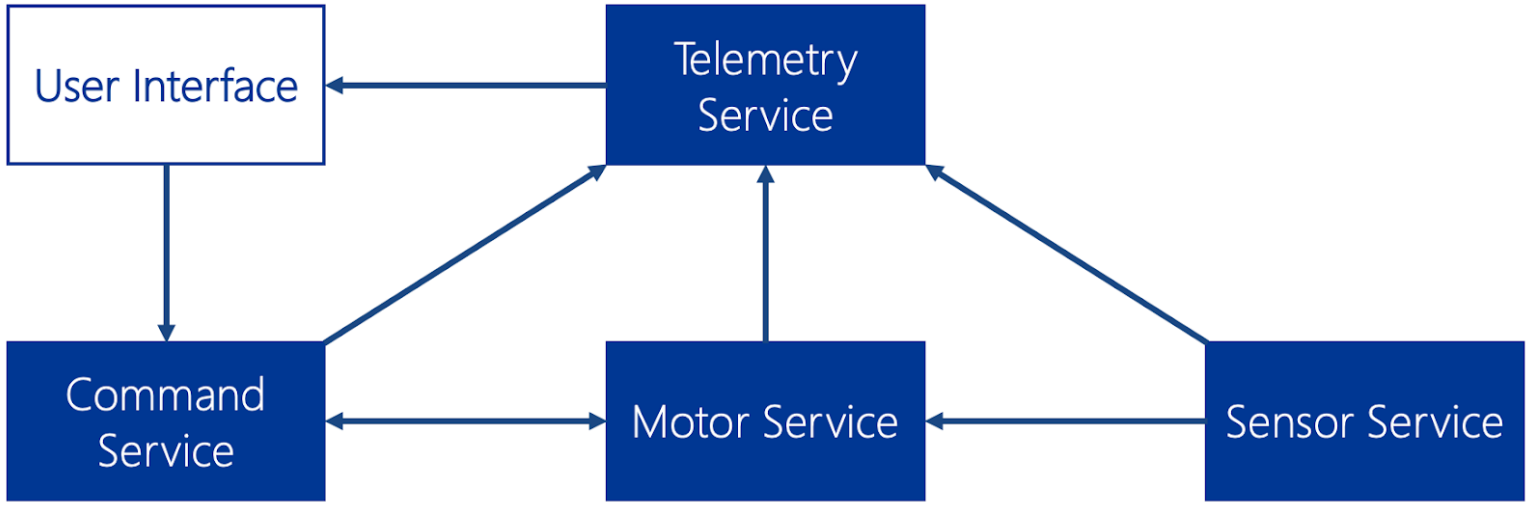
Step #2 – Identify the Systems Data Assets

Data Asset	Asset Type	Data Size	Sample Rate	Processing
Analog	Sensor	32 Bytes	1 kHz	Digital Notch Filter
Digital	Sensor	128 Bytes	1 KHz	Running Average – 5 Sample
Firmware	IP	256 KBytes	-	See design
Keys	Keys	128 Bytes	-	Secure Storage
Device ID	Data	128 Bits	-	Secure Storage

