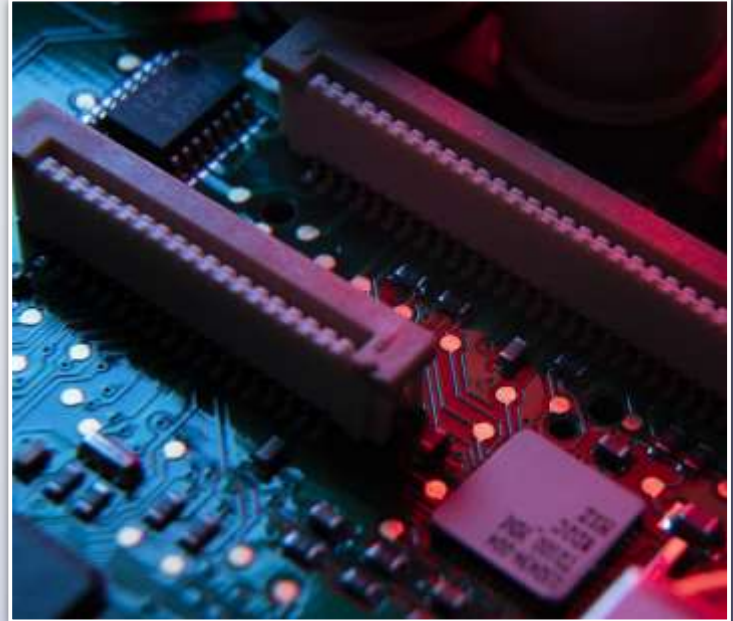


EDA Database

Final Presentation

Group: Mat Yohannes, Yana Zaynullina, Jason Muturi

May 9, 2024



Abstract

EDA Project - Electronic Design Automation

The goal is to design and create a database of electronic components that will be used to communicate with the graphic user interface.

Front End - GUI team

Back End - SQL team

Goals:

- Upload DigiKey data to MySQL
- Collaborate with GUI team to connect Front to Back

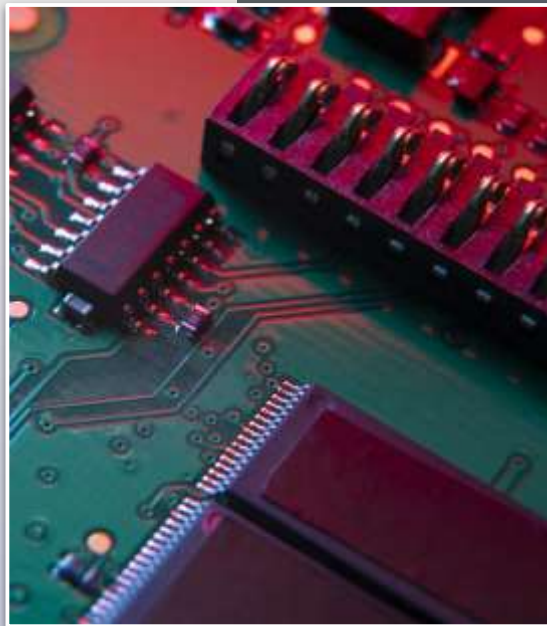
For who:

This program is created for use by Professor Jeffrey A. Wiegley



Final Product

- Delivered organized database of DigiKey components following the schema created earlier in the Fall semester
- The data was pulled from the distributor's official APIs and formatted to follow the desired structure
- Current files consider the possibility of future updates, allowing the user to make these modifications with ease. In case an update fails, the changes will not be executed
- Due to the size of files, the pulling and updating will require significant amount of time



What We Are Doing

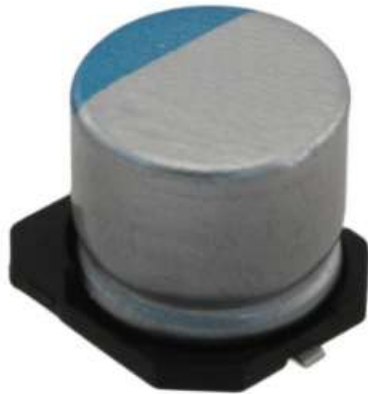


Image shown is a representation only. Exact specifications should be obtained from the product data sheet.

