Electronics Online Challenge Entry

Date: 01/9/2018
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Team Name: A for effort
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Introduction

For this online challenge we decided to dismantle a Vex EDR cortex. With the new V5 equipment coming out soon, the cortex will soon be out dated. We thought it would be interesting to see what is inside of a cortex, as it is a vital part of our robot. Because this challenge is for Vex robotics, we thought it would be educational to disassemble a Vex product.

In the past we have had problems with the inbuilt motor controllers burning out (quite literally). In taking apart the cortex we hoped to address this problem.

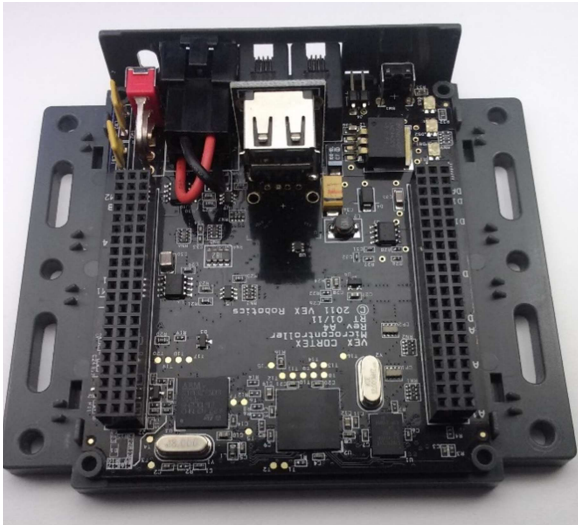
Table of contents

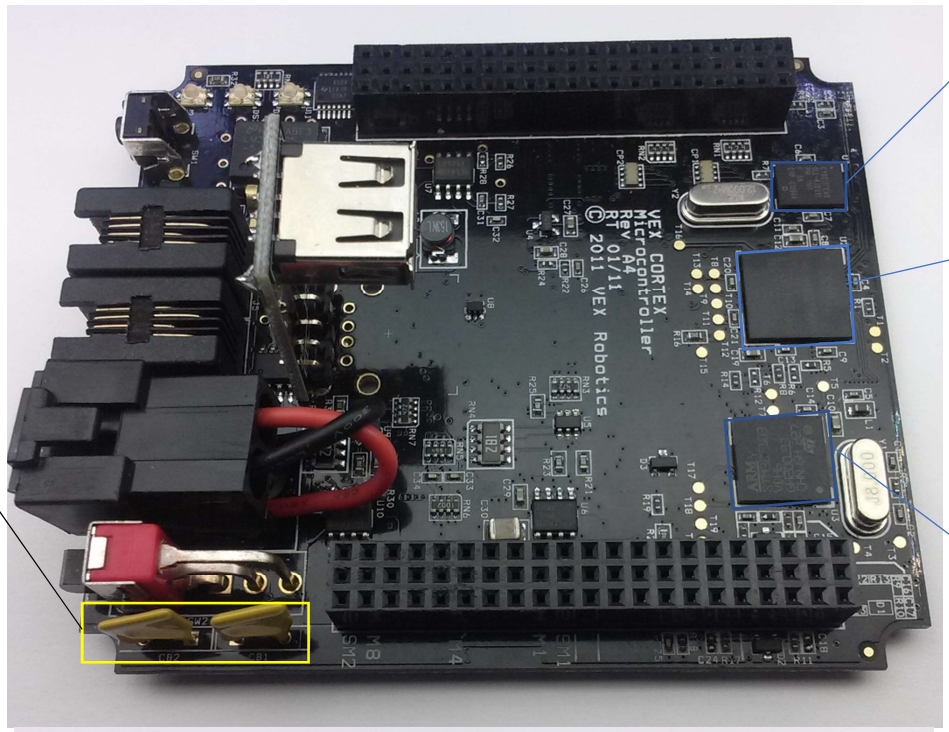
Parts brake down of the ICs

Part	Quantity	Description	Manufacturer
U1	1	8-Mbit static RAM	Cypress