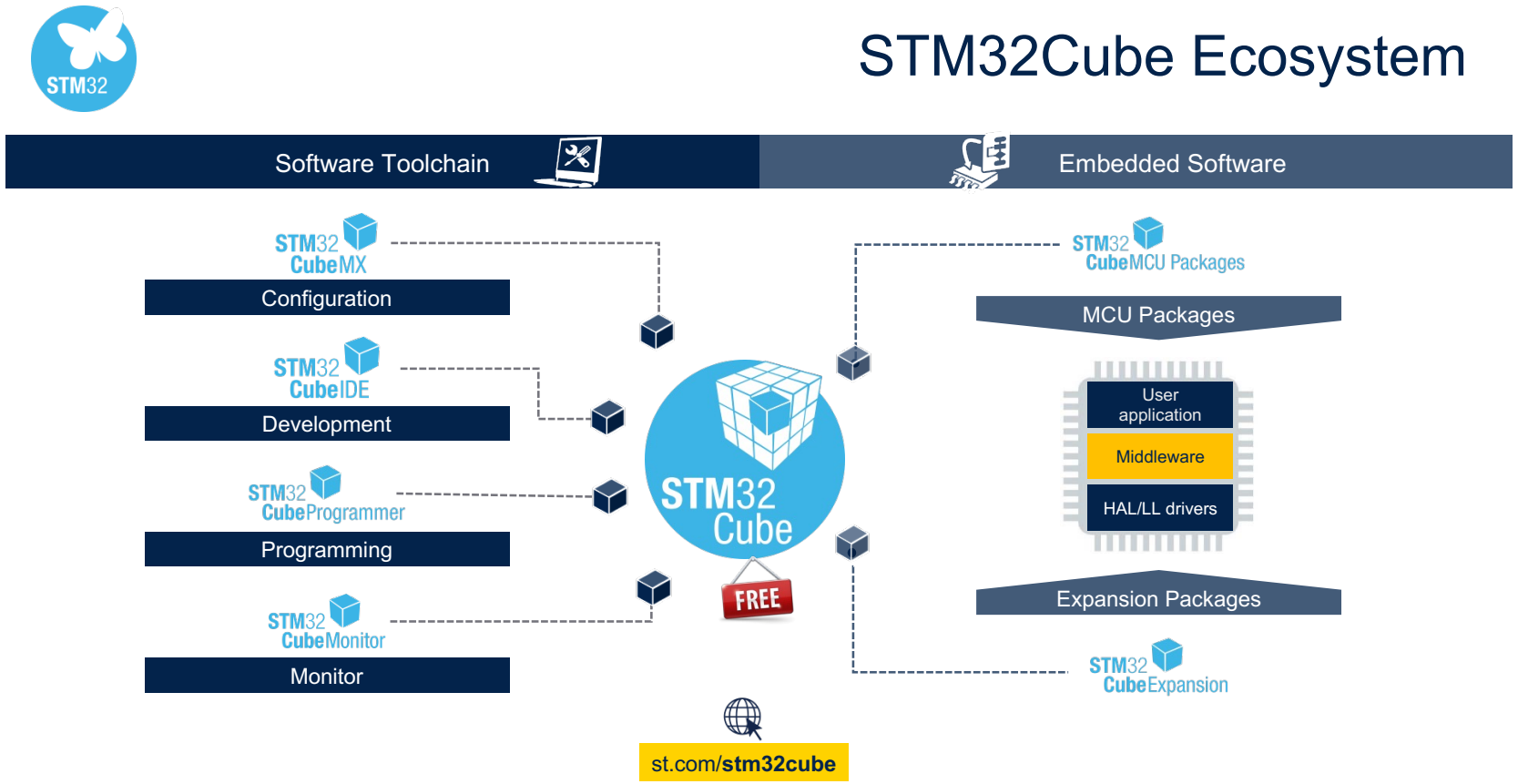
Step #3 – Perform a TMSA

Security Objective	Countered Threats	Targeted Data Assets	Security Properties[2]	Design	Mfg	Inventory	End Use	Term
Access Control[1]	Spoofing Malware	Configuration T. Firmware	C I, A	N/A Dig Sign	N/A Dig Sign	N/A N/A	Encryption Dig Sign	Dead[4] Dead[4]
Secure Storage[1]	Tamper	HW ID T. Firmware User Data Configuration Keys	I I, A C, I C C, I	N/A Dig Sign N/A N/A N/A	eFuse Dig Sign N/A N/A SEF[3]	eFuse Dig Sign N/A N/A SEF[3]	eFuse Dig Sign Encryption Encryption SEF[3]	eFuse Dead[4] Dead[4] Dead[4] Dead[4]
Firmware Auth	Malware	T. Firmware	I, A	Dig Sign	Dig Sign	Dig Sign	Dig Sign	Dead[4]
Comm[1]	MitM	User Data Keys	C, I C, I	N/A N/A	N/A SEF[3]	N/A SEF[3]	Encryption SEF[3]	Dead[4] Dead[4]
Secure State	Malware Tamper	T. Firmware HW ID T. Firmware User Data Configuration Keys	I I, A I, A C, I C C, I	Dig Sign N/A Dig Sign N/A N/A N/A	Dig Sign eFuse Dig Sign N/A N/A SEF[3]	Dig Sign eFuse Dig Sign Encryption Encryption SEF[3]	Dig Sign eFuse Dig Sign Encryption Encryption SEF[3]	Dead[4] eFuse Dead[4] Dead[4] Dead[4] Dead[4]

Step #4 – Review the Software Model and Architecture



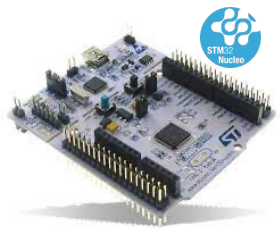
Step #5 – Research Microcontroller Ecosystems



