

- C03009 -

- How to Choose the Right MCU -



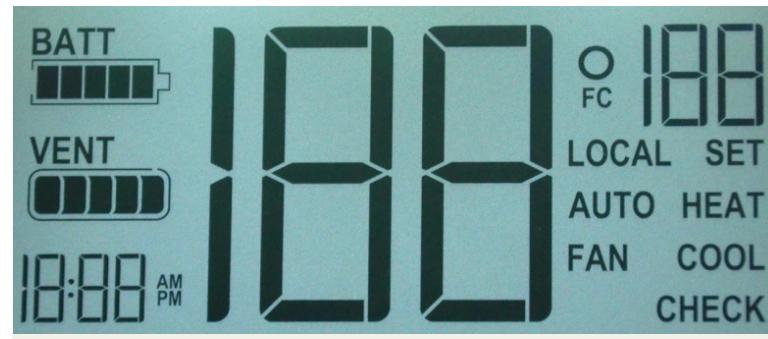
Questions to Answer

- Do you have the needed time, talent, and budget for this project?
- What happens if you cannot find an “ideal” MCU?
- Are you already familiar with an MCU family and associated hardware and software tools?
- Does your company dictate approved vendors? You might start with a limited group of MCU choices.
- What are your product restraints, requirements, and specifications?



What Will Your Product Need? (1)

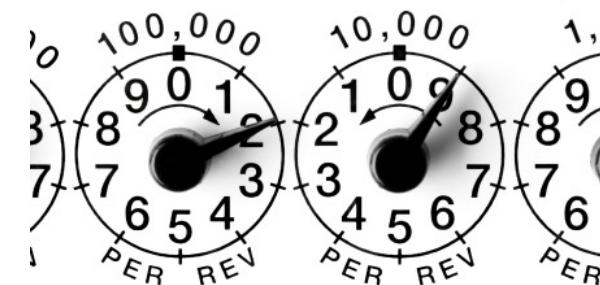
- **Human interface:** Keyboard, display, annunciator, motor, solenoid..?.
 - Does the display need a touch-control overlay? MCUs have built-in touch-control electronics
 - Some MCUs can directly drive LCD segments.
 - Do you need individual pixel control?
 - Build or buy an off-the-shelf LCD?
 - How many I/O pins will the human interface need?



What Will Your Product Need? (2)

■ Control-and-measurement capabilities?

- Will standard digital, analog, and communication ports suffice?
Beware of pin conflicts!
- Must the MCU measure analog signals?
 - How many analog inputs and outputs?
 - What resolution and accuracy do you require?
 - Do you need signal conditioning circuits?
- Do you need interrupts?
- Do you need PWM outputs?



What Will Your Product Need? (3)

■ Do you need real-time or near real-time performance?

- You might need a real-time operating system, or a “scheduler” for your application.
- Ethernet and USB communications require real-time response from an MCU.
- Something you cannot determine an MCU’s real-time capability until you create some code and test it.
- Find out what MCU vendor software libraries offer.



What Will Your Product Need? (4)

■ What's your power budget?

- Line power
- Battery power
- Alternate energy source
- MCU low-power and sleep modes
- Take advantage of power- measuring development software tools
- Consider system power needs and control



What Will Your Product Need? (5)

■ What types of communications does your product need?

- Chip-level: SPI, I2C, I2S?
- System-level: CAN, UART, Ethernet..?
- Wireless communications?
 - Standard or proprietary?
 - DIY or drop-in module?
 - FCC or agency approvals?
 - Range and data rate?
 - Regional limits?



