

Reverse Engineering Online Challenge 2022-23
Disassembly of Texas Instruments TI-34 MultiView Calculator (2008)



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Introduction:

We are a team consisting of seven members, all varying in age and grade. We came together as a team in the beginning of this school year (22-23), and have had the same 7 members ever since.

Why the Calculator?


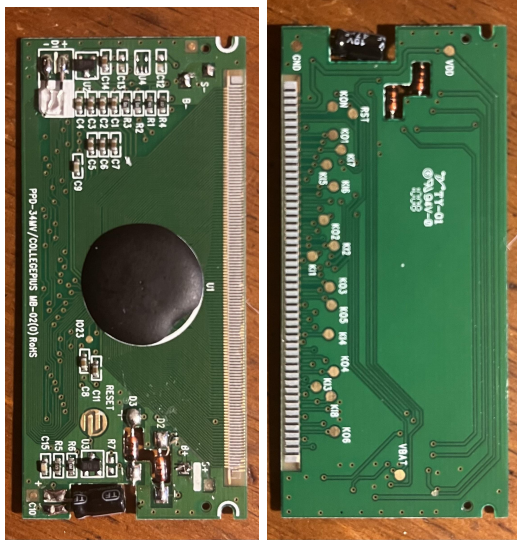

We picked the TI-34 MultiView Calculator because, while we might not all enjoy math, we recognize that our world wouldn't exist without it. The connection between engineering and mathematics is so grand that, with every decision we make on our robot, math is involved in some way, shape, or form. We chose to disassemble a calculator to help us better understand what kind of work gets put behind solving equations whenever needed.


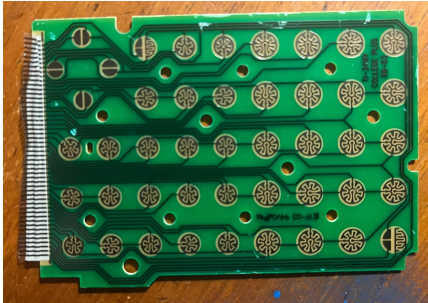

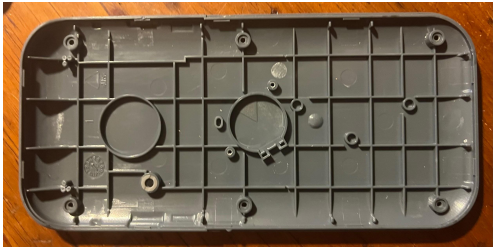
Disassembly:




Tools Needed:



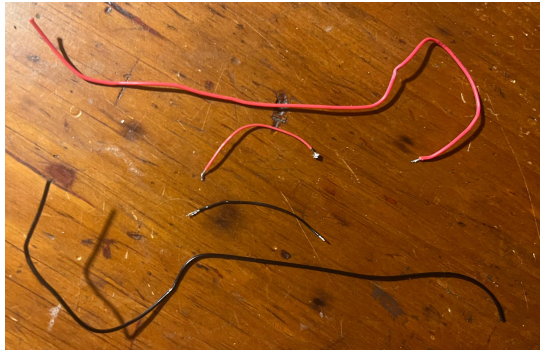

- Philips Head Screwdriver
- Flat Head Screwdriver
- Razor Blade

Device Components:

Part Description	Quantity	Photo	Function
Display Panel (96x31 Pixel)	1		To display information inputted and outputted
Circuit Board	1	 <p style="text-align: center;">(Front) (Back)</p>	Uses information from the inputs of the Silicon Button Membrane(binary) to calculate and send the output to the display panel
Circular Plastic Buttons	42		Presses down on a touchpad

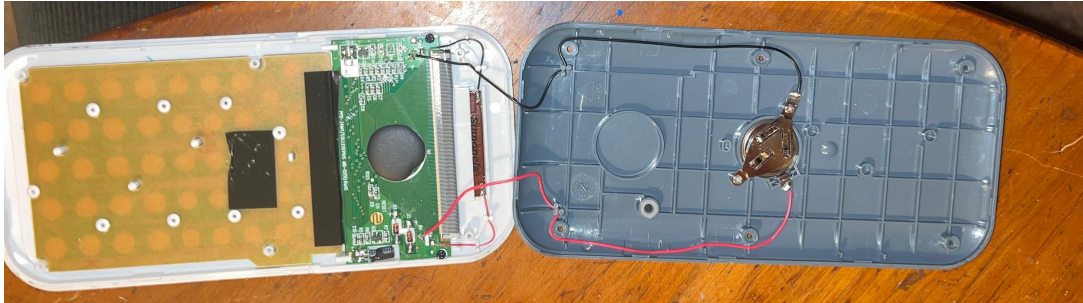
Silicon Button Membrane	1		When a key is pressed, the flexible plastic presses down onto the contact pads on the motherboard
Motherboard	1		Ties all electrical components together and gives them all power, contact pads send signals to circuit board
PV Cell	1		Also called the Solar Cell, converts solar energy into electricity
Back Casing (Gray)	1		Holds the battery and its casing in one spot

<p>Front Casing (White)</p>	<p>1</p>	 <p>(Back) (Front)</p>	<p>Holds the Display Panel, Circuit Board, Plastic Buttons, Silicon Button Membrane, Motherboard, and PV Cell in Place</p>
<p>Front Protector Case (Gray)</p>	<p>1</p>		<p>Covers the Front Casing to protect it from outside elements</p>
<p>Black Screws</p>	<p>8</p>		<p>Six hold the back and front casing together, two hold the circuit board in place</p>

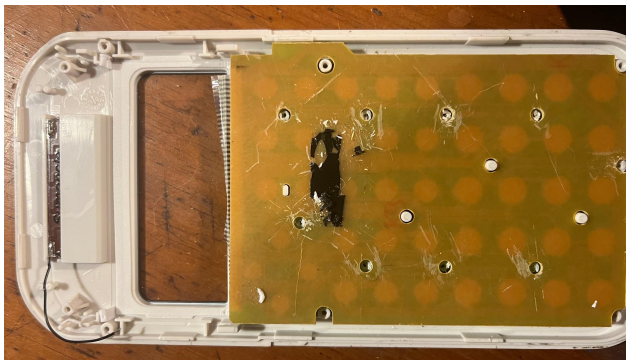
Silver Screws	2		Holds Battery against battery casing
Battery Casing	1		Holds Battery in place; Connects wires to battery
Wires	4 (2 Black, 2 Red)		Two (1 Black, 1 Red) connect the PV Cell to the Circuit Board, Two (1 Black, 1 Red) connect the battery to the Circuit Board.
Connector	2		Connects the Motherboard to Circuit Board and the Circuit Board to Display Panel

Process:

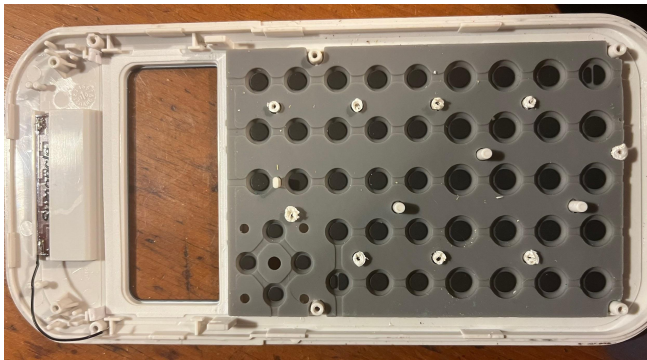
1. Unscrew the six screws that hold together the two casings, and then pry apart the two sides



2. Disconnect Wires
3. Take off Circuit Board and Display Panel



4. Pry off Motherboard



5. Remove Silicon Button Membrane and Plastic Buttons



6. Remove Silver Screws from Battery Case
7. Remove Battery Case



8. Cut out plastic and remove PV Cell



What did we learn?

Through the deconstruction of this calculator, we learned many things. The first is that calculators have lots of parts inside of them. Before this, we had no idea how much went into making a calculator. Another thing we learned was that this was tougher than we thought to take apart. When the calculator gets opened you see the back of the motherboard attached by eight plastic discs that are impossible to remove. Trying to pry the motherboard off was too risky as we did not want to break it completely, so we decided to remove the discs by cutting them off (safely with parental supervision and gloves). This process included a lot of troubleshooting that we did not expect.

Citations:

- Babu, Anjan. "Teardown: Calculators - T-Works." *T, T-Works*, 2 May 2022, <https://tworks.telangana.gov.in/blog/2019/9/13/teardown-calculators-1>.
- "Calculator Repairs." *Articles\Calculator Repairs*, https://www.calculator.org/articles/Calculator_Repairs.html.
- Mertes, Alyssa. "What Is inside of Calculators & How Do They Work?" *Promotional Products Blog*, 6 Apr. 2022, <https://www.qualitylogoproducts.com/blog/how-calculators-work/>.
- "Photovoltaic Cell." *Photovoltaic Cell - Energy Education*, https://energyeducation.ca/encyclopedia/Photovoltaic_cell.
- "TI-34." *Wikipedia*, Wikimedia Foundation, 22 Oct. 2021, [https://en.wikipedia.org/wiki/TI-34#TI-34_MultiView_\(2008\)](https://en.wikipedia.org/wiki/TI-34#TI-34_MultiView_(2008)).