Step #6 - Evaluate Development Boards

STM32 Development Boards

For rapid evaluation and prototyping



Nucleo Boards

Flexible Prototyping

st.com/**stm32nucleo**

Discovery Kits

Key Feature Prototyping

st.com/**stm32discovery**

Evaluation Boards

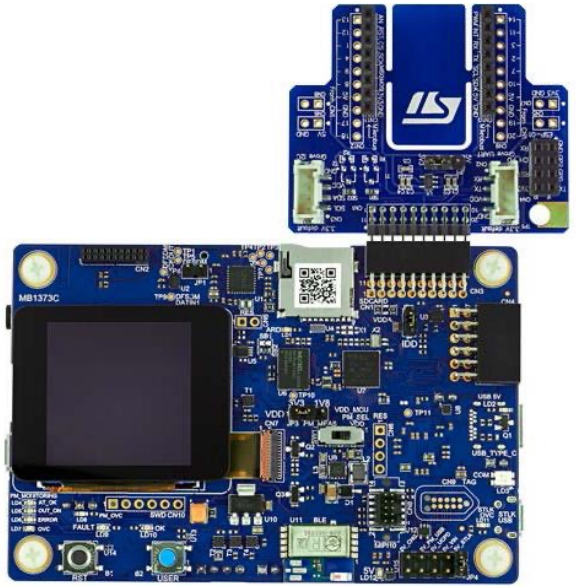
Full Feature Evaluation

st.com/**stm32evaltools**

Note: All *ST* boards integrate an in-circuit *ST*-Link debugger and programmer.

Step #7 – Make the Final Selection

	Criteria	Weight	Microcontroller #1 Rating 1	Rating 2	Rating 3	Rating 4	Rating 5	Weighted Rating Total	Microcontroller #2 Rating 1	Rating 2	Rating 3	Rating 4	Rating 5	Weighted Rating Total
Hardware	32-bit Architecture	4	3	3	3	3	3	60	2	2	2	2	2	40
	Processor speed	4	2	2	2	2	2	40	1	1	1	1	1	20
	Instruction set	5	2	1	1	1	2	35	1	2	2	2	1	40
	Minimial interrupt latency	5	1	2	2	1	1	35	3	1	1	3	2	50
	Loweset energy consumption	5	1	1	1	1	1	25	2	2	2	2	2	50
	Part Availability	5	1	2	1	1	1	30	2	3	3	3	3	70
	Memroy footprint / speed	4	3	3	3	3	3	60	2	2	2	2	2	40
Middleware	File system best meets system requirements	4	2	1	2	2	1	32	3	2	3	3	1	48
	TCP/IP stack best meets system requirements	4	2	1	2	2	1	32	3	2	3	3	1	48
	USB stack best meets system requirements	4	2	1	2	2	1	32	3	2	3	3	1	48
	Graphics stack best meets system requirements	4	2	1	2	2	1	32	3	2	3	3	1	48
	Middleware requires minimal integration effort	4	2	1	2	2	1	32	3	2	3	3	1	48
	Additional 3rd party tools integrated seamlessly	3	1	2	1	2	1	21	2	3	2	3	2	36
Engineer	Maxmize professional growth potential	2	2	2	1	3	1	18	1	1	3	2	3	20
	Least amount of stress to implement	2	2	3	1	1	3	20	1	2	3	3	2	22
	Most fun / interesting	1	2	3	3	1	2	11	3	1	1	2	3	10
	Minimized labor intensity	3	1	2	3	1	3	30	2	3	1	2	1	27
	Least deadline constrained to get up to speed	2	2	1	2	1	3	18	3	2	3	2	1	22
	Most internal resources available	3	1	2	3	3	3	36	2	3	1	1	1	24
Security	Security Certified RTOS	5	2	2	1	3	1	45	3	3	2	1	2	55
	Supports Arm TrustZone	4	1	1	2	1	1	24	2	2	3	2	2	44
	Supports TF-M	5	1	1	1	2	2	35	2	2	2	3	3	60
	Secure OTA / Bootloader support	3	2	2	1	2	2	27	1	1	2	3	3	36
	Total	198	98	94	101	101	95	1852	104	113	109	116	102	2059
			Microcontroller #1						Microcontroller #2					



Which is more important to you in the selection process?

