HOMEWORK ASSIGMENT

Design Heterogeneous ICs with Chiplets — A Power Perspective

Jawad Nasrullah
CTO, zGlue, Inc.
Http://www.zglue.com

VISIT OUR DAC 2020 BOOTH
https://dac2020.pathable.co/organizations/aKPenY37tCNL9WMG5

zGlue

Tutorial Homework Reference Material

zGlue OmniChip:

Overview: https://zglue.com/products/omnichip

Collaterals: https://zglue.com/oci/project/omnichip

Design Files: https://zglue.com/applications/2647

Supporting Material for DAC Tutorial: https://drive.google.com/drive/u/1/folders/1liOxbHKNkF9jDC84DxXbXMkFnFpwKR_v

zGlue University Courses: https://zglue.com/university

zGlue Chiplet Library: https://chipletstore.zglue.com/products/chipletstore

zGlue ChipBuilder: https://chipbuilder.zglue.com

Homework

1- Review OmniChip: https://zglue.com/products/omnichip

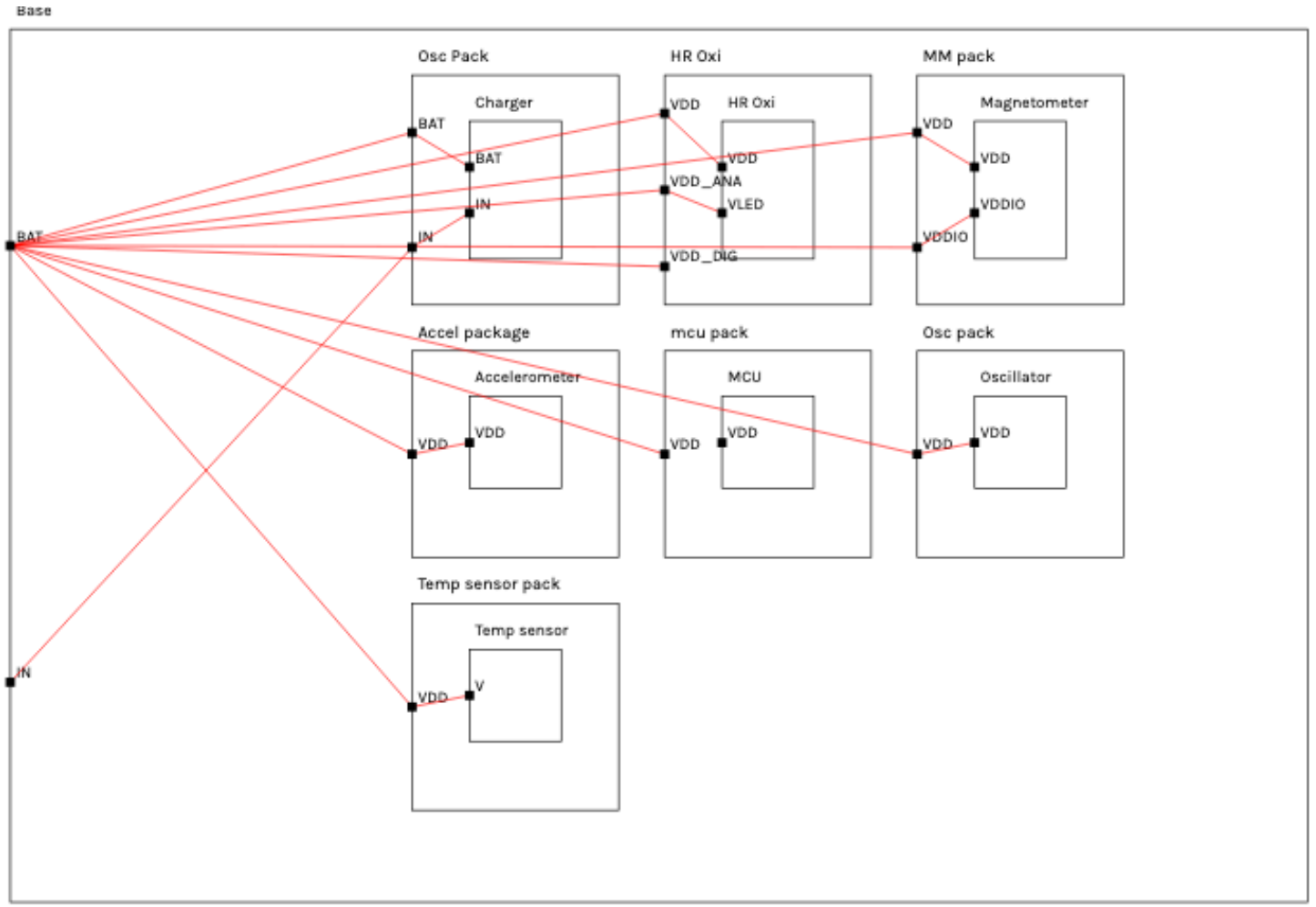
a) How many chiplets are in this system?

b) List each chiplet in OmniChip and its function

Chiplet Name	Function

Homework

What power source is the V pin of TMP108 connected to?