APXF6R3ARA151ME40G

DigiKey Part Number

565-APXF6R3ARA151ME40GTR-ND - Tape & Reel (TR)
565-APXF6R3ARA151ME40GCT-ND - Cut Tape (CT)
565-APXF6R3ARA151ME40GDKR-ND - Digi-Reel®

Manufacturer

Chemi-Con

Manufacturer Product Number

APXF6R3ARA151ME40G

Description

CAP ALUM POLY 150UF 20% 6.3V SMD

Manufacturer Standard Lead Time

22 Weeks

Customer Reference

Detailed Description

150 μ F 6.3 V Aluminum - Polymer Capacitors Radial, Can - SMD 20mOhm 3000 Hrs @ 105°C



What We Are Doing

Product Attributes

| TYPE | DESCRIPTION |
|------------------------------------|---|
| Category | Capacitors Aluminum - Polymer Capacitors |
| Manufacturer | Chemi-Con |
| Series | NPCAP™-PXF |
| Packaging | Tape & Reel (TR) ⓘ Cut Tape (CT) ⓘ Digi-Reel® ⓘ |
| Part Status | Active |
| Type | Polymer |
| Capacitance | 150 µF |
| Tolerance | ±20% |
| Voltage - Rated | 6.3 V |
| ESR (Equivalent Series Resistance) | 20mOhm |

| | |
|------------------------------------|---------------------------------------|
| Voltage - Rated | 6.3 V |
| ESR (Equivalent Series Resistance) | 20mOhm |
| Lifetime @ Temp. | 3000 Hrs @ 105°C |
| Operating Temperature | -55°C ~ 105°C |
| Ratings | - |
| Applications | General Purpose |
| Ripple Current @ High Frequency | 2.7 A @ 100 kHz |
| Lead Spacing | - |
| Size / Dimension | 0.197" Dia (5.00mm) |
| Height - Seated (Max) | 0.165" (4.20mm) |
| Surface Mount Land Size | 0.209" L x 0.209" W (5.30mm x 5.30mm) |
| Mounting Type | Surface Mount |
| Package / Case | Radial, Can - SMD |

File Directory Structure

- ..
- Attributes
- Postman Exports
- APIPuller.jar
- APIPuller.sh
- AttributeCollector.sh
- CategoriesList.txt
- CategoriesToSQL.jar
- ClientList.txt
- JSONSQL.jar
- output.txt
- Printer.jar
- sqlCategories.sh
- sqlcharacteristics.sh
- sqlmembership.sh

- ..
- Capacitors
- Connectors, Interconnects
- Crystals, Oscillators, Resonators
- Inductors, Coils, Chokes
- Integrated Circuits (ICs)
- Potentiometers, Variable Resistors
- Relays
- Resistors
- Switches
- categories.json
- desktop.ini

| | |
|---|---------|
| Aluminum - Polymer Capacitors.json | 53 151 |
| Aluminum Electrolytic Capacitors 2.json | 132 085 |
| Aluminum Electrolytic Capacitors 3.json | 122 839 |
| Aluminum Electrolytic Capacitors 4.json | 126 113 |
| Aluminum Electrolytic Capacitors 5.json | 104 797 |
| Aluminum Electrolytic Capacitors.json | 144 350 |
| Capacitor Accessories.json | 1 528 |
| Capacitor Networks, Arrays.json | 10 601 |
| Ceramic Capacitors 10.json | 111 925 |
| Ceramic Capacitors 11.json | 112 139 |
| Ceramic Capacitors 12.json | 111 073 |

The Meat



Main files to interact with the project:

AttributeCollector
DigiKeyAPI3
categoriesFile
CategoriesToSQL
JSONFileReader

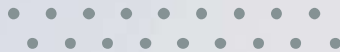
Helper Files:

ClientScanner
CategoryHeaders
DirectoryFiler
JDBC
characteristics2Table
membershipTable
Characteristics
CategoriesCheckList