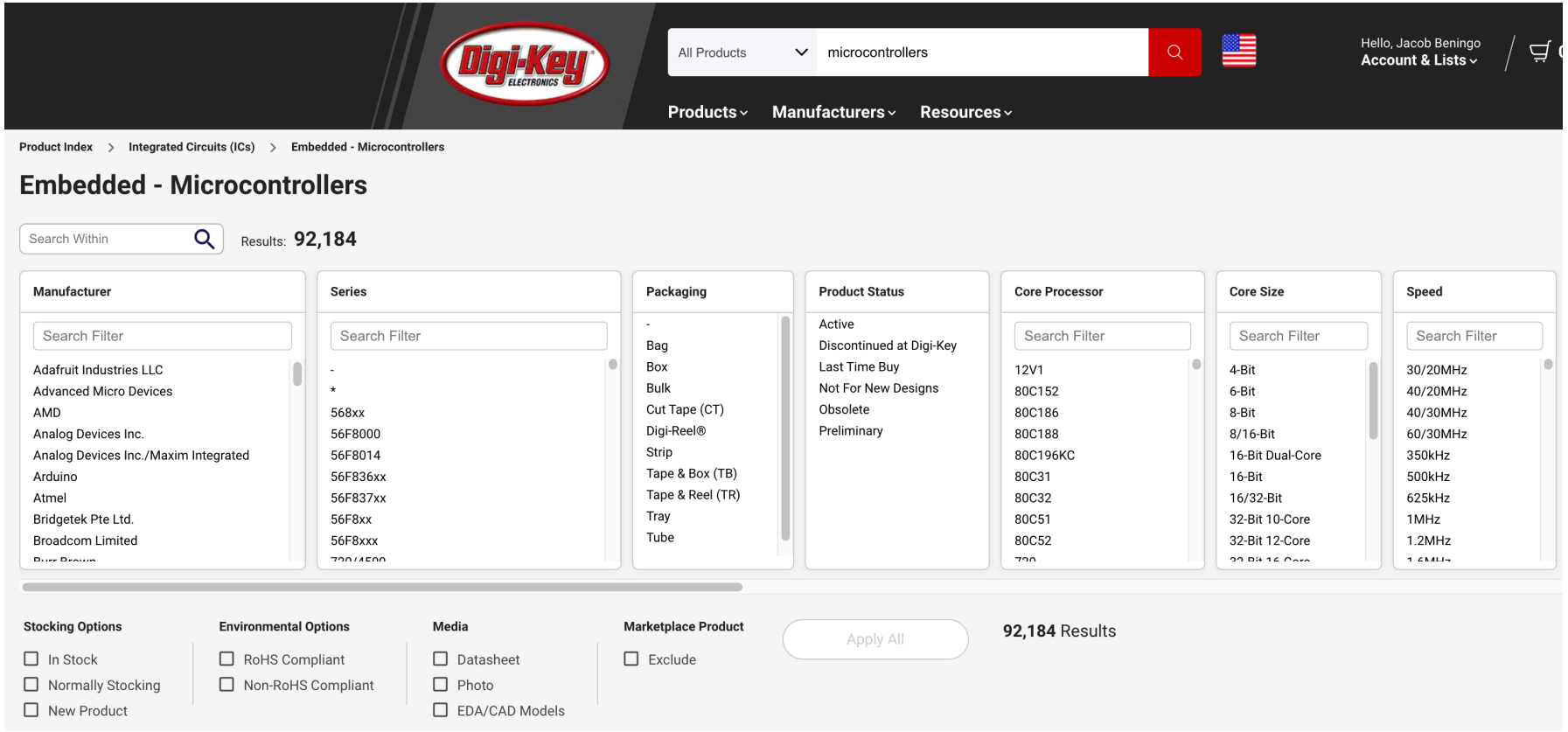
- Hardware
- Software
- The combined ecosystem
- Other

3

Tools for Finding Microcontrollers

How do we find the right options?

Digikey



STM32 MCU/MPU Portfolio

#1 GP MCUs, 9.4 billion shipped! (as of 2021)

Embedded MPUs								STM32**MP1** 3040+260 DMIPS 800 MHz C-A7 209 MHz C-M4
High Perf MCUs			STM32**F2** 398 CoreMark 120 MHz		STM32**F4** 608 CoreMark 180 MHz		STM32**F7** 1082 CoreMark 216 MHz	STM32**H7** 3224 CoreMark 240 MHz C-M4 480 MHZ C-M7
Mainstream MCUs	STM32**F0** 106 CoreMark 48 MHz	STM32**G0** 142 CoreMark 64 MHz	STM32**F1** 177 CoreMark 72 MHz		STM32**F3** 245 CoreMark 72 MHz	STM32**G4** 550 CoreMark 170 MHz		
Secure ULP MCUs		STM32**L0** 75 CoreMark 32 MHz	STM32**L1** 93 CoreMark 32 MHz	STM32**L5** 443 CoreMark 110 MHz	STM32**U5** 610 CoreMark 160 MHz	STM32**L4** 273 CoreMark 80 MHz	STM32**L4+** 409 CoreMark 120 MHz	
Wireless MCUs						STM32**WL** 161 CoreMark 48 MHz	STM32**WB** 216 CoreMark 64 MHz	