What Will Your Product Need? (6)

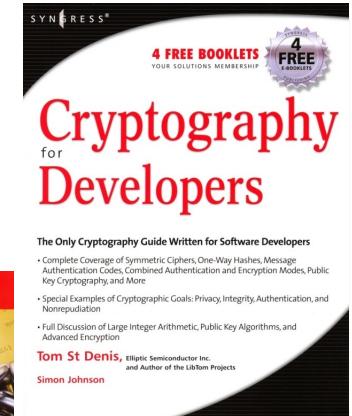
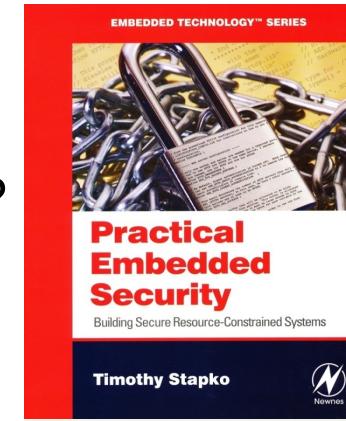
■ Do you need math operations?

- Some MCUs have a multiplier-accumulator, which helps speed FFTs, FIR filter routines, etc.
- Floating point or fixed point?
 - Single- or double-precision math?
 - IEEE 754?
- Can MCU vendors supply a math library?
- Use a math add-on chip:
 - Micromega 28-pin IC
 - www.micromegacorp.com

What Will Your Product Need? (7)

■ Does your product require security?

- How much security do you need?
- Must you protect code, data, or both?
- Investigate “secure” MCUs.
- Will the Advanced Encryption Standard (AES) suffice?
- Look for an MCU that includes an AES “engine.”
- Buy or license encryption-decryption libraries.



ATM Approach to Security



What Will Your Product Need? (8)

■ Will your product involve safety of humans?

- Learn about safety standards from FDA, FAA, FCC, etc.
- Ask software companies for information about tools that measure compliance with standards: MISRA C, DO-178, etc.



Use MCU Selection Tools

- Web sites let you choose selection criteria and find MCUs:
 - datasheets.com
 - gruntwareinc.com
 - Vendor sites
 - Distributor sites

DataSheets.com
Electronic Parts Datasheets & Inventory

Part Number	Description	Inventory	Products	Manufacturers
Enter a part number, such as: BAV99				
New Products	Parametric Search	Compare Parts	Saved Parts	Inventory Watch
My				

Microcontroller ▶ Microcontroller

Parametric Search Hide

Would you rather filter through different parametric options? [Send us a note](#) and we'll change the filters for this category.

Data Bus Width	Device Core	Instruction Set Architecture	Program Memory Size
Reset 4 8 4 8 32 8 16 8 16	Reset 8032 8051 8052 ARM720T STM8 ARM1176-JZF	Reset CISC CISC DSP RISC CISC RISC RISC	Reset 128Byte 384Byte 0.448KB 0.5KB 504Byte 512Byte

Program Memory Type	Number of Timers	Maximum Speed	Interface Type
Reset EEPROM EPROM FASTROM Flash OTP PROM	Reset 1 2 3 4 5 6	Reset 0.024 0.032 0.033 0.038 0.04 0.065	Reset 12C/I2S/UART/USB 2-Wire 2-Wire/3-Wire 2-Wire/3-Wire/CSI/UART 2-Wire/3-Wire/I2C/SBI/UART 2-Wire/3-Wire/I2C/UART

Showing 1- 15 of 24 search results for **Microcontroller**

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Part Number ▲	Manufacturer ▲	Description	Inventory	Quantity	Buy Now
<input type="checkbox"/> MSC1200Y2PFBT	Texas Instruments	Register or login	Digi-Key More Distributors	241	Buy now More
<input type="checkbox"/> MSC1200Y3PFBT	Texas Instruments	Register or login	Digi-Key More Distributors	224	Buy now More
<input type="checkbox"/> MSC1201Y2RHHT	Texas Instruments	Register or login	More Distributors		More
<input type="checkbox"/> MSC1201Y3RHHT	Texas Instruments	Register or login	Digi-Key More Distributors	477	Buy now More

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Welcome to **GOPHER** Web Plus!