Shell Files

| Java File | Shell Files |
|------------------------------------|-----------------------|
| AttributeCollector | AttributeCollector.sh |
| CategoriesToSQL | sqlCategories.sh |
| DigKeyAPI3 | APIPuller.sh |
| JSONFileReader for membership | sqlcharacteristics.sh |
| JSONFileReader for characteristics | sqlmembership.sh |



APIPuller.sh

```
java -Xmx4g -jar APIPuller.jar
```

sqlCategories.sh

```
java -jar CategoriesToSQL.jar
```



ClientList.txt

ClientID Delimiter “ | ” **ClientSecret** Delimiter “ | ” **Status**

Status:

X - incomplete

O - complete

| ClientList.txt | | |
|----------------|-----------------------------------|------------------|
| 1 | lWNGv9df3Jw9hZt6DasTM0jKYN4PZz1Fi | R4hJSM1YzaLG0jfq |
| 2 | 3JVzsxuTlgNwDGEA8jrFuaWMZ7U5jhMe | QmdDFpWp05Jr1XQv |
| 3 | T0k7ot88fL1QiytWVaHtCDCZZEpGIGHS | hhWHnvASpppLICvP |
| 4 | LZAMeydeUNgc4Ra1h88Atd7jW4zVhx2H | SICjZIP5cozkskAC |
| 5 | 1b46py11nyq6RfeBQqwkphLEiE6Ip4FV | R3A9331phj0ziCam |
| 6 | 9dbFAeiRhu1fSE2LV5KaMAV8LAUgvG5y | ce0vEJkdzjfb1Xt7 |
| 7 | r5a0RFLpiob32CniBZX5g8T8c7cEGAvG | BpSQUYUAEuyhLZ9 |
| 8 | BV2PEhEBHbFgABvwaVvzwkEH24i7qrVZ | pUGz4k2uIPc8flg9 |
| 9 | FDckWvSA6THWL15bvYp0nGVsjaYalqNQ | kzIEp21ijuK65hDx |
| 10 | j74EeEuH7jCYhptQ5Sfaotr3bidne1mB | BaicYfSAm8UsGpL |
| 11 | 1JkM89ihGj2d9PHwVaneB90lWkpSmmZM | RW7FrgG1SLysyxoB |
| 12 | Oj49mbUSHOX6IOwo56QAFNETGRrn6RuT | abHwkcJx8tyuGLu |
| 13 | sR27U9eRmVz4G1xyvZGbbIppx94pp6mq | 348ZdwUIwztxicgW |
| 14 | V8SizfB7ukPMUam1XmOYkvECCQjHOXnX | k7dKEdoR9PVTevJ |
| 15 | kCmJAYaccoCkrqG07yMexUTZDVXinK0T | MPw5FZPvgnvsmog7 |
| 16 | nyD7WAV2W50Wv7KEH6VGA0Nbp3nGkNPz | NPetuRmsfUzYafjS |
| 17 | 9pIQeSg8NEw9BpNfzqM2CzKGDfXULxGQ | 4diAUwcLfNTADwn |
| 18 | UzyXFWk3J6oCkzwxpsrJGZXRp0Ab1pUQ | wgYAxwJ00E58vvGg |
| 19 | glKAh80p58xtWRWDJTq7esAIN22ZLE3 | 4sz04hAg5eDqjvLN |
| 20 | QWgKGNgzRFz9IQEEHjVKoiJvzIua1s7I | 3chocQjCtIopldhJ |
| 21 | ZS8RX7GM5CoT2zCv5pCgYzTRZt00R2LB | yB00wKPFFt2U3Pxh |
| 22 | ISGpizzzbvoXjA894LtooRyPdt25bL9Q | GB0bGBamT9CAleQY |
| 23 | | |

CategoriesList.txt

The subcategories name
on the left

Delimiter “ | ”

Status:

