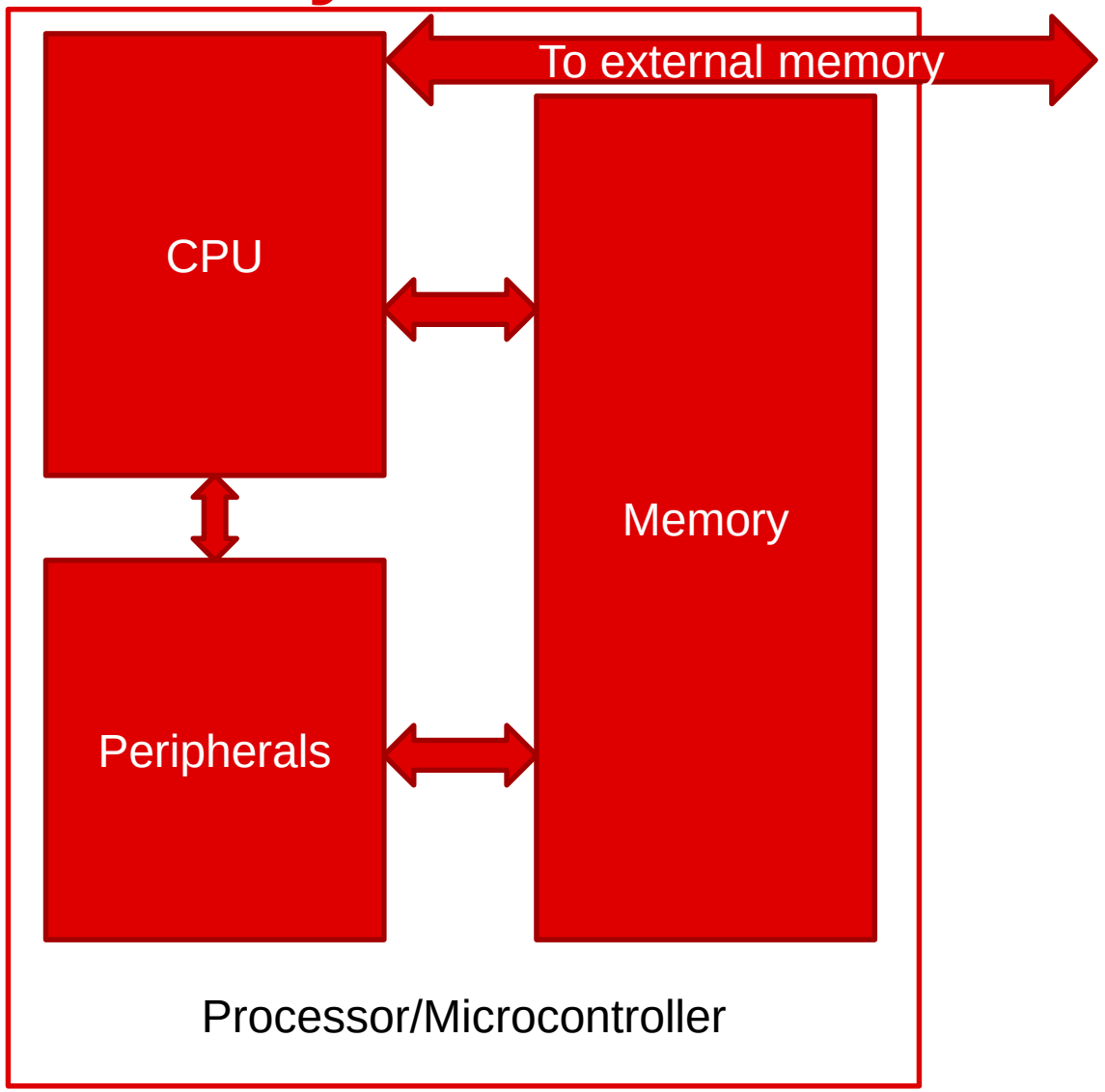
Embedded RAM

TI Precision Labs – Microcontrollers

Prepared and Presented by Omer Amir

Memory in an embedded system

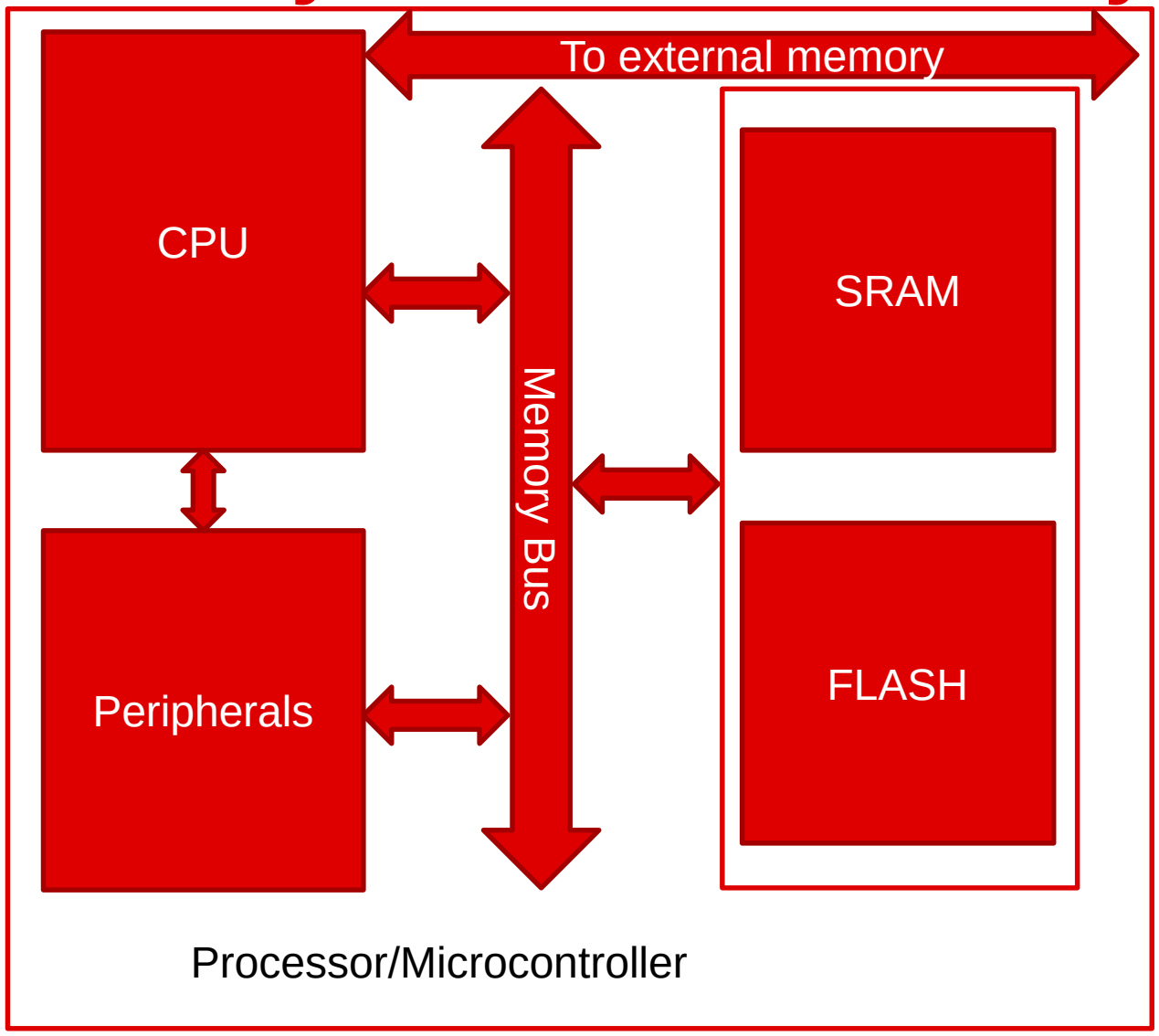


- All embedded devices have some type of memory
- Role in the system:
  - Program (code) storage for the CPU
  - Data storage for both CPU and Peripherals

- Two types of memory
  - Volatile: Contents lost when device is powered down
  - Non-volatile: Contents preserved when device is powered down

- Volatile
  - SRAM
  - DRAM
  - Caches
- Non-volatile
  - Flash
  - FRAM
  - ROM