zGlue

Homework

3- Open OmniChip Design in ChipBuilder. (You will need to login. Setting up an account is free but required for security reasons. Proper identification and 2FA security is required for pro features. Third party logins (FB, Goog, in) are supported. Chrome is the ONLY supported browser. Incognito not supported)

a) Visit: https://zglue.com/applications/2647

b) Login and you should land at https://chipbuilder.zglue.com/system/2647

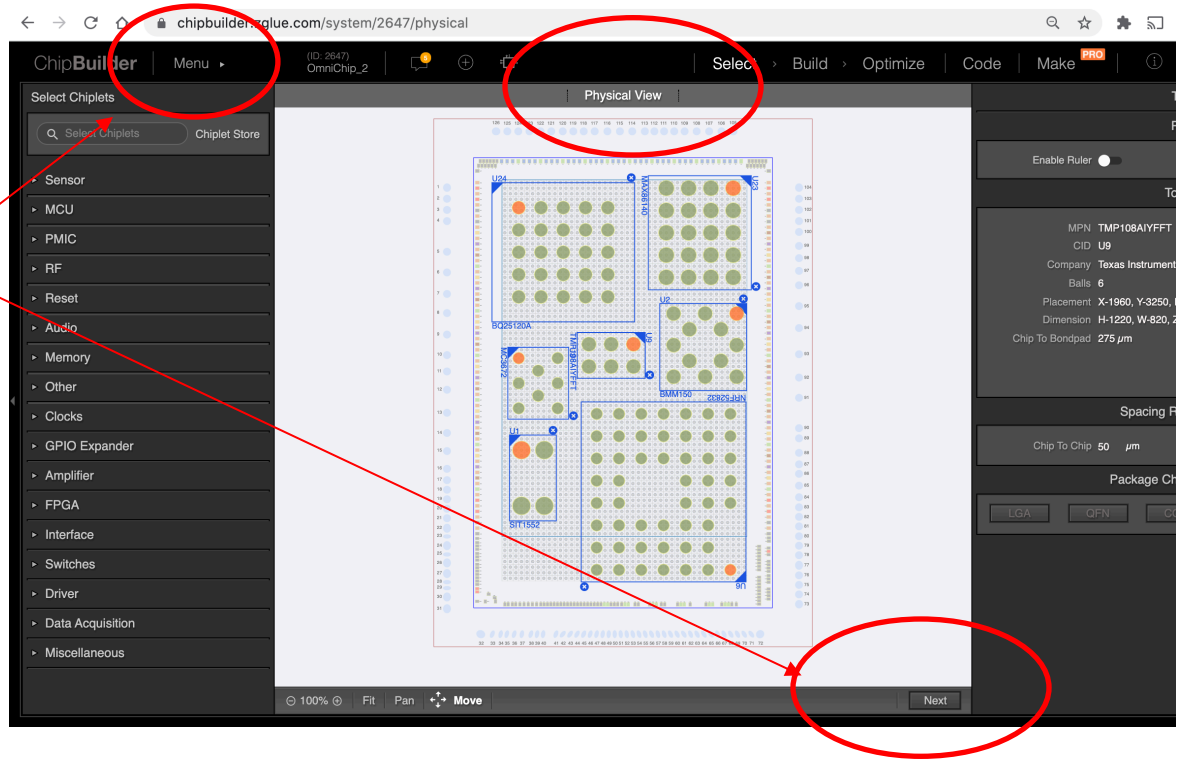
c) Click Next and go to Schematic View. Keep clicking next until you get to 3D view. Rotate it around. What kind of Package stack up is used?

d) What kind of package is used for OmniChip? QFN, LGA, BGA?

e)What are the dimesions of package substrate of OmniChip, x, y, z?

f) Do you think OmniChip needs a heat spreader or heatsink?

g) 'Save As' your own copy and modify the design. OR create a new one and play with chiplet based design.