www.st.com/longevity

Arm® Cortex® Core	C-M0	C-M0+	C-M3	C-M33	C-M4	C-M7	C-A7 + C-M4
		2019		2020	2021		

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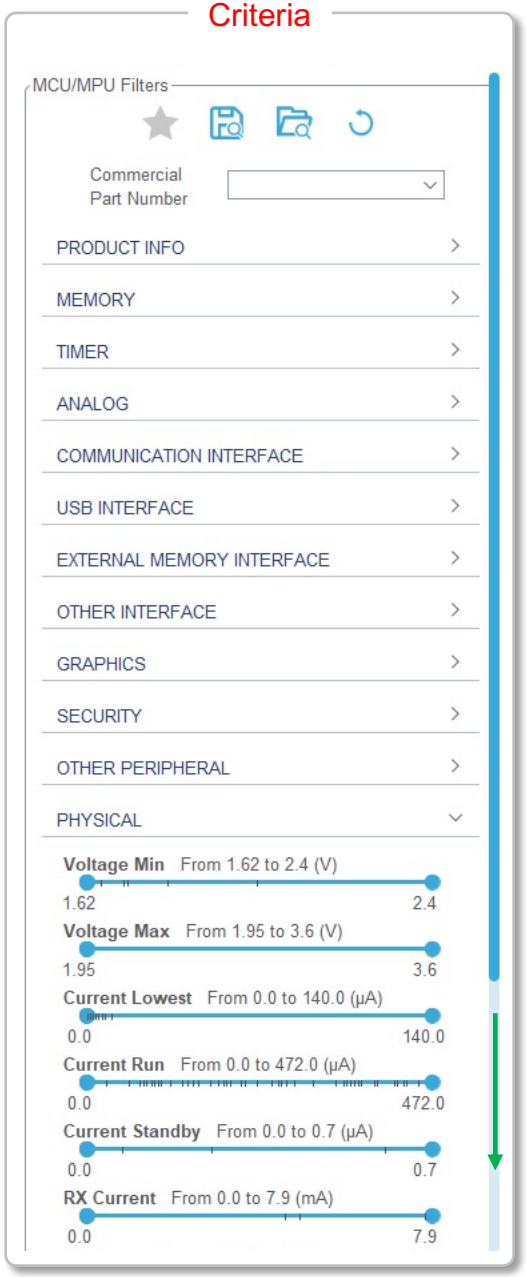
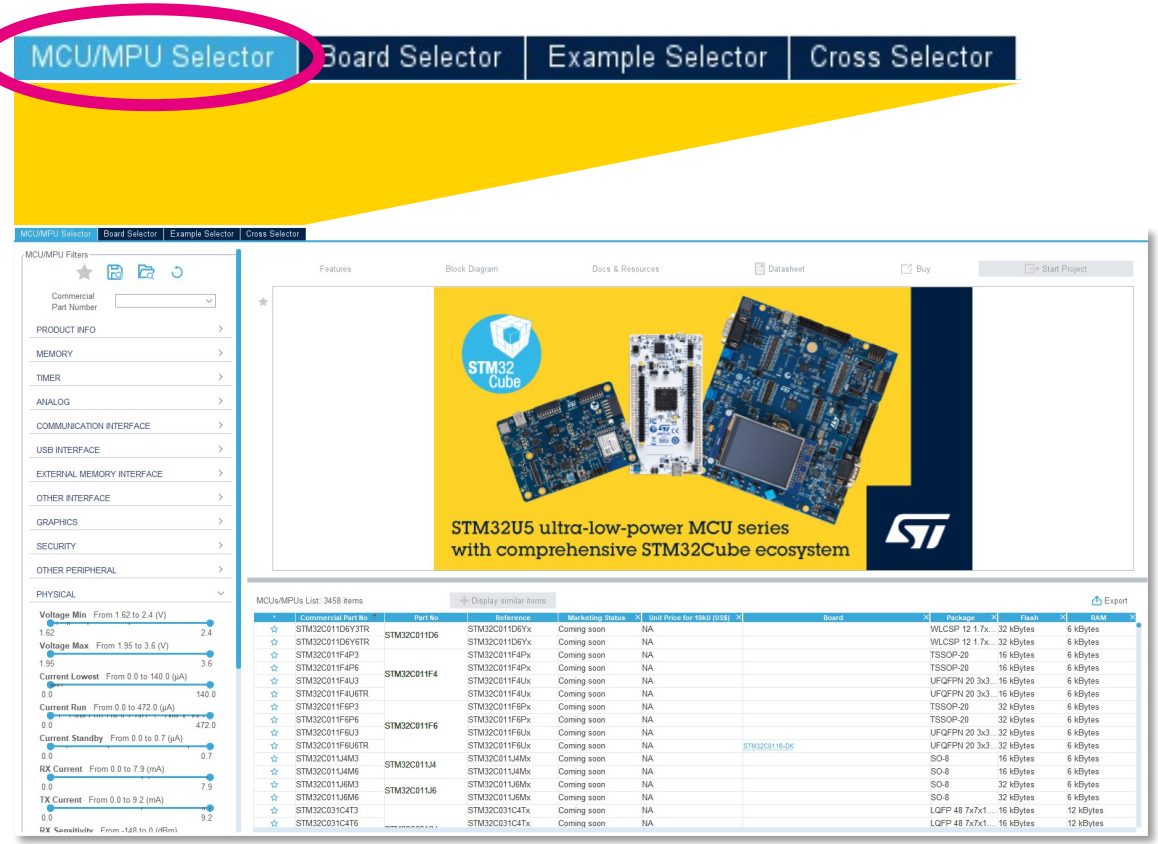
Chip & Module Selection