Memory in an embedded system

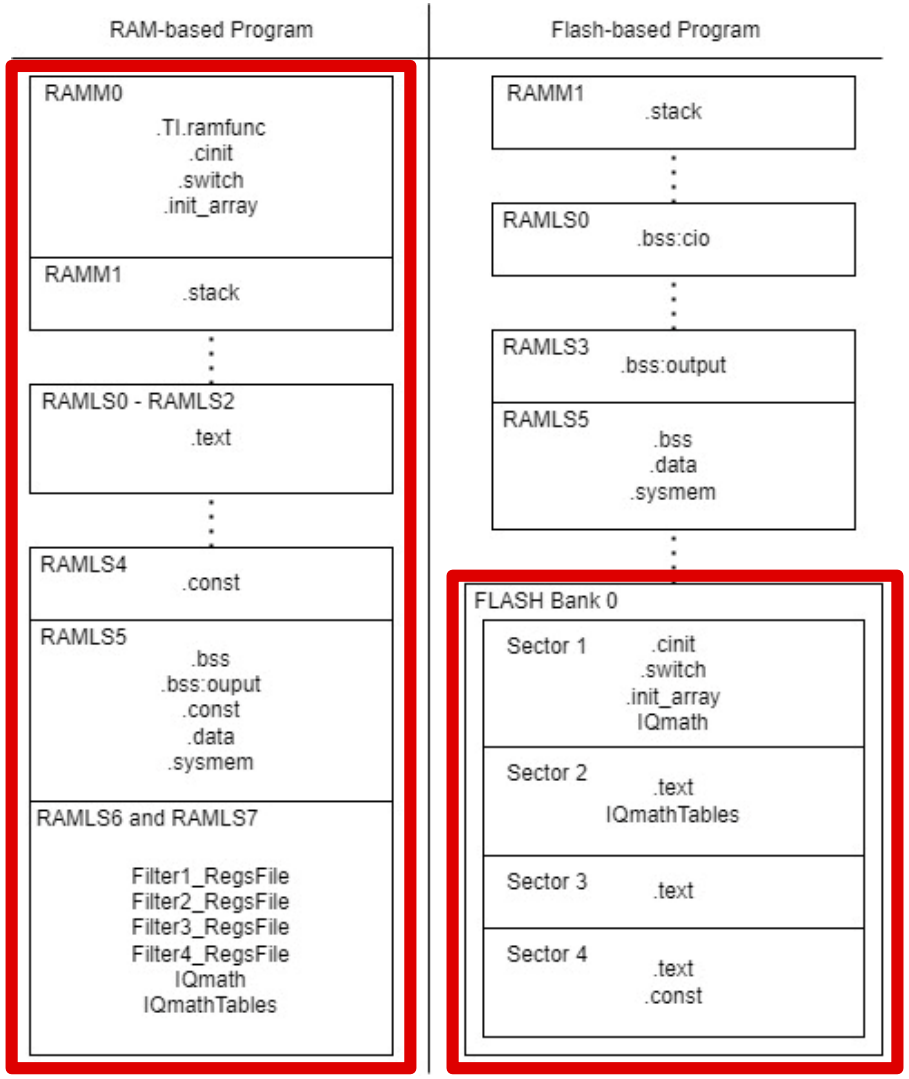


- Memory bus transfers data to different areas of the device
- Bus can be multiplexed depending on the device

Typical tradeoffs between memory types

Topic	Volatile (SRAM)	Non-Volatile (Flash)
Retention between power cycling	No	Yes
Speed	Faster, up to CPU max operating frequency	Slower, less than CPU max operating frequency
Writes	Direct from CPU	Requires special operations to change contents
Endurance	Limitless changes to memory contents	Capped in the range of tens of thousands changes