https://zglue.com/university/curriculum/chipbuilder-quickstart-tutorial/1

zGlue

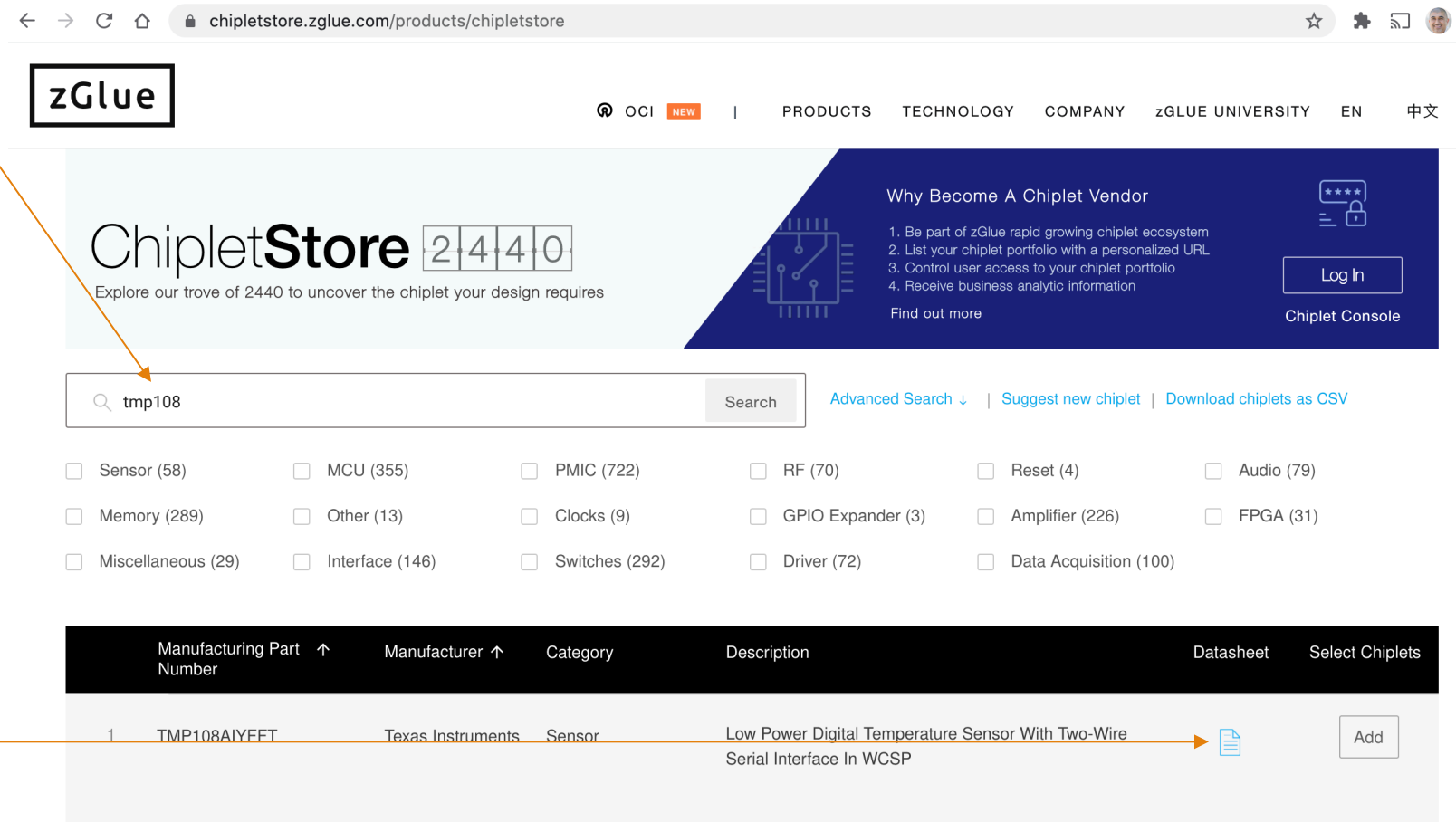
Homework

3- Download datasheet for TMP108

a) https://chipletstore.zglue.com/products/chipletstore

b) search for TMP108

c) download datasheet



Homework

4- Take a look at the TMP108 datasheet and answer the following questions

a) How many Vdd rails are there?

b) What are the min, typ, and max values of Vdd?

c) What kind of IO does this chip use?

d) What is the power issue with Open Drain IOs? (this is generic question)

e) How many modes of operation can you count for this chip?

f) What is the shutdown current for this chip at 1.8V and 25C? See page 4

g) What is the quiescent current changing with the I2C frequency. What is the reason for steep current increase with frequency?

h) What is the shutdown current for this chip at 3.6V and 125C? See page 8---this is the normalization data

e) Now try to read the power ZEF file for TMP108 at

https://docs.google.com/spreadsheets/d/1V-xcuTvl_RY945oZrovVbi16B3S1EK3PhcxuThgoMfY

Note the four sections, meta data, modes of operation, EC table, and normalization data. This is an encoded f orm of the power information provided by the chiplet vendor converted to a machine-readable format. Power solvers can read and make use of this data to calculate different scenarios.

Homework

5- What is the most power hungry condition of TMP108 that a designer should avoid to reduce power dissipation.

- Create a power dissipation scenario assuming OmniChip is used in an industrial tracker. Assume a worker wears it 8 hours in a industrial setting lifting moving 10 boxes an hour. The tracker is used to monitor the movement activity for box counting.

Homework

6- If power modeling of OmniChip intrigues you, download its collaterals from
https://drive.google.com/drive/u/1/folders/1liOxbHKNkF9jDC84DxXbXMkFnFpwKR_v

You will notice that the low-hanging fruit in the power dissipation are the radio transmission in the MCU. See if you can spot it.

Try to make Power zef files for other 6 chiplets.

Use the power profile estimates and with the help from a thermal modeling tool, simulate power dissipation profile. Use the STEP files in the folder.

Make a data-driven decision on what kind of thermal cooling solution is appropriate for this chip.

Assume a 200mAh battery and estimate if that battery can last for one day for your scenario in #5.

If you need help, contact jawad@zglue.com. Email the completed homework assignment if you want it graded and want feedback.

Thank You Very Much