X - incomplete

O - complete

OO - over 120k rows

```
CategoriesList.txt
100 Pluggable Connector Accessories | O
101 Pluggable Connector Assemblies | O
102 Arrays, Edge Type, Mezzanine (Board to Board) | Issue O
103 Board In, Direct Wire to Board | O
104 Board Spacers, Stackers (Board to Board) | OO
105 Free Hanging, Panel Mount | Issue O
106 Headers, Male Pins | OO
107 Headers, Receptacles, Female Sockets | OO
108 Headers, Specialty Pin | O
109 Rectangular Connector Accessories | O
110 Rectangular Connector Adapters | O
111 Rectangular Connector Contacts | Issue O
112 Rectangular Connector Housings | O
113 Spring Loaded | O
114 IC Sockets | O
115 Socket Accessories | O
116 Socket Adapters | O
117 Solid State Lighting Connector Accessories | O
118 Solid State Lighting Connector Assemblies | O
119 Solid State Lighting Connector Contacts | O
120 Barrier Blocks | O
121 Din Rail, Channel | O
122 Headers, Plugs and Sockets | Issue O
123 Interface Modules | O
124 Panel Mount | Issue O
125 Power Distribution | O
126 Terminal Blocks Specialized | O
127 Terminal Block Accessories | X
128 Terminal Block Adapters | X
129 Terminal Block Contacts | X
130 Wire to Board | X
131 Terminal Junction Systems | X
132 Terminal Strips and Turret Boards | X
133 Barrel, Bullet Connectors | X
134 Foil Connectors | X
135 Housings, Boots | X
136 Knife Connectors | X
137 Lugs | X
138 Magnetic Wire Connectors | X
139 PC Pin Receptacles, Socket Connectors | X
140 PC Pin, Single Post Connectors | X
```

sqlcharacteristics.sh/sqlmembership.sh

```
# List of categories

categories="Capacitors 'Connectors, Interconnects' 'Crystals, Oscillators, Resonators'

# Iterate over each category in categories

for category in $categories
do
    java -jar JSONSQL.jar $category "c"
done
```