25 manufacturers, 16,000+ MCUs and more than 245,000 links to supporting products



Home (Database contains 16,239 searchable MCUs) [What's GOPHER Web Plus?](#) [What's GOPHER PC?](#)

GOPHER Web Plus is a web-based version of the standard PC-Based GOPHER search engine. There are a number of differences between the products as shown in the following table ([table of differences](#)).
[Example GOPHER Web Plus Searches](#)

Check All MCU Manufacturers of Interest (If none checked, all manufacturers are searched)

<input type="checkbox"/> Analog Devices	<input type="checkbox"/> Energy Micro	<input type="checkbox"/> Microchip	<input type="checkbox"/> Ramtron	<input type="checkbox"/> Toshiba America
<input type="checkbox"/> Applied Micro Circuits	<input type="checkbox"/> Freescale Semi	<input type="checkbox"/> National Semi	<input type="checkbox"/> Renesas Electronics	<input type="checkbox"/> Western Design
<input type="checkbox"/> Atmel	<input type="checkbox"/> Fujitsu	<input type="checkbox"/> NEC (Now Renesas)	<input type="checkbox"/> Samsung	<input type="checkbox"/> Zilog
<input type="checkbox"/> Cirrus Logic	<input type="checkbox"/> Infineon Tech	<input type="checkbox"/> Net Silicon	<input type="checkbox"/> Silicon Labs	
<input type="checkbox"/> Cyan	<input type="checkbox"/> Luminary (now TI)	<input type="checkbox"/> NXP	<input type="checkbox"/> STMicroelectronics	<input type="checkbox"/> CLEAR
<input type="checkbox"/> Cypress Semi	<input type="checkbox"/> Maxim (Dallas Semi)	<input type="checkbox"/> Rabbit Semi	<input type="checkbox"/> Texas Instruments	<input type="checkbox"/> ALL

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AdChoices ▾

Part Nbr:

Search **Clear Settings**

MCU, Bus & Status

Status = <input type="button" value="Production"/>	MCU Type = <input type="button" value=""/>	<input type="checkbox"/> On Chip Osc	<input type="checkbox"/> Clk PLL	<input type="checkbox"/> Sub Clk
CPU Nbrs = <input type="button" value=""/>	CPU Size = <input type="button" value=""/>	<input type="checkbox"/> Mply Instr	<input type="checkbox"/> MAC Instr	<input type="checkbox"/> FPU
MCU Freq >= <input type="button" value=""/>	Bus Size = <input type="button" value=""/>	<input type="checkbox"/> Barrel Shifter	<input type="checkbox"/> Graphics	<input type="checkbox"/> Graphics Acc
Bus Freq >= <input type="button" value=""/>		<input type="checkbox"/> XY Cnvtr	<input type="checkbox"/> IEBus	<input type="checkbox"/> PCI
		<input type="checkbox"/> PCI Express	<input type="checkbox"/> ISA	

Memory

RAM >= <input type="button" value=""/>	FRAM >= <input type="button" value=""/>	FROM >= <input type="button" value=""/>	PROM >= <input type="button" value=""/>	EROM >= <input type="button" value=""/>
MROM >= <input type="button" value=""/>				

Memory Options

DMA Chans >= <input type="button" value=""/>	<input type="checkbox"/> MMU	<input type="checkbox"/> MPU	<input type="checkbox"/> EMIF	<input type="checkbox"/> Ext Bus Ctrl
	<input type="checkbox"/> Ext Mem Card			

Voltages & Temps

Sply V Min <= <input type="button" value=""/>	Sply V Max >= <input type="button" value=""/>	IO V Min <= <input type="button" value=""/>	IO V Max >= <input type="button" value=""/>	<input type="checkbox"/> Low Pwr
Oper Temp Min <= <input type="button" value=""/>	Oper Temp Max >= <input type="button" value=""/>			



