

Meeting number 9

Agenda

Frigus – Meeting 9

10/31/2016

EP324A – ME conference room

3:30 am – 4:30 pm

Introduction:

- JT takes minutes

Previous Action items:

- Caleb – Agenda, math model, solid model
- JT – Minutes, math model, solid models
- Connor – Wiki page, math model, solid model

Discussion:

- Team – Progress Report
- Simulations – file type, changes, dimensions
- Math model – Ideas, changes, error
- Machine specifications - Come up with a Machinable part
- Wikipage begun-
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- New ideas? Changes|
- Attachment ideas

Action Items:

- Assign weekly tasks

Math model

```
"bernoullis"
P_1/gama+v_1^2/(2*g)+z_1=P_2/gama+v_2^2/(2*g)+z_2+h_L+h_L2
"givens"
"side 1"
v_1=v_fan "o or v_fan"
P_1=100000 [pa] "1 bar"
V_dot=0.1778 [m^3/s]
z_1=0 [m]
"side 2"
z_2=.030 [m]
"both"
gama=11.8 [N/m^3]
g=9.81 [m/s^2]
"finding fan v"
V_dot=V_fan*A_fan
A_fan=pi*d_fan^2/4
d_fan=.09 [m]
"mass balance rho*V*A"
A_cross_m*V_2=V_dot
A_cross_m=A_cross*convert(mm^2,m^2)
A_cross=(block-gray)
"calac cross area"
block=(80^2) [mm^2]
gray=4*(410.3-28.94) [mm^2]
"head loss due to flow through heat sink"
h_L=V_fan^2/(2*g)*(t_2/D_hy)*f
t_2=t*convert(mm,m)
leftmoody=eps/d_hy_mm
f=.025 "or .025 frition factor"
Re=(V_fan*D_hy)/(nu) "reldeds number"
nu=kinematicviscosity(Air,T=20 [c],P=100 [kpa])
eps=.002 [mm]
"not need for now"
h_L2=V_fan^2/(2*g)*(K_enter+K_exit)
L_2=.040 [m]
D_2=.09 [m]
k_enter=1
k_exit=.5
delta_p=P_1-P_2
"hydraulic diameter"
d_hy=(4*A_cross)/wetted_p*convert(mm,m)
"d_hy=(4*wetted_area)/(wetted_p)*convert(mm,m)"
d_hy_mm=d_hy*convert(m,mm)
"wetted_area=4*(2*Tri_tops+flat_top+2*sides+2*bot)
Tri_tops=367.7 [mm^2]
flat_top=20 [mm^2]
sides=7627.38 [mm^2]
bot= 308.98 [mm^2]"
```

Solution

Main Key Variables

Unit Settings: SI C kPa kJ mass deg

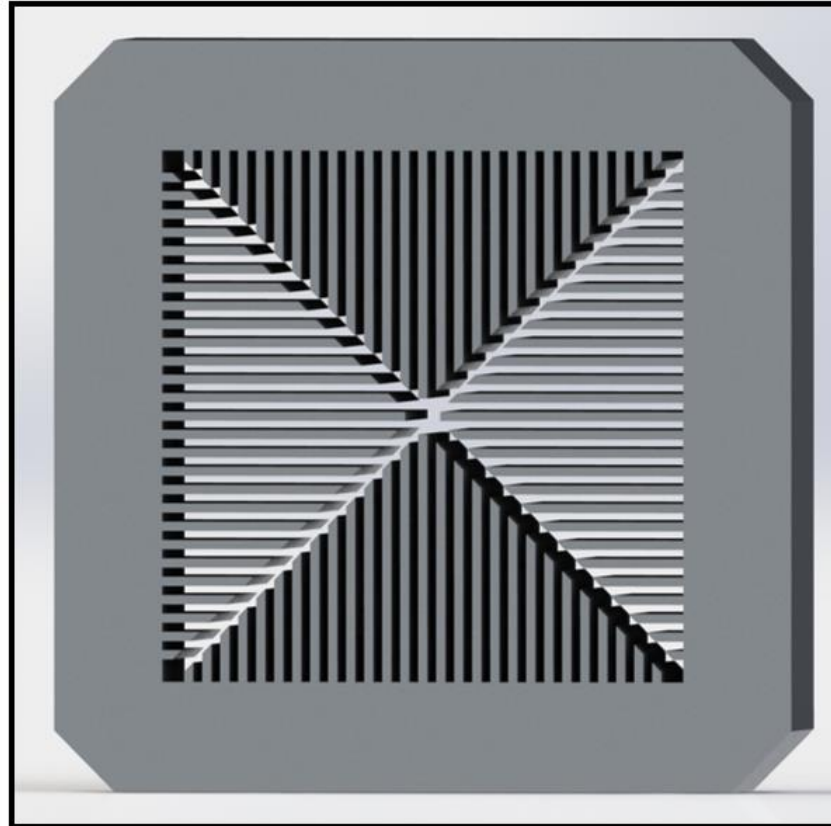
A _{cross} = 4875 [mm ²]	A _{cross,m} = 0.004875 [m ²]	A _{fan} = 0.006362 [m ²]	block = 6400 [mm ²]
Δp = 10.8 [Pa]	D ₂ = 0.09 [m]	d _{fan} = 0.09 [m]	D _{hy} = 0.02593 [m]
d _{hy,mm} = 25.93 [mm]	eps = 0.002 [mm]	f = 0.025	g = 9.81 [m/s ²]
gama = 11.8 [N/m ³]	gray = 1525 [mm ²]	h _L = 0.007676 [m]	h _{L2} = 0.5972 [m]
K _{enter} = 1 [dim]	K _{exit} = 0.5 [dim]	leftmoody = 0.00007712 [dim]	L ₂ = 0.04 [m]
v = 0.00001536 [m ² /s]	P ₁ = 100000 [Pa] {1 [bar]}	P ₂ = 99989 [Pa]	Re = 4719 [dim]
t = 20 [mm]	t ₂ = 0.02 [m]	v ₁ = 2.795 [m/s]	v ₂ = 3.648 [m/s]
Ṁ = 0.01778 [m ³ /s]	v _{fan} = 2.795 [m/s]	wetted _p = 751.8 [mm]	z ₁ = 0 [m]
z ₂ = 0.03 [m]			

No unit problems were detected.

Calculation time = 16 ms

Machining up date

- We figured out away to make the fin gaps smaller can go to
- either 1mm or .78 mm gaps
- Making Connor design possible



Material 1: Aluminum

Mass = 258.72 grams

Volume = 95821.57 mm³

Surface area = 84291.37 mm²

Material 2: Copper

Mass = 852.81 grams

Volume = 95821.57 mm³

Surface area = 84291.37 mm²

Design Pros:

Can be machined in four parts

Even Flow distribution to each section

Noncomplex shapes