Criteria



3,458 part numbers and growing



ST-MCU-FINDER-PC

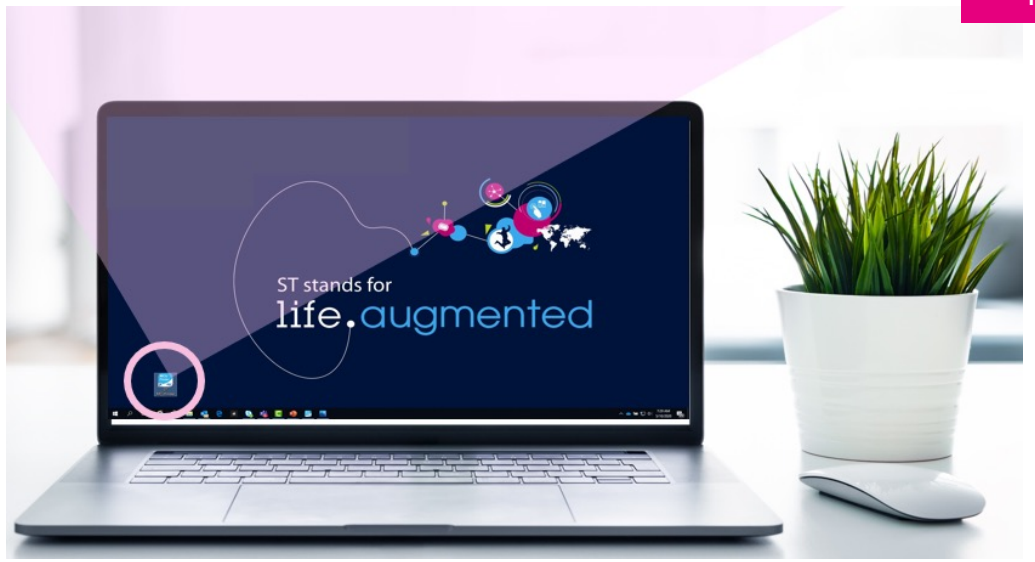
STM32 MCU Finders
for Smartphones and PCs

STM32 Mobile and PC MCU Finders

Mobile Version

GET IT ON Google Play | iOS | Android

PC Version



Windows | macOS® | Linux

www.st.com/**stm32finder**

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What tools do you use to find microcontrollers?
- Supplier tools
- Vendor tools
- Web tools / searches
- Other

4 Going Further

Thank you for attending

Please consider the resources below:

- www.beningo.com
  - Blog, White Papers, Courses
  - Embedded Bytes Newsletter
    - http://bit.ly/1BAHYXm
  - Embedded Software Design
    - https://bit.ly/3PZCtNO

From www.beningo.com under

- Blog > CEC – How to Select the Right Microcontroller for an Application

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