U2	1	16-bit/32-bit micro; 512 kB flash, Ethernet, CAN, ISP/IAP, USB 2.0 device/host/OTG, external memory interface	NXP
U3	1	ARM Cortex-M3 MCU with 384 Kbytes Flash, 72 MHz CPU, motor control, USB and CAN	ST
U7	1	2.5A STEP DOWN SWITCHING REGULATOR	ST
U6-10	2	-30V Dual P-Channel MOSFET in a SO-8 package	Fairchild
U13-15	2	30V Dual N-Channel HEXFET Power MOSFET in a SO-8 package	International Rectifier
U11	1	Part # unknown (possibly an LED controller)	Texas Instruments
U12	1	1A Low Dropout Regulator	National Semiconductor (This part is also made by Texas Instruments. However, the part in this product was manufactured by National Semiconductor)

Beginning to disassemble cortex

Cortex with cover off.



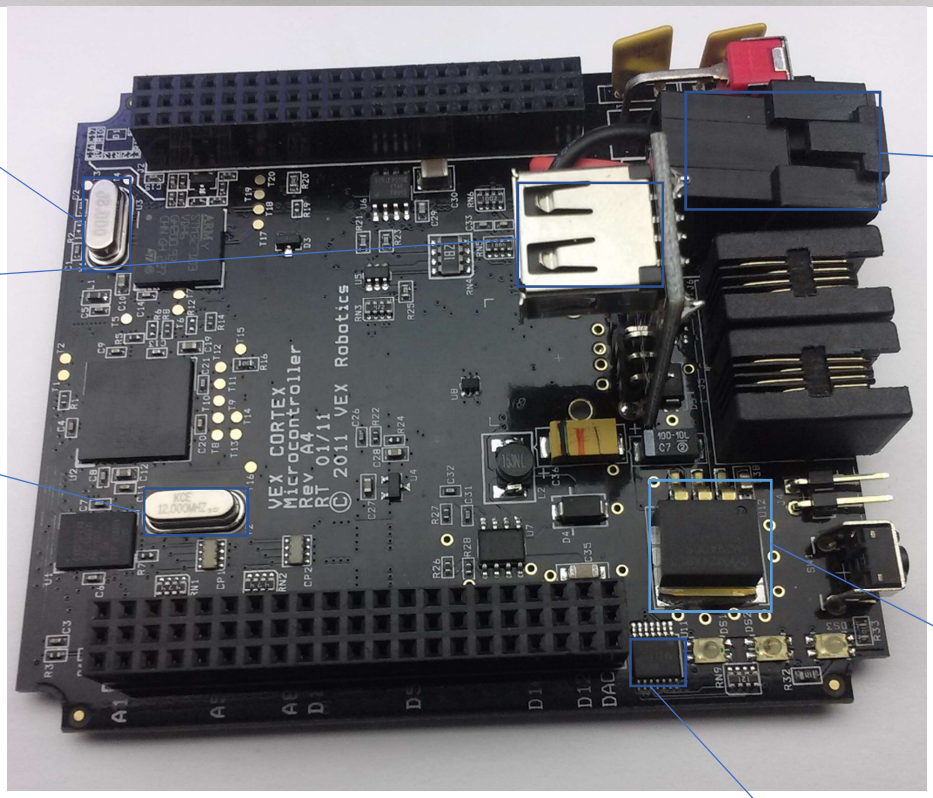


PPTC Resettable fuse (Stops your robot from having infinite power!!)

8-Mbit static RAM

U2: 16-bit/32-bit micro; 512 kB flash, Ethernet, CAN, ISP/IAP, USB 2.0 device/host/OTG, external memory interface

