

AccessionIndex: TCD-SCSS-T.20250919.002

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Object name: Arduino shield for Motorola MC14500

Vintage: 2025

Synopsis: A board that enables execution of software by the 14500, a very interesting 1-bit microprocessor designed for industrial control applications, 2025.

### **Description:**

This Retrosshield 14500 is one a series of Arduino shields (*retrosields*) designed by Erturk Kocalar [1] to not only host early microprocessors but also to execute their original native software, an approach he has termed “Breadboarding in Software”.

The RetroShield 14500 [2] is a daughter card that plugs into an Arduino Mega [3] or Teensy [4], see Fig.1. The Motorola MC14500 microprocessor [5][6][7] executes native MC14500 code while the Arduino emulates MC14500 system hardware. The choice of emulated MC14500 system hardware is done by uploading relevant Arduino code. This enables the experience of old computer systems, the learning of low-level aspects of the early microprocessors, the keeping of valuable historical software alive, and even changing original native software simply by changing C code in the Arduino IDE, and use with other Arduino shields and libraries.

The Arduino Mega is an inexpensive platform with a 16MHz CPU that allows the retrosshield’s early microprocessor to run at about up to 400kHz, with over 200kB of emulated ROM and about 6kB of emulated RAM (reserving 2kB for the Arduino stack/heap). Peripherals like a UART, PIA, Timer, etc. can be emulated by the Arduino, and other Arduino *shields* can be used to add new features. The Arduino Mega operates at 5V TTL levels. The retrosshield plugs into the Arduino Mega digital input/output connector.

The Teensy is a more expensive but faster platform with a 600MHz CPU that allows the retrosshield’s early microprocessor to run at full speed (e.g. 1MHz), with over 512kB of emulated ROM. Emulated RAM capacity depends on the Teensy version, 256kB for Teensy 3.5 or 3.6, 1MB for Teensy 4.1. It includes a microSD slot that can be used to emulate disk drives. Other peripherals like a UART, PIA, Timer, etc. can be emulated by the Arduino, and other Arduino *shields* can be used to add new features. The Teensy operates at 3.3V, but plugs into a Teensy daughter card designed by Erturk Kocalar that provides onboard 3.3V-to-5V TTL level shifting & vice-versa. The retrosshield then plugs into that daughter card in the same way that it would into an Arduino Mega digital input/output connector.

The Motorola MC14500 was intended for simple industrial control logic applications. It had a 1-bit datapath, but executed any of sixteen 4-bit instructions. It did not have the traditional registers, even a program counter, those had to be implemented externally. Architecturally it only had one 1-bit RESULT register showing the result from the 1-bit ALU, although internally it had a 4-bit instruction register, and various flag registers to indicate specific status and instruction events, see Fig.6. It has been reported that its architecture was similar to that of the DEC PDP-14 computer. It was a fully static design fabricated in CMOS, executing one instruction per clock cycle, where its built-in clock generator operated from DC to 1.0MHz and its power supply

voltage range of 3V to 18V made it very suitable for industrial programmable logic controllers (PLCs). The Retroschild 14500 design files are at [8].

The Retroschild 14500 can execute user programs under the control of the Arduino via a monitor, 14500 assembler and disassembler. The 14500's clock frequency can be adjusted and it can be single-stepped through its program. The retroschild has eight buttons and eight LEDs for program input/output, and also LEDs that indicate the 14500's state. It can execute the *Killbit* game, and also Yaroslav Veremenko's *hello world*. The Retroschild 14500 software is at [9].

Many thanks to Erturk Kocalar and Brian Coghlan for donating this item.

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<b>Accession Index</b>	<b>Object with Identification</b>
<a href="#">TCD-SCSS-T.20250919.002</a>	Arduino shield for Motorola MC14500. A board that enables execution of software by the 14500, a very interesting 1-bit microprocessor designed for industrial control applications, 2025.
<a href="#">TCD-SCSS-T.20250919.001</a>	Motorola MC14500 microprocessor. A very interesting 1-bit microprocessor designed for industrial control applications. 1977.
<a href="#">TCD-SCSS-X.20250916.001</a>	Dr.Brian Coghlan's Collection of Early Microprocessors. An extensive and nearly complete set of unused 1970s microprocessor chips, most accompanied with documentation, some with demonstration boards. 1971.

## References:

1. Erturk Kocalar, *8bitforce*, [erturkk@8bitforce.com](mailto:erturkk@8bitforce.com), see:  
<https://8bitforce.com/>  
Also: <https://gitlab.com/8bitforce>  
Last browsed to on 16-Dec-2025.
2. Erturk Kocalar, *Retrosshield 14500*, see:  
<https://www.tindie.com/products/8bitforce/retrosshield-MC14500-for-arduino-mega/>  
Last browsed to on 16-Dec-2025.
3. Arduino, *Arduino MEGA*, see:  
<https://store-usa.arduino.cc/products/arduino-mega-2560-rev3>  
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4. PJRC, *Arduino Teensy*, see:  
<https://www.pjrc.com/teensy/>  
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5. Wikipedia, *Motorola MC14500*, see:  
[https://en.wikipedia.org/wiki/Motorola\\_MC14500](https://en.wikipedia.org/wiki/Motorola_MC14500)  
Last browsed to on 19-Sep-2025.
6. Motorola, *MC14500B datasheet*, see:  
<https://www.scss.tcd.ie/SCSSTreasuresCatalog/hardware/TCD-SCSS-T.20250919.002/Motorola-MC14500B-datasheet-MC14500Brev3.pdf>  
Last browsed to on 19-Sep-2025.
7. Vernon Gregory, Brian Dellande, Ray DiSilvestro, Terry Malarkey, Phil Smith, Mike Hadley, *Motorola MC14500B Industrial Control Unit Handbook*, 33-B78/8.0, Motorola Semiconductor Products Inc., 1977, see:  
[https://www.bitsavers.org/components/motorola/14500/MC14500B\\_Industrial\\_Control\\_Unit\\_Handbook\\_1977.pdf](https://www.bitsavers.org/components/motorola/14500/MC14500B_Industrial_Control_Unit_Handbook_1977.pdf)  
Also: <https://www.scss.tcd.ie/SCSSTreasuresCatalog/hardware/TCD-SCSS-T.20250919.002/Motorola-MC14500B-IndustrialControlUnit-Handbook-1977.pdf>  
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8. Erturk Kocalar, *Retrosshield-HW Design Files*, see:  
<https://gitlab.com/8bitforce/retrosshield-hw>  
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9. Erturk Kocalar, *Retrosshield 14500 Source Code*, see:  
<https://gitlab.com/8bitforce/retrosshield-arduino/-/tree/master/k14500b>  
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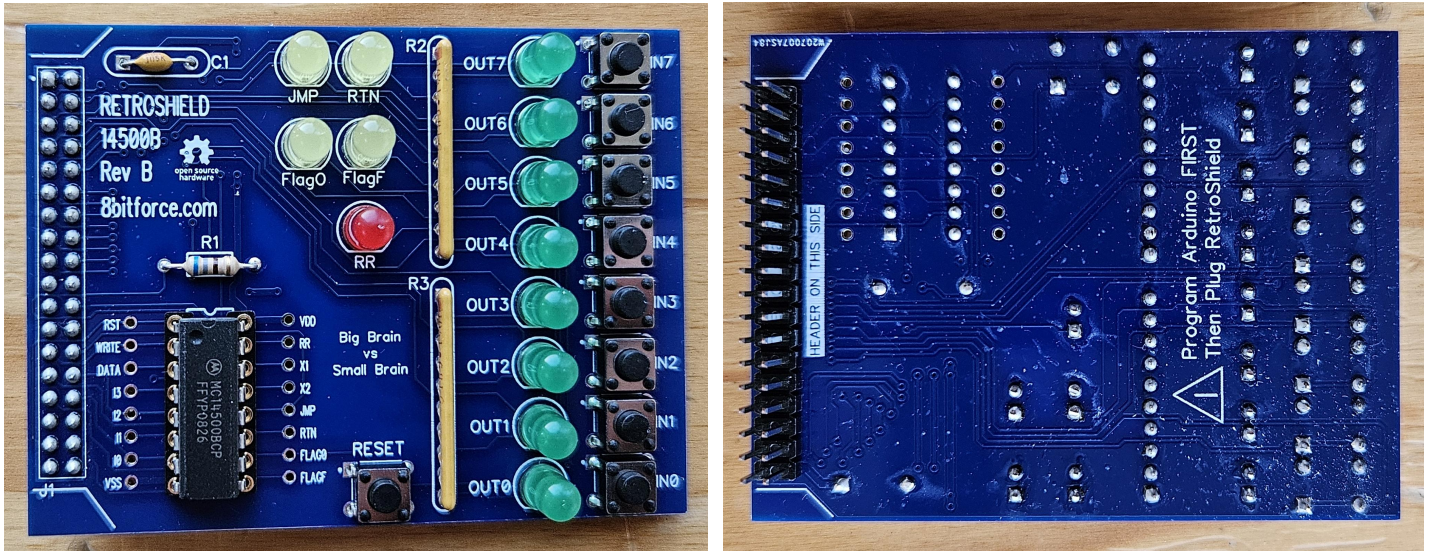