Manuf	PartNbr	ProdLine	Status	MCU Type	CPU	CPU Nbrs	CPU Size	MCU Freq	Bus Size	Bus Freq	On Chip Osc	Clk PLL	Sub Clk	Mply Instr	MAC Instr	FPU	Barrel Shifter	Graphics	Graphics Acc	XY Cnvtr	Ibus	PCI E
MIC	PIC24HJ128GP202	PIC24H	Production	MCU	PIC24H	1	16	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	
MIC	PIC24HJ128GP204	PIC24H	Production	MCU	PIC24H	1	16	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	
MIC	PIC24HJ128GP206	PIC24H	Production	MCU	PIC24H	1	16	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	
MIC	PIC24HJ128GP210	PIC24H	Production	MCU	PIC24H	1	16	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	
MIC	PIC24HJ128GP306	PIC24H	Production	MCU	PIC24H	1	16	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	
MIC	PIC24HJ128GP310	PIC24H	Production	MCU	PIC24H	1	16	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	
MIC	PIC24HJ128GP502	PIC24H	Production	MCU	PIC24H	1	16	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	

GOPHER Links

Manufacturer:

[Microchip](#)

Part Number:

[PIC24HJ128GP202](#)

Pricing and Availability:

[Octopart](#)

[Datasheet and/or Hardware Manual](#)

[App notes, eval boards, software, etc](#)

There are currently **292,471** links to support products by other manufacturers in the Gopher database. The following links came from reference material provided by those manufacturers indicating that the products listed below support the MCU you selected: **PIC24HJ128GP202**

Hardware Cables/Adapters

Company	List Price	Part number	Description
CCS	\$29.95	Tag-Connect	ICSP Programming Cable

Programmer/Debugger

Company	List Price	Part number	Description
CCS	\$75	ICD-U64	In-Circuit Programmer/Debugger
CCS	\$75	ICD-S40	In-Circuit Debugger/Programmer

Hardware Programmer

Company	List Price	Part number	Description
CCS	\$199	MachX	Mach X Programmer
CCS	\$199	LoadnGo	Load-n-Go Handheld Programmer
CCS	\$899	PRIME8	Production Programmer



digikey.com

Processor	Core Processor	Core Size	Speed	Connectivity
Microcontroller Processor	- ACE1001 ACE1202 ACE1502 ARM Cortex-A8 ARM Cortex-M0 ARM Cortex-M4 ARM® Cortex™ - R4F ARM® Cortex™-M4/M0 ARM® Cortex-M3™	- 4-Bit 8-Bit 8/16-Bit 16-Bit 16/32-Bit 32-Bit 32-Bit Dual-Core	- 30/20MHz 40/20MHz 40/30MHz 60/30MHz 40kHz 625kHz 1MHz 1.2MHz 1.6MHz	- ACCESS.Bus (2-Wire/I ² C, SMBus), CAN, Microwire/Plus (SPI), UART/USART ACCESS.Bus (2-Wire/I ² C, SMBus), Microwire/Plus (SPI) ASC, CAN, EBI/EMI, I ² C, SSC, UART/USART ASC, CAN, EBI/EMI, MLI, MSC, SSC ASC, CAN, EBI/EMI, SSC ASC, CAN, MLI, MSC, SSC ATA, Audio, CAN, EBI/EMI, I ² C, IDE, MMC/SD, SPI, UART/USART, USB OTG ATA, Compact Flash, EBI/EMI, Memory Stick, MMC, SCI, SD, Smart Media, U ATAPI, Ethernet, I ² C, SCI, SSI, USB