Typical memory allocations

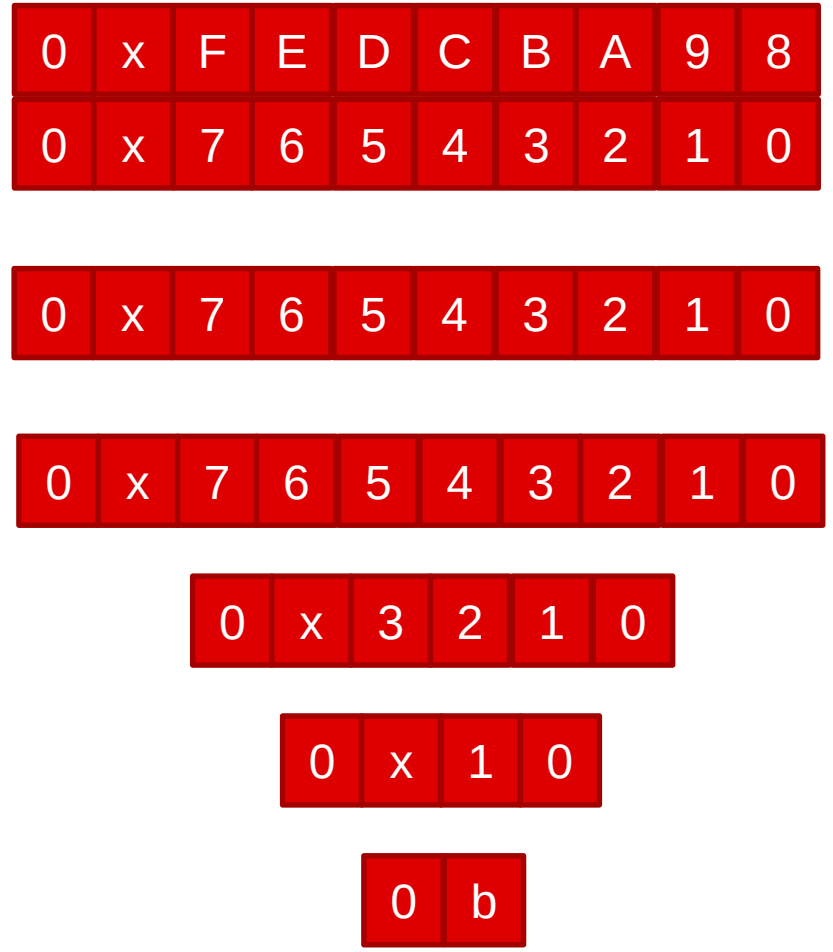



```
91 SECTIONS
92 {
93    codestart        : > BEGIN
94    .TI.ramfunc      : > RAMM0
95    .text            : >> RAMLS0 | RAMLS1 | RAMLS2 | RAMLS3 | RAMLS4
96    .cinit           : > RAMM0
97    .switch          : > RAMM0
98    .reset           : > RESET,                    TYPE = DSECT /* not used, */
99
100   .stack           : > RAMM1
101
102#if defined(__TI_EABI__)
103   .bss             : > RAMLS5
104   .bss:output      : > RAMLS5
105   .init_array      : > RAMM0
106   .const           : > RAMLS5 | RAMLS4
107   .data            : > RAMLS5
108   .sysmem          : > RAMLS5
109  .bss:cio          : > RAMLS0
110#else
111   .pinit           : > RAMM0
112   .ebss            : > RAMLS5
113   .econst          : > RAMLS5
114   .esysmem         : > RAMLS5
115   .cio             : > RAMLS0
116#endif
117
118    ramgs0 : > RAMGS0
119    ramgs1 : > RAMGS1
120
121   /* The following section definition are for SDFM examples */
122   Filter1_RegsFile : > RAMLS6_7
123   Filter2_RegsFile : > RAMLS6_7
124   Filter3_RegsFile : > RAMLS6_7
125   Filter4_RegsFile : > RAMLS6_7
```