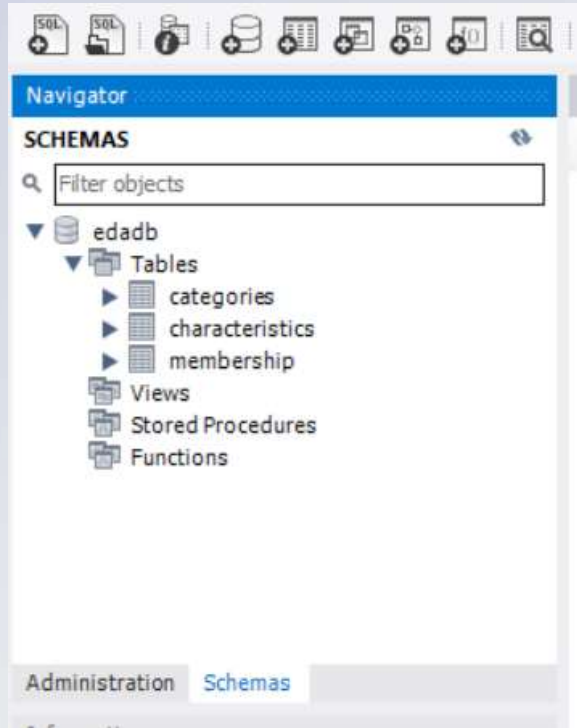
AttributeCollector.sh

```
directory="/root/EDAPProject/Postman Exports"

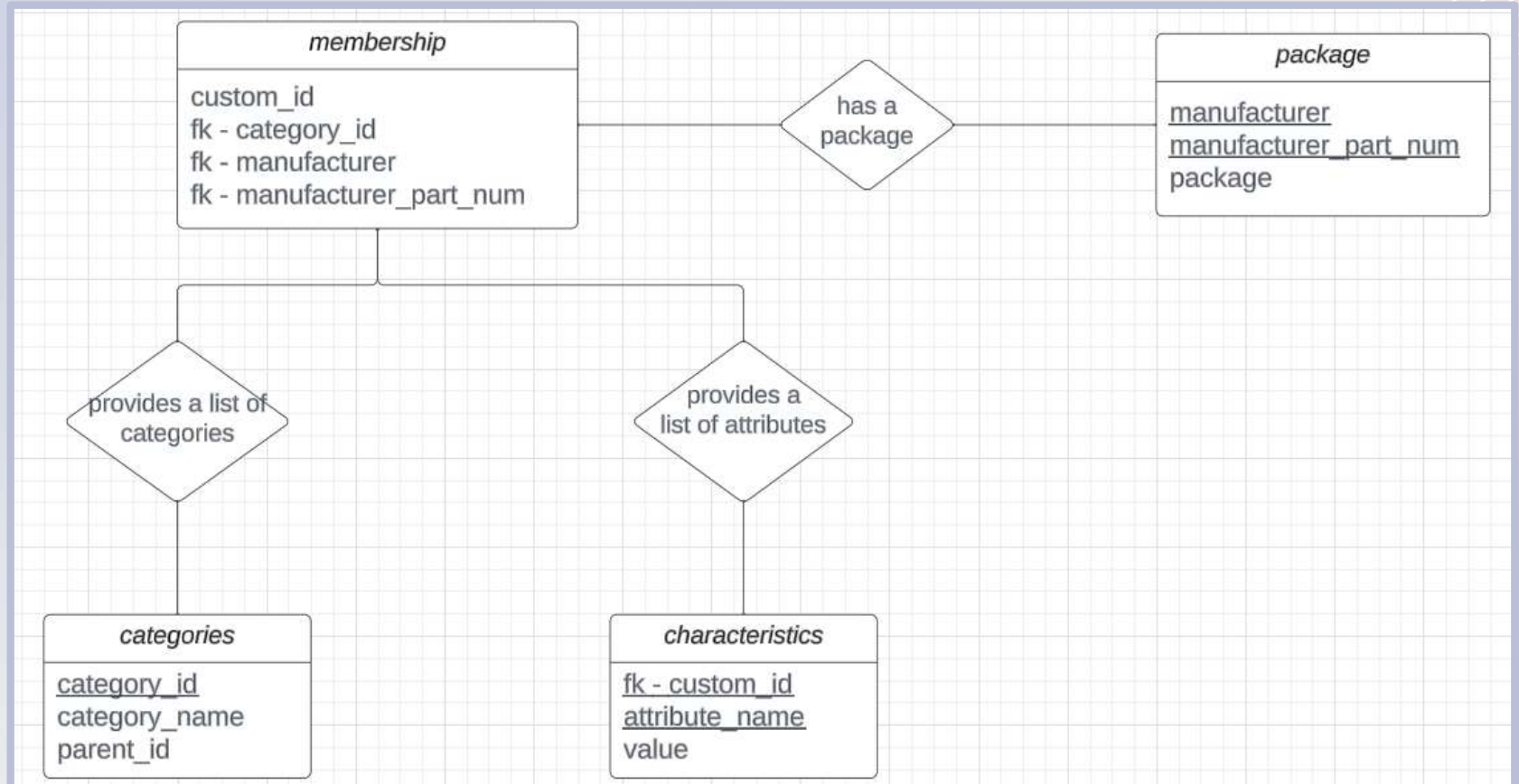
#Check if directory exists
if [ -d "$directory" ]; then
    # Loop through each entry in the directory
    for entry in "$directory"/*; do
        #Check if the entry is a directory
        if [ -d "$entry" ]; then
            substring=$(echo $entry | cut -d '/' -f5-)
            echo "$substring"
            java -jar Printer.jar "$substring" > Attributes/"$substring".txt
        fi
    done
else
    echo "Directory does not exist."
fi
```

| Name | Size (KB) |
|--|-----------|
| .. | |
| Capacitors.txt | 3 |
| Connectors, Interconnects.txt | 32 |
| Crystals, Oscillators, Resonators.txt | 8 |
| Inductors, Coils, Chokes.txt | 1 |
| Integrated Circuits (ICs).txt | 35 |
| Potentiometers, Variable Resistors.txt | 2 |
| Relays.txt | 3 |
| Resistors.txt | 10 |
| Switches.txt | 9 |