ARM Cortex-M3 MCU with 384 Kbytes Flash, 72 MHz CPU, motor control, USB and CAN



8 MHZ time crystal

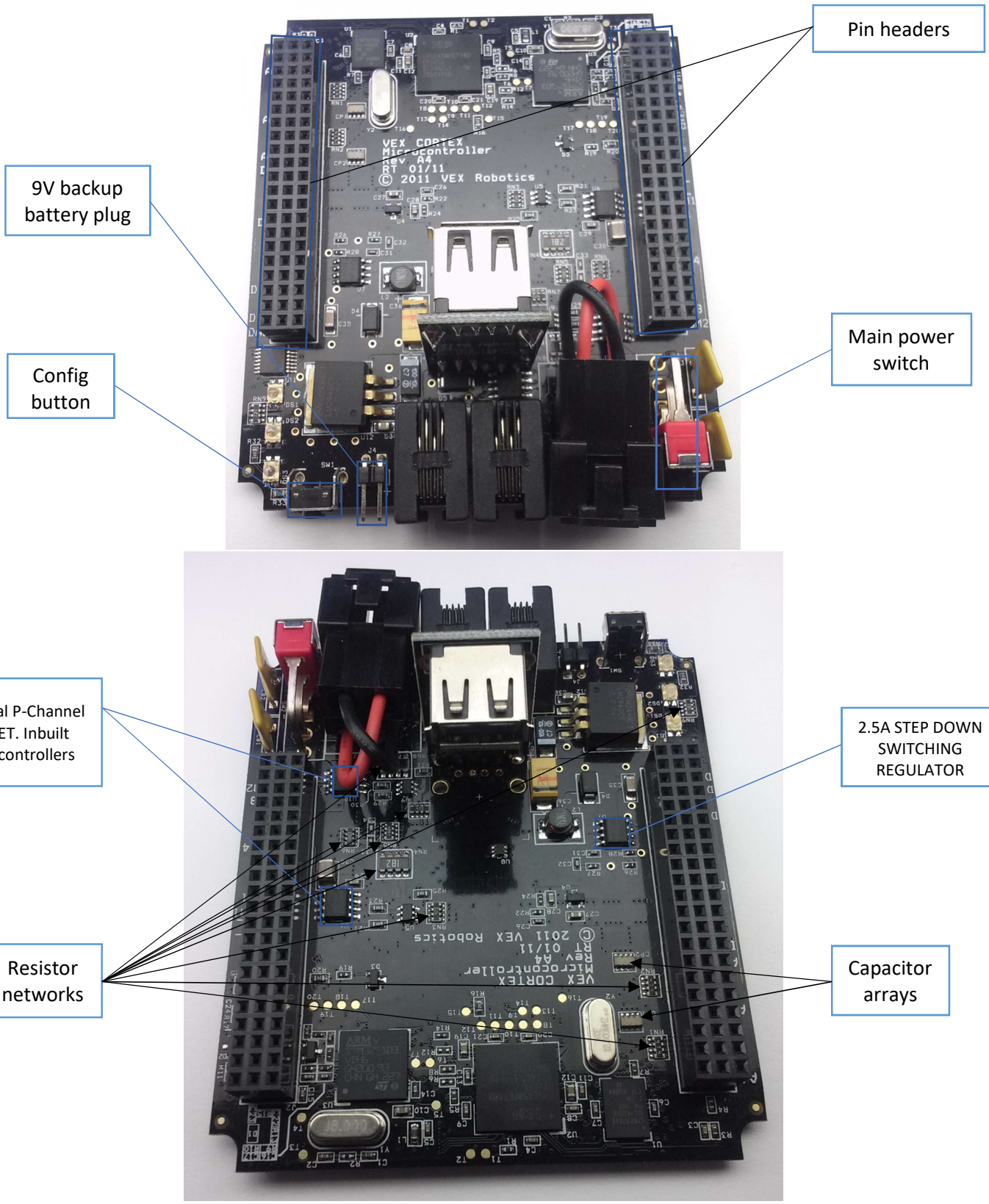
USB for VEX net key and programing

12 MHZ time Crystal

Kyosho Battery Connector

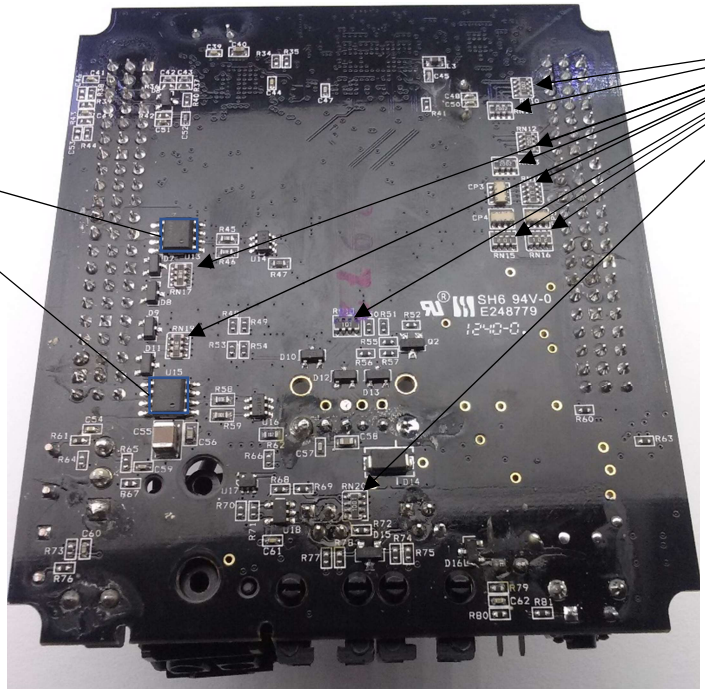
U12: 1A Low Dropout Regulator

Led interface IC Made by Texas Instruments

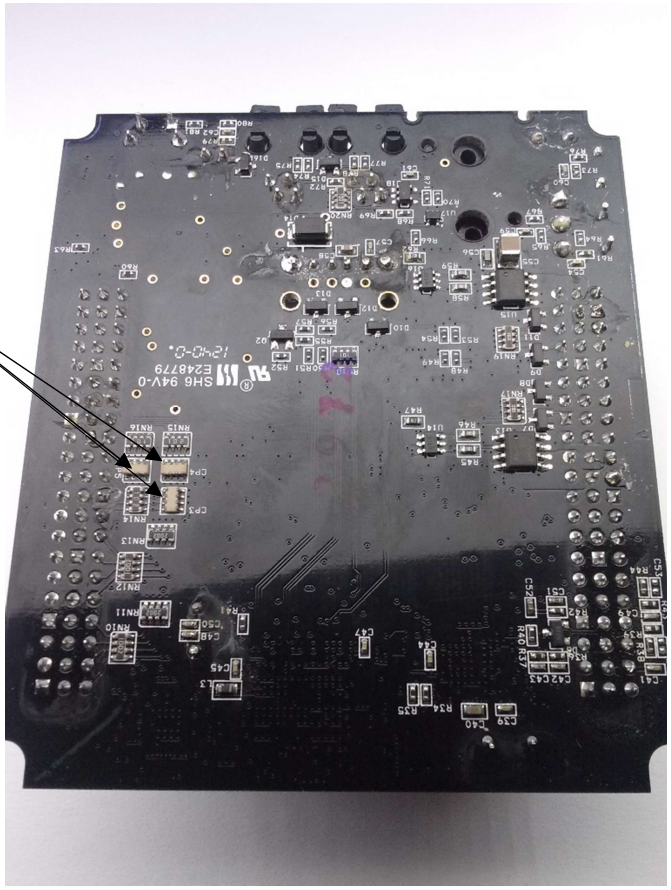

Pin headers
9V backup battery plug
Config button
Main power switch
-30V Dual P-Channel MOSFET. Inbuilt motor controllers
2.5A STEP DOWN SWITCHING REGULATOR
Resistor networks
Capacitor arrays

30V Dual N-Channel HEXFET Power MOSFET. Inbuilt motor controllers

Resistor networks



Capacitor arrays



Conclusion:

By taking apart the cortex we discovered that the IC's inside are made by many different manufacturers. People may suffer under the impression that all IC's and other components in a specific product are made by a single manufacture. This, however, is not true. In the cortex we examined, there were IC's from 7 different manufactures.

We learned that the inbuilt motor controllers (U6, 10, 13, and 15) should not have burned out, as they can handle seven amps of continuous current (which one motor alone should not draw) and up to fifty amps pulsed. Therefore, we ruled out the possibility that they were receiving too much current. We have not yet addressed the exact cause of the burn outs. ESD (electro static discharge) seems to be a likely cause, as Mosfets are particularly susceptible to static discharge. And static buildup on the practice field can get quite powerful.

All pictures taken by Team 6403A

Resources

Datasheetcatalog.com