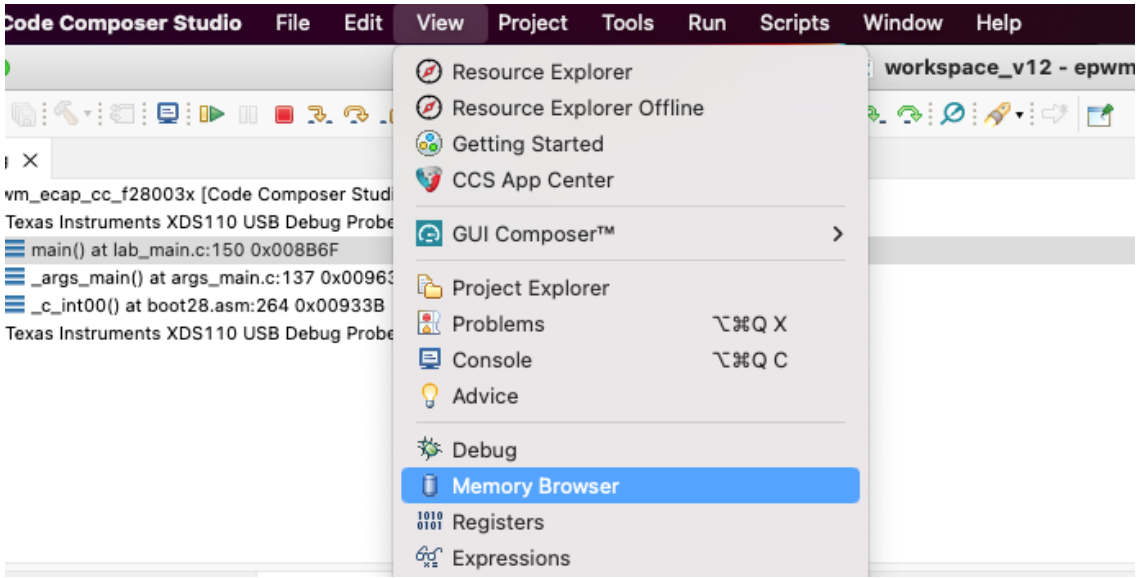
*These images are used in the context of the TMS320F280039C device

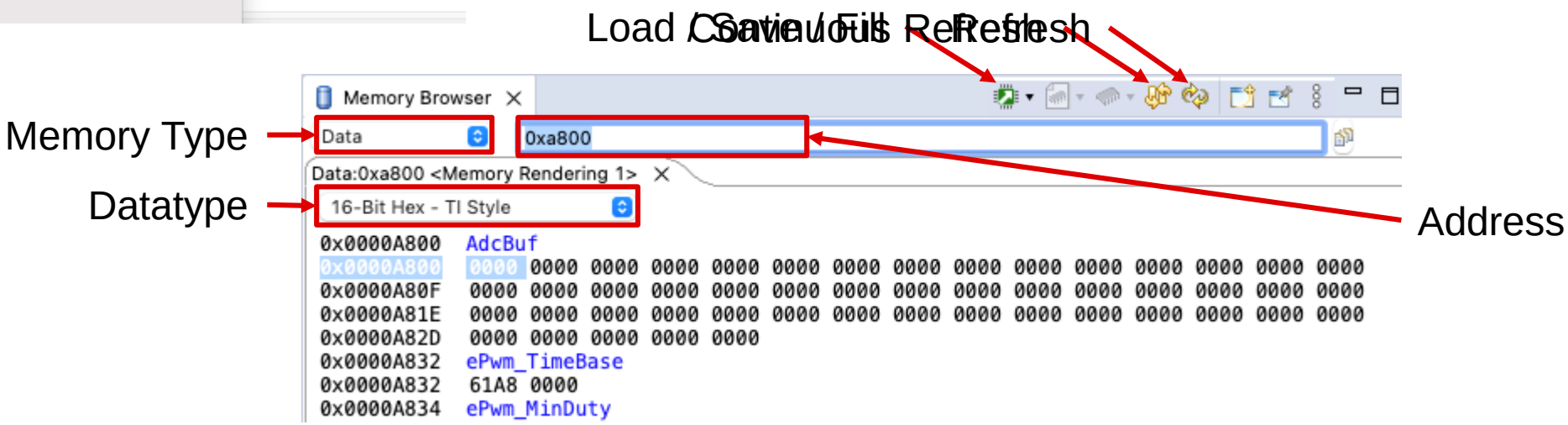
Memory terminology

Term	Definition	Example
Double	Grouping of multiple Words(64, 128, etc)	Decimal value = -1.22881872048e+303
Float	Grouping of multiple words(32, 64, etc)	Decimal value = 1.0759593e+33
Long	Grouping of multiple words(32, 64, etc)	Decimal value = 1,985,229,328
Word	Grouping of multiple bits(16, 32, 64, etc)	10 kilowords = 10KW
Byte	Grouping of 8 bits	10 kilobytes = 10KB
Bit	Binary Value 0(b) or 1(b)	10 kilobits = 10Kb



CCS Memory Window





To find more Microcontroller and Processor technical resources and search products, visit **https://www.ti.com/microcontrollers-mcus-processors/overview.html**.