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Part Number	Manufacturer Part Number	Description	Series	Manufacturer	Core Processor	Core Size	Speed	Connectivity	Peripherals	Number of I/O	Program Memory Size	Program Memory Type	EEPROM Size	RAM Size
PIC10F200T-I/OT-ND	PIC10F200T-I/OT	IC PIC MCU FLASH 256X12 SOT23-6	PIC® 10F	Microchip Technology	PIC	8-Bit	4MHz	-	POR, WDT	3	384B (256 x 12)	FLASH	-	16 x 8
PIC10F200T-I/OTCT-ND	PIC10F200T-I/OT	IC PIC MCU FLASH 256X12 SOT23-6	PIC® 10F	Microchip Technology	PIC	8-Bit	4MHz	-	POR, WDT	3	384B (256 x 12)	FLASH	-	16 x 8
PIC10F200T-I/OTDKR-ND	PIC10F200T-I/OT	IC PIC MCU FLASH 256X12 SOT23-6	PIC® 10F	Microchip Technology	PIC	8-Bit	4MHz	-	POR, WDT	3	384B (256 x 12)	FLASH	-	16 x 8

ti.com

Add/Hide Parameters	Status	SubFamily	Max Speed (MHz)	CAN	ADC Channels	Motion PWM	SSI/SPI	I2C	Timers	Maximum 5-V Tolerant GPIOs	Dedicated 5-V Tolerant GPIOs	Watchdog Timers
Total Parts: 31	<input type="checkbox"/> ACTIVE <input type="checkbox"/> PREVIEW	9000 Series	<input type="checkbox"/> 80	<input type="checkbox"/> 2 <input type="checkbox"/> 3	<input type="checkbox"/> 16	<input type="checkbox"/> 0 <input type="checkbox"/> 6 <input type="checkbox"/> 8	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 5	<input type="checkbox"/> 60 <input type="checkbox"/> 65 <input type="checkbox"/> 72	<input type="checkbox"/> 0	<input type="checkbox"/> 2
Matching Parts: 31												
Highlight Differences	▲▼	▲▼	▲▼	▲▼	▲▼	▲▼	▲▼	▲▼	▲▼	▲▼	▲▼	▲▼
<input type="checkbox"/> LM3S9B81 - Stellaris Microcontroller	ACTIVE	9000 Series	80	3	16	0	2	2	5	65	0	2
<input type="checkbox"/> LM3S9B90 - Stellaris Microcontroller	ACTIVE	9000 Series	80	2	16	0	2	2	5	60	0	2
<input type="checkbox"/> LM3S9B92 - Stellaris Microcontroller	ACTIVE	9000 Series	80	2	16	8	2	2	5	65	0	2
<input type="checkbox"/> LM3S9B95 - Stellaris Microcontroller	ACTIVE	9000 Series	80	2	16	8	2	2	5	65	0	2
<input type="checkbox"/> LM3S9B96 - Stellaris Microcontroller	ACTIVE	9000 Series	80	2	16	8	2	2	5	65	0	2
<input type="checkbox"/> LM3S9BN2 - Stellaris Microcontroller	ACTIVE	9000 Series	80	2	16	8	2	2	5	72	0	2

Investigate MCU HW Tools

■ What hardware tools does an MCU vendor offer?

- Evaluation boards and kits
- Development boards and kits
- Reference designs
 - Schematic diagrams
 - PCB files
 - Bill of materials (BOM)
- Code
 - Download and review manuals and user guides



Investigate MCU SW Tools

■ What software tools does an MCU vendor offer?

- Complete set of coding tools
 - IDE (Integrated Development Environment)
 - Editor, assembler, compiler, debugger
 - Project-management software
- Technical support and user forums
- Application notes
- Software examples
- Libraries
- More about software in the next session

Dig Deeper

- **Locate more information and tools**

- Run a Web search to find independent information about hardware, software, tools, and problems and accolades.
- Look at third-party development hardware and software.
- Examine information about your chosen MCU’s “family.”
- Ask vendors about their MCU “roadmap.”
- Try demo software before you buy.
- ...

Further Reading

- <https://www.youtube.com/watch?v=R7IPEeUyNNA>
- https://www.youtube.com/watch?v=_Y211pA0ITM
- <https://www.youtube.com/watch?v=vbaFMT9LXmg>