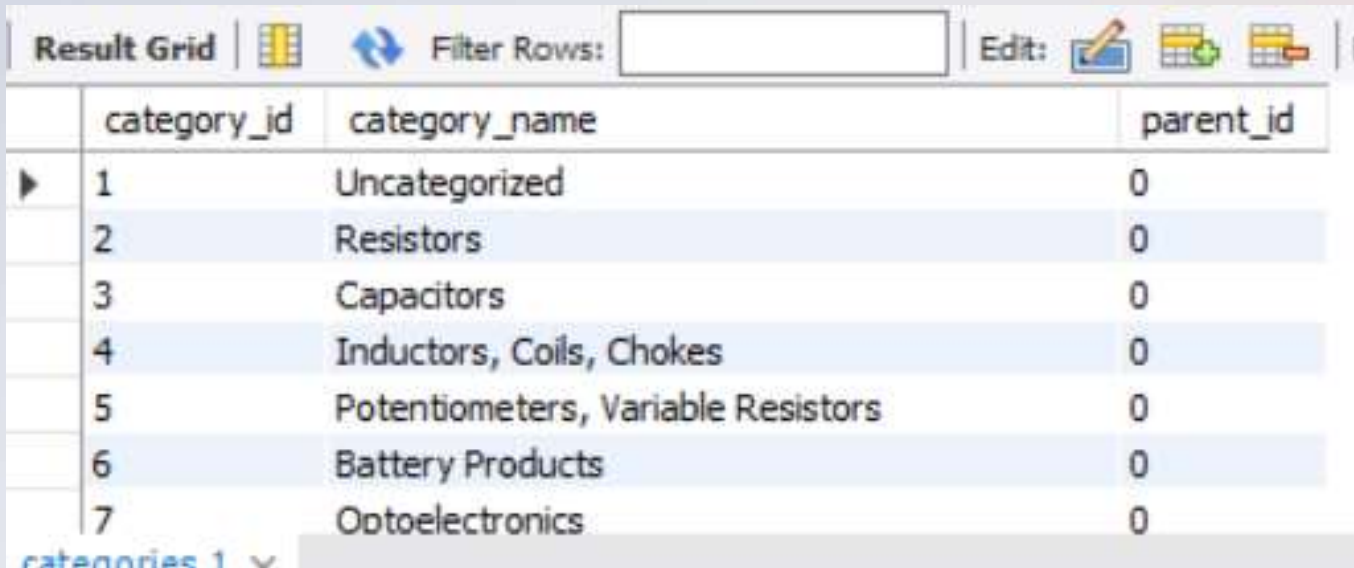
SQL Tables



E-R Diagram



Categories Table



The screenshot shows a database application interface. At the top, there is a toolbar with icons for 'Result Grid', 'Filter Rows' (with a search box), and 'Edit' (with a pencil icon). Below the toolbar is a table with three columns: 'category_id', 'category_name', and 'parent_id'. The table contains seven rows of data. The first row is 'Uncategorized' with 'category_id' 1 and 'parent_id' 0. The subsequent rows are 'Resistors', 'Capacitors', 'Inductors, Coils, Chokes', 'Potentiometers, Variable Resistors', 'Battery Products', and 'Optoelectronics', all with 'parent_id' 0. The table is titled 'categories 1' at the bottom left.

| | category_id | category_name | parent_id |
|---|-------------|------------------------------------|-----------|
| ▶ | 1 | Uncategorized | 0 |
| | 2 | Resistors | 0 |
| | 3 | Capacitors | 0 |
| | 4 | Inductors, Coils, Chokes | 0 |
| | 5 | Potentiometers, Variable Resistors | 0 |
| | 6 | Battery Products | 0 |
| | 7 | Optoelectronics | 0 |

