



DUNAÚJVÁROSI EGYETEM
UNIVERSITY OF DUNAÚJVÁROS

Reproducing the Classic Calculator

Using Modern Web Technology

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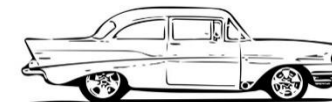
Supervisor: Dr. Király Zoltán, Tetsuo Iwase



Introduction

- ❑ **The Goal Is to Provide Realistic Simulation With the World's First Calculator**
 - **Photo**
 - **Display**
 - **Sound**
 - **Touch Feeling**
 - **Unique Operation**

- ❑ **We are familiar to Calculator**
 - Use it in real life, shopping, study, business
 - Computer Science Students learn programming of calculator.
- ❑ **Calculator H/W is decreasing...**
 - Go in the PC, now go in Smartphone
 - Calculator may disappear like analog phones.
- ❑ **Modern people will be interested in classic calculators.**
 - Like classic cars.





History of World's First Calculator

Focused on Handheld, Display Technology

According to:
- EdTechMagazine.com
- VintageCalculators.com
- TheCalculatorSite.com
- arithmomuseum.com

W-First: World's First

1623: W-First
Adding Machine
(DE)
<photo: replica>



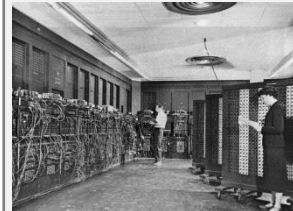
1773: W-First
Functional
Calculator
(DE)



1820: W-First
Commercially
Produced Mechanical
Calculator (FR)



1945: W-First
Vacuum Computer
ENIAC (US)



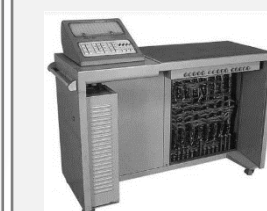
1948: W-First
Pocket Calculator
CURTA (AU)



1954: W-First All-
Transistor
Calculator 608 by
IBM (US)



1957: W-First All-
Electronic Dedicated
Calculator 14-A by
CASIO (JP)



1961: W-First All-
Electronic Desktop
Calculator ANITA-VII
by **Bell Punch (UK)**



1964: First
Desktop
HUNOR (HU)



1600 1650 1700 1750 1800 1850 1900 1950 1960 1970 1980 1990 2000 2010 2020



1967: W-First
portable battery-
operated calculator
ICC-500W by
SONY (JP).
Nixie display



1967: W-First
prototype handheld
'Cal-Tech' by Texas
Instruments (US).
Output:
Paper-tape only.



1970: W-First
mass-produced
handheld battery
calculator QT-8B
by **SHARP (JP)**.
VFD display.



1970: W-First
Handheld Nixie
display Calculator,
ICC-82D by
SANYO (JP)
Nixie display.



1970 W-First Handheld
Printing Calculator,
Pocketricon by **Canon**
(JP), Contribution by
Texas Instruments (US)
Paper-Tape only.



1971: W-First
Handheld LED
display, LE-
120A by
Busicom (JP).
Segment LED.



1973: W-First
LCD Display,
LC-800 by
DATAKING
(US).
Segment LCD



1973: W-First
mass-produced
LCD Display,
EL-805 by
SHARP (JP).
Segment LCD



2007: W-First
touchscreen
smartphone with
calculator, iPhone
by **Apple (US)**.
Pixel LCD, color.



Why Focused on Sharp QT-8B? From Many of the World's First.

- ❑ One of collection at Smithsonian Museum, USA
 - Archiving the "Creativity and Innovation Things" →
- ❑ SHARP received IEEE Milestone, includes QT-8D (predecessor of QT-8B) ↓



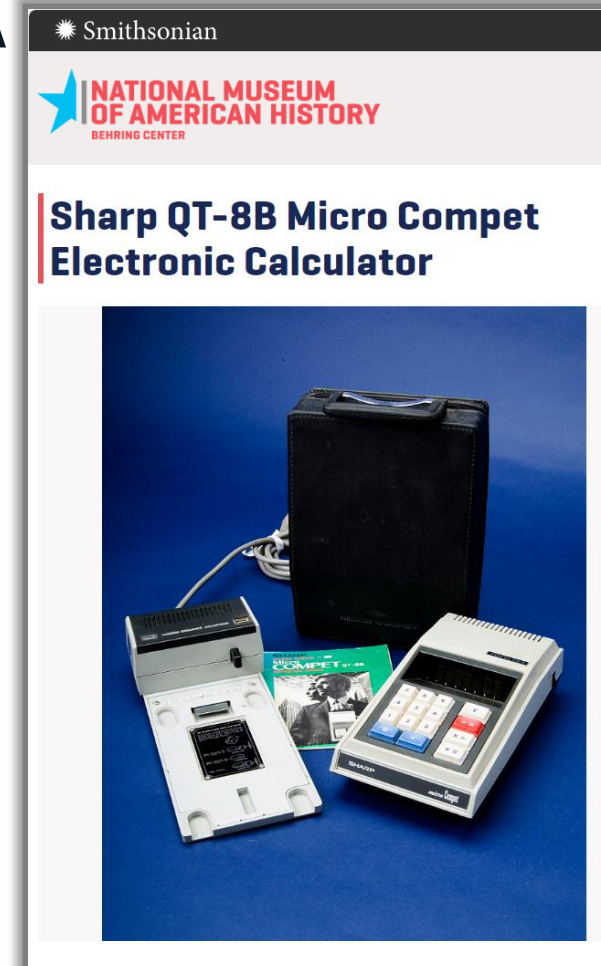
QT-8D, 1969
AC Powered



QT-8B, 1970
Battery Powered



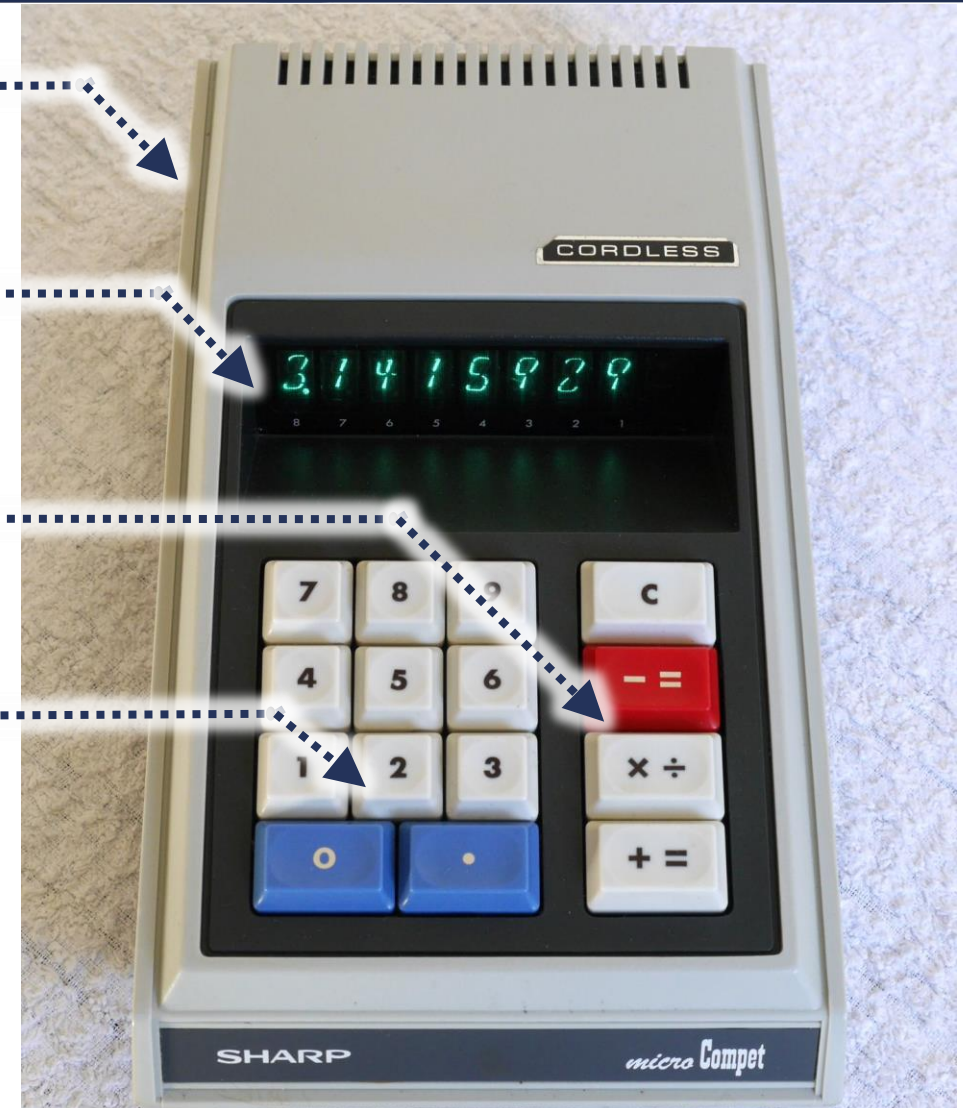
SHARP IEEE Milestone Calculators, 1964-1973
"Honor Historical Achievements"





Let's Go Back to 1970 Simulation Points and Direction

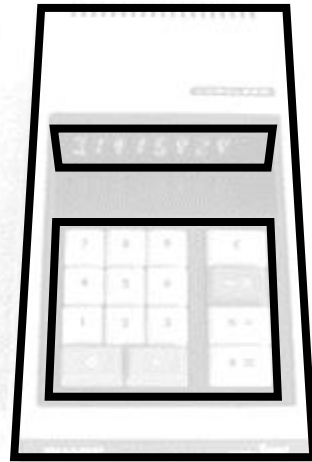
1. **Use a real photograph**
 - 3D perspective
2. **Simulate the display, look and feel**
 - VFD segment display
3. **Simulate the old era operations**
 - Very unique combination key
4. **Simulate the feel of the buttons**
 - Mechanical sound, Button touch
5. **Direction: simulate it ...**
 - On a web page for people to experience





[1] Use a Real Photograph

- ❑ Got acceptance to use it from owner of photo, QT-8B
- ❑ Perspective is adapted
 - Display, buttons on the photo
 - Transformed a rectangle into a trapezoid



Just put the objects



Perspective is adapted




Technology: CSS Transforms Module Level 1 (2019 candidate Recommendation)



[2] Simulate the Display Look and Feel

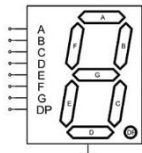
❑ VFD segment display and special design was used

↓ QT-8B, 1970

Sample Photo and Power Consumption			
Technology Name	NIXIE (Numeric Indicator experiment No.1)	VFD (Vacuum Fluorescent Display)	LCD (Liquid Cristal Display)
Main-stream	1950-1970s	1967-1980s	1973-now

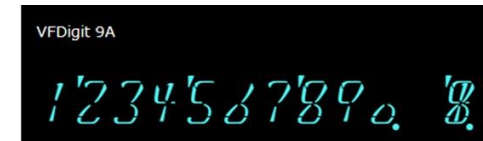


QT-8B has 9 segment



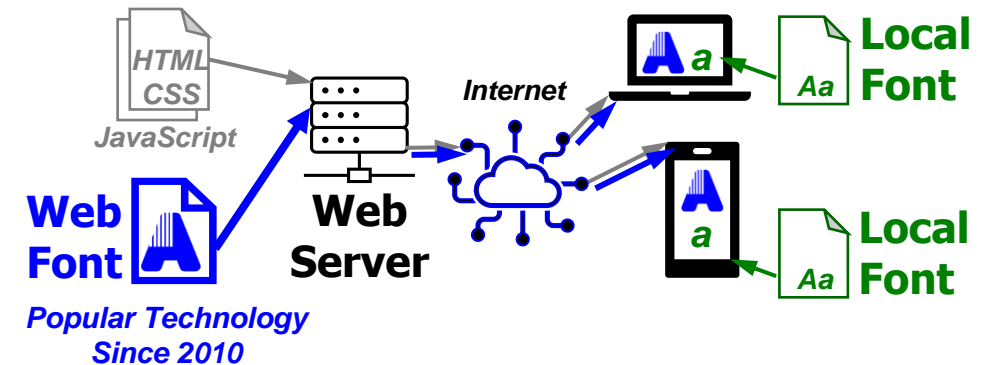
Recent design 7 segment

❑ Same design font is available since 2021, by individual



SIL Open Font License
<https://github.com/jz5/fonts-vfdigit>

- I used it with web-font technology
- To show it for all audience





The Road to Simulation for Display

1. Font is adapted

3.141592

2. Letter space is adjusted

3.141592

3. Transform perspective is adapted

3.141592

4. Overlay on the real photo

3.141592

5. Color is adjusted

3.141592

6. Illuminated by shadow attribute

3.141592

7. Mesh on the text

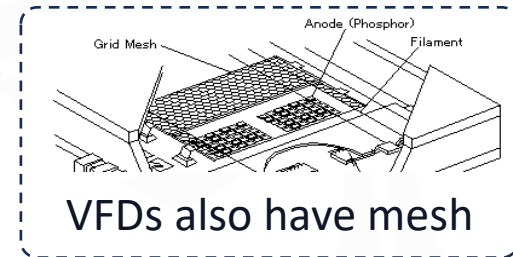
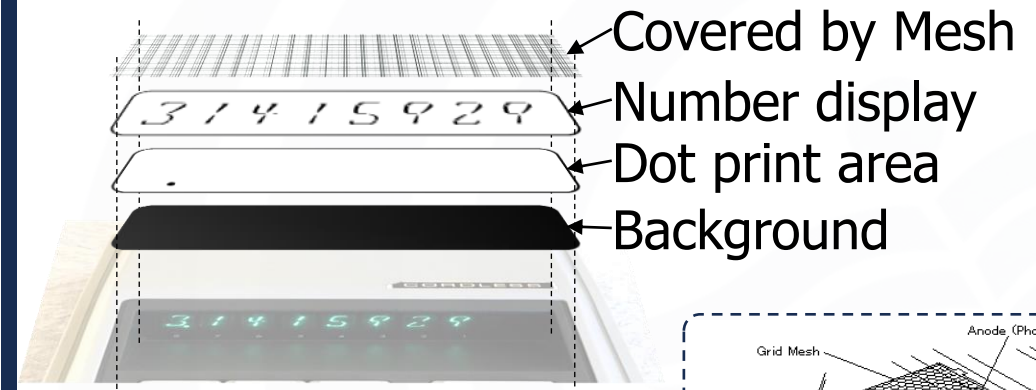
3.141592

8. Real photo

3.141592

❑ Ingenuity Point

- Made a layered display on HTML



❑ Technology

- CSS Text Decoration Module Level 3 (2019 candidate Recommendation), transport, ...



[3] Simulate the Old Era Operations

❑ Seems influenced from cash register operation



❑ Expression-based input wasn't settled in old time

■ Cf. SONY calculator followed expression-based input in 1964, got "amazing" but it was done as prototype.

		QT-8B		Regular Calc.	
	Action	Operation	Display	Operation	Display
1	Purchase \$10	10[+]=	10.	10[+]	10.
2	Purchase \$20	2[+]=	12.	2[+]	12.
3	It was TYPO!	2[-]=	10.	[-]2[+]	10.
4	Re-enter	20[+]=	30.	20[+]	30.
5	Give \$100	100[-]=	70. -	[-]100[=]	70. -
6	Back \$70			2 more keys	



QT-8B Keys

The Work What I Did

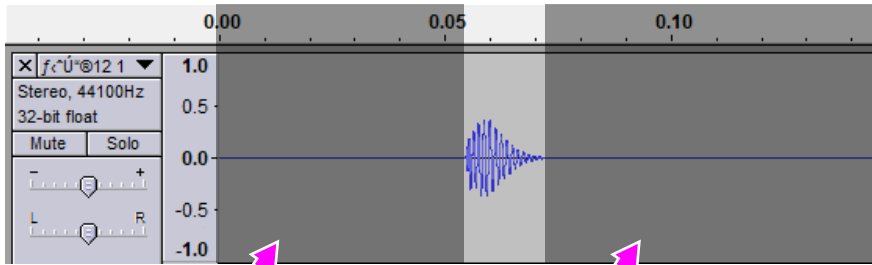
- ✓ Check the Instruction Manual
- ✓ Check the real behavior QT-8B/8D especially, division



[4] Simulate the Feel of the Buttons

❑ Need mechanical sound

- Just record it and make sound editing as short



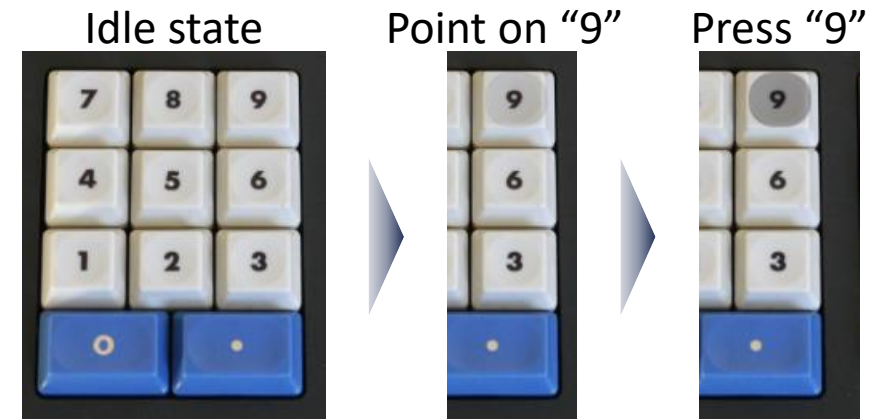
- Play sound when press the key



QT-8B> Sound is ready.

❑ Simulate the feeling of touch

- Imitate the shadow of a finger



- PC keyboard also available



PC Keyboard



QT-8B Keys



[5] Direction: Simulate It ...

- ❑ On a web page for people to experience

HTML	60 Lines
CSS	150 Lines
JavaScript	500 Lines
Total	710 Lines

- ❑ Using modern web technology

- JavaScript ES6 (since 2015)

- Object-oriented programming is available

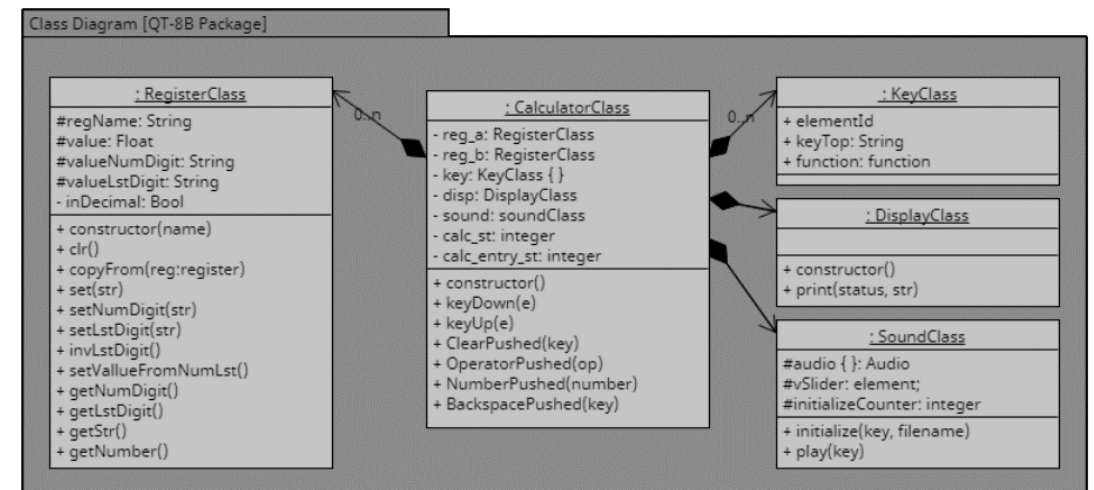
- CSS3 recent level

- Web-Font (since 2010), transform, perspective, text-shadow (since 2019)

- ❑ Apply object-oriented programming

- Object class corresponding to real-world concept

Calculator	Key	Sound
	Display	Register a, b





Now, Simulator For World's Classic Calculator Is Here



QT-8B Simulator (video 25sec)



Video Operation

Expression	Mouse
1+2 = 3	1 [+]= 2 [+]=
×4 = 12	[×÷] 4 [+]=
÷24=0.5	[×÷] 24 [-]=
PC keyboard	
3.1415929	
⌘6	

You Can Try
It by Yourself

<https://bit.ly/fujiwat-qt-8b>



The Results

Difficulty: easy ■■■■■ hard

Item	Difficulty	Achieved
[1] Use a real photograph	—	—
Get approval to use	■■	100%
3D perspective	■■■■■	100%
[2] Simulate the display, look and feel	—	—
Font design	■■	100%
Using web font	■■	100%
Illuminate the numbers	■■■■■■■	80%
[3] Simulate the old era operations	—	—
Operation key: [− =] [× ÷] [+ =]	■■■■■■■	90%
[4] Simulate the feel of the buttons	—	—
Mechanical Sound	■■	100%
Imitate the shadow of a finger	■■■■■	100%
[5] Direction: Simulate it	—	—
On a web page	■■■■■	100%
Using modern technology	■■■■■	100%
Apply object-oriented programming	■■■■■	100%

Already at a similar level when looked at normally.

➤ But precisely to say, it is different...

QT-8B has a function of fixed-point display for decimal fraction (without division result).

➤ Need to investigate more



I received
message.→

I was very
encouraged
with it.

*“I took my version from the cabinet to compare.
The behavior as well as the looks
very well resemble the real machine. ”*

*– Tiny Henst, owner of QT-8B.
from the Netherlands, 30th October 2023.*

Thank You for Your Kind Attention

You can try
QT-8B→