Figure 1: 8bitforce Retroshield 14500.

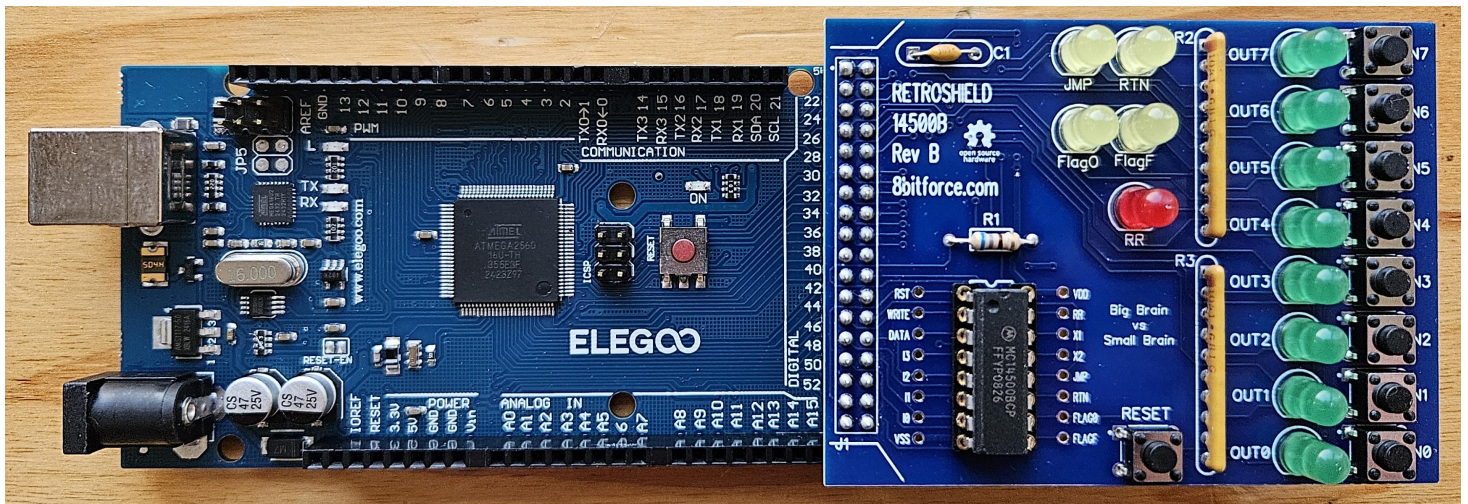


Figure 2: 8bitforce Retroshield 14500 coupled to an Arduino Mega.

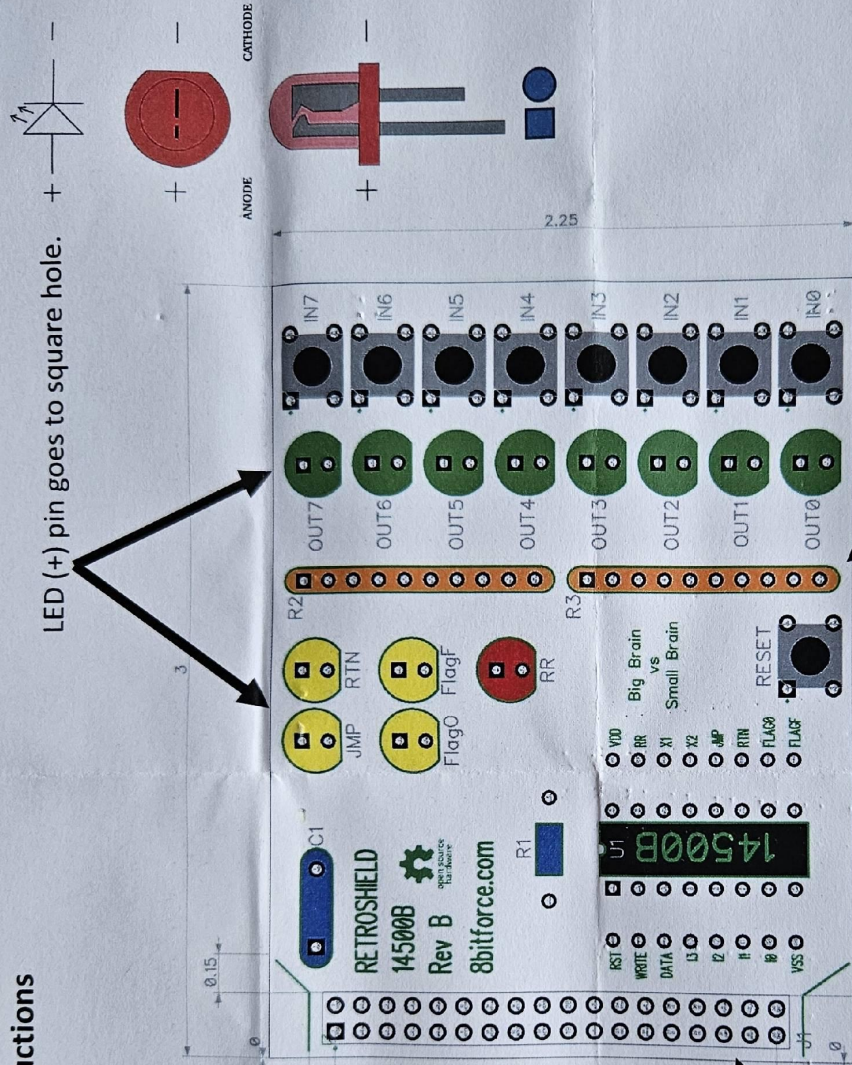
# RetroShield 14500 Assembly Instructions

Rev B, 2025/01/29

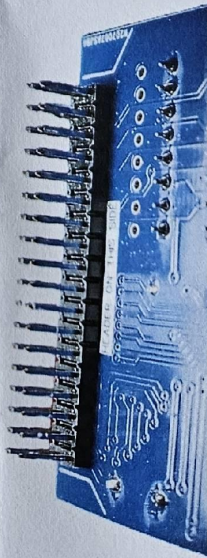
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## Solder parts from shortest to tallest:

- C1 = 1uF
- R1 = 680 ohm
- SW = 9 switches
- Socket = U1 socket
- RP1/RP2 = 680 ohm
- first solder 1pin only, check vertical then solder rest.
- LED's = Match colors as shown
- J1 = Goes on bottom side.



Header installed on bottom side.



Ensure pin1 (mark) goes to square hole.



[https://commons.wikimedia.org/wiki/File:%2B-\\_of\\_LED\\_2.svg](https://commons.wikimedia.org/wiki/File:%2B-_of_LED_2.svg)

Figure 3: 8bitforce Retroshield 14500 assembly instructions (from 8bitforce).

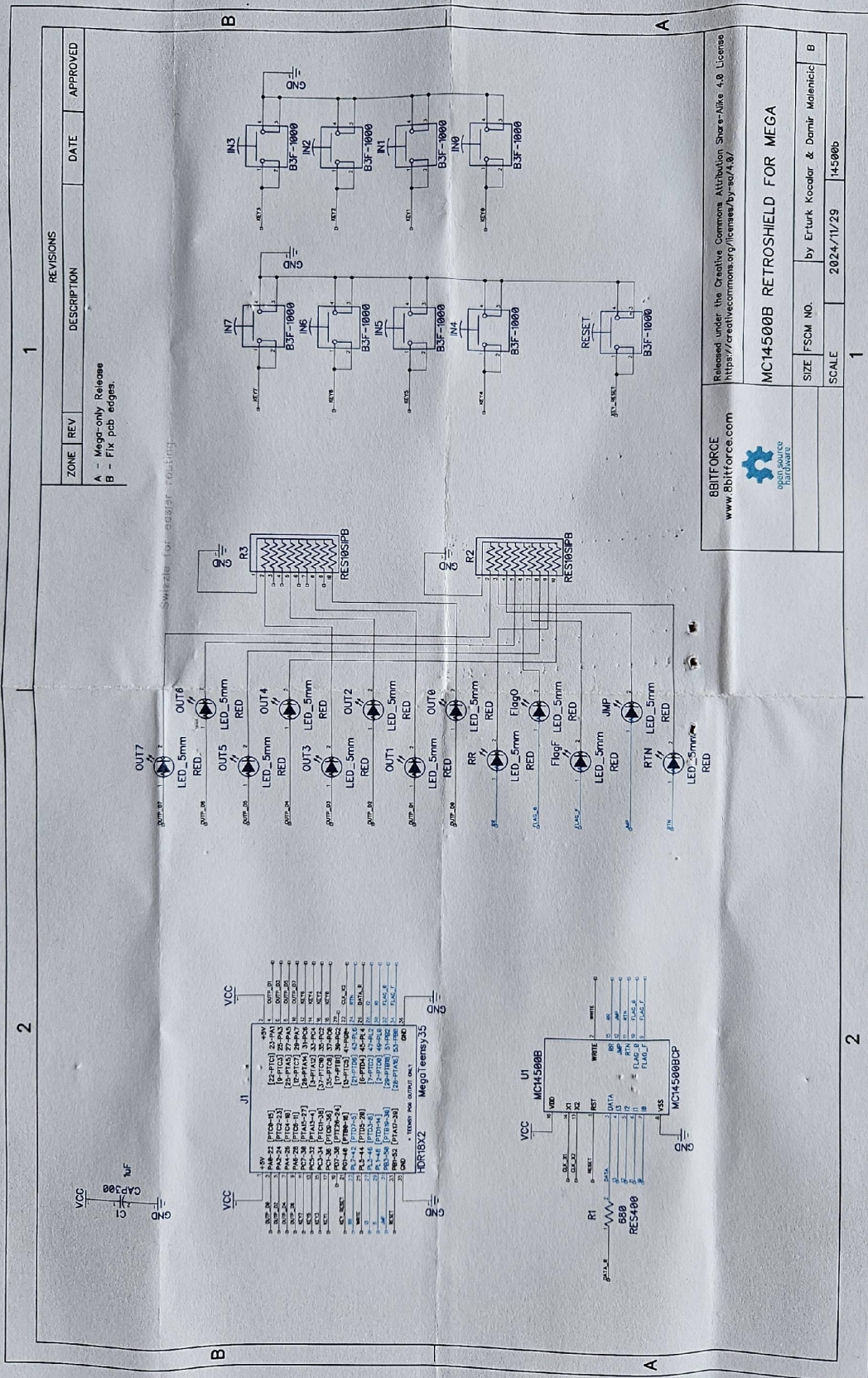


Figure 4: 8bitforce Retrosshield 14500 circuit diagram (from 8bitforce).

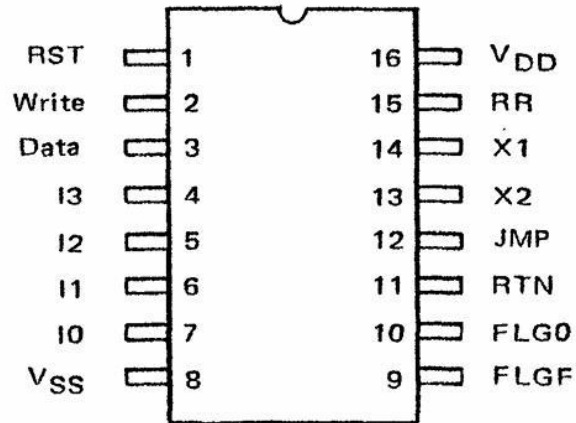


Figure 5: Motorola MC14500 pinout (from [7]).

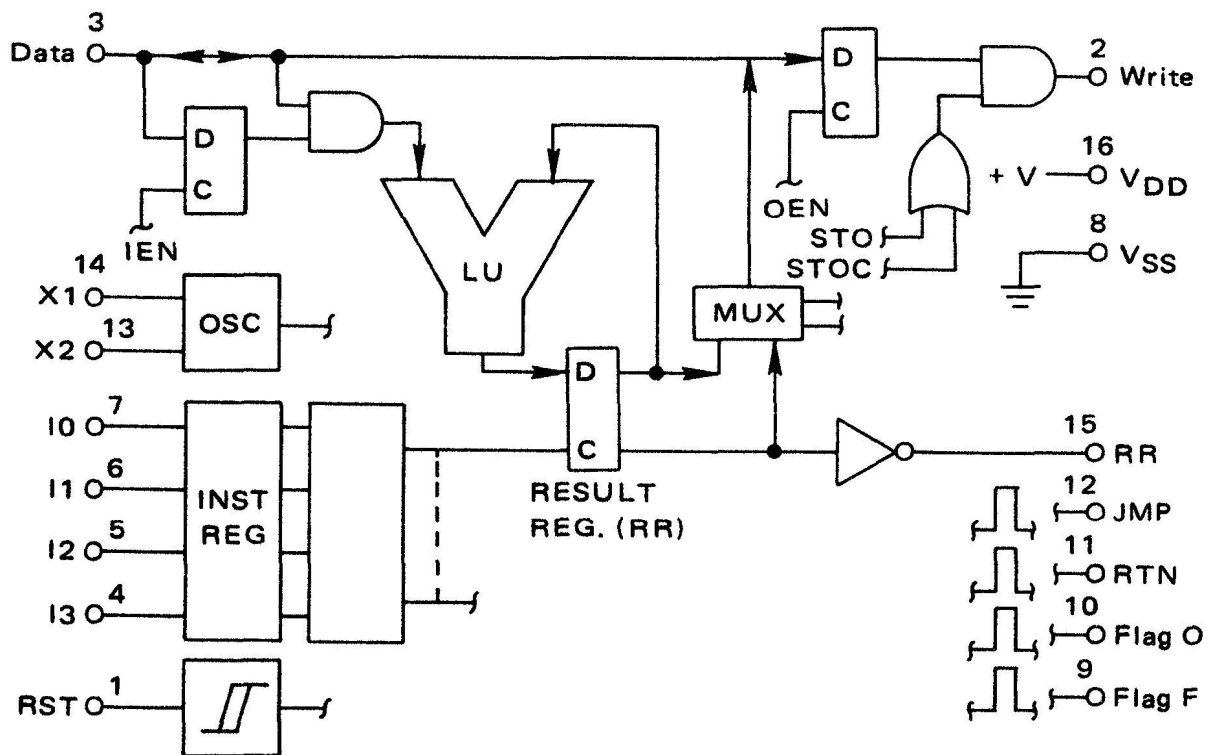


Figure 6: Motorola MC14500 architecture (from Wikipedia).