categories 1 ▼

Membership Table

| Result Grid | | | | |
|-------------|-----------|--------------|-------------------|------------------------|
| | | Filter Rows: | | |
| | | Edit: | | |
| | custom_id | category_id | manufacturer | manufacturer_part_num |
| | 37 | 399 | KEMET | T522V227M004ATE025 |
| | 38 | 399 | KEMET | T523V187M020APE1007706 |
| | 39 | 399 | KEMET | T500B106K016BG6110A |
| | 40 | 478 | KYOCERA AVX | F921D225MBA |
| | 41 | 338 | Cornell Dubili... | TDL226K035M1E-F |
| | 42 | 399 | KEMET | T212C685M050MS |
| | 43 | 399 | KEMET | T110A394K050AS |
| | 44 | 399 | KEMET | T110B275K050AS |
| | 45 | 399 | KEMET | M39003/09-2082 |
| | 46 | 399 | KEMET | M39003/03-0286 |
| | 47 | 4054 | Quantic Evans | THQM2016502 |
| | 48 | 4054 | Quantic Evans | TDB1100132 |
| | 49 | 4054 | Quantic Evans | TDD1110202 |
| | 50 | 4054 | Quantic Evans | THQ2016502 |

membership table

Characteristics Table

| Result Grid | | | | Filter Rows: | Edit: | Export/Import: | |
|-------------|-----------|------------------------------------|---|--------------|-------|----------------|--|
| | custom_id | attribute_name | value | | | | |
| | 47 | Type | Hermetically Sealed | | | | |
| | 47 | Voltage - Rated | 16 V | | | | |
| | 48 | Capacitance | 1.3 mF | | | | |
| | 48 | ESR (Equivalent Series Resistance) | 125mOhm | | | | |
| | 48 | Features | Hybrid Wet Tantalum | | | | |
| | 48 | Height - Seated (Max) | 0.344" (8.74mm) | | | | |
| | 48 | Lead Spacing | 0.400" (10.16mm) | | | | |
| | 48 | Lifetime @ Temp. | 2000 Hrs @ 85°C | | | | |
| | 48 | Mounting Type | Through Hole | | | | |
| | 48 | Operating Temperature | -55°C ~ 125°C | | | | |
| | 48 | Package / Case | Radial, Can | | | | |
| | 48 | Size / Dimension | 1.000" L x 1.000" W (25.40mm x 25.40mm) | | | | |
| | 48 | Tolerance | ±20% | | | | |
| | 48 | Type | Hermetically Sealed | | | | |
| | 48 | Voltage - Rated | 100 V | | | | |
| | 49 | Capacitance | 2000 µF | | | | |
| | 49 | ESR (Equivalent Series Resistance) | 85mOhm @ 1kHz | | | | |

Tools We Used

- **Jira** - project management, tracking, initial documentation and project planning
- **Discord** - team communication
- **GitHub** - version control
- **IntelliJ** - IDE of choice to work with Java
- **MobaXterm** - X-server and SSH client
- **Postman** - receive and send API requests; later was discontinued
- **MySQL** - database to store our products



Challenges Faced

- ❖ Working with these technology for the first time required a lot of researching prior to start:
 - Using APIs to access files
 - Dealing with storage issues and eventually working on a remote Linux server
 - Dealing with very big databases in MySQL (over X rows)
- ❖ Working with a company's API requires careful reading of their documentation
 - Initially started with Postman to get the files
 - Due to singular and daily pull limits, had to write our own Java files to access the JSON files

Challenges Faced

- ❖ Coming up with the database schema
 - Had to keep in mind future updates and storage of several vendors
 - Navigating many attributes of the products, focusing on their relationships within the system and eliminating irrelevant features
- ❖ Some of the initial files were corrupted due to incorrect indexing, they were fixed once identified
- ❖ Each file on our server is limited to 25,000 items to avoid heap issue. Directory filer creates a new file with indexes to keep track of all the items
 - This number of items grants the best performance time (4 seconds)

What We Learned

- ❖ Working with basic APIs using Postman and your own code
- ❖ Manipulating large amounts of data with attention to efficiency
- ❖ Utilizing and modifying JSON files to suit the needs of our database
- ❖ Interacting with online server to store our files and run Linux commands to manipulate them
- ❖ Reviewed basic SQL for database management
- ❖ Scheduling processes on Linux





Future Improvements for Next Generation

- ❖ Collaborating with the Front-end team to connect the parts
- ❖ Provide SQL procedures to run the required queries
- ❖ Add a new electronics vendor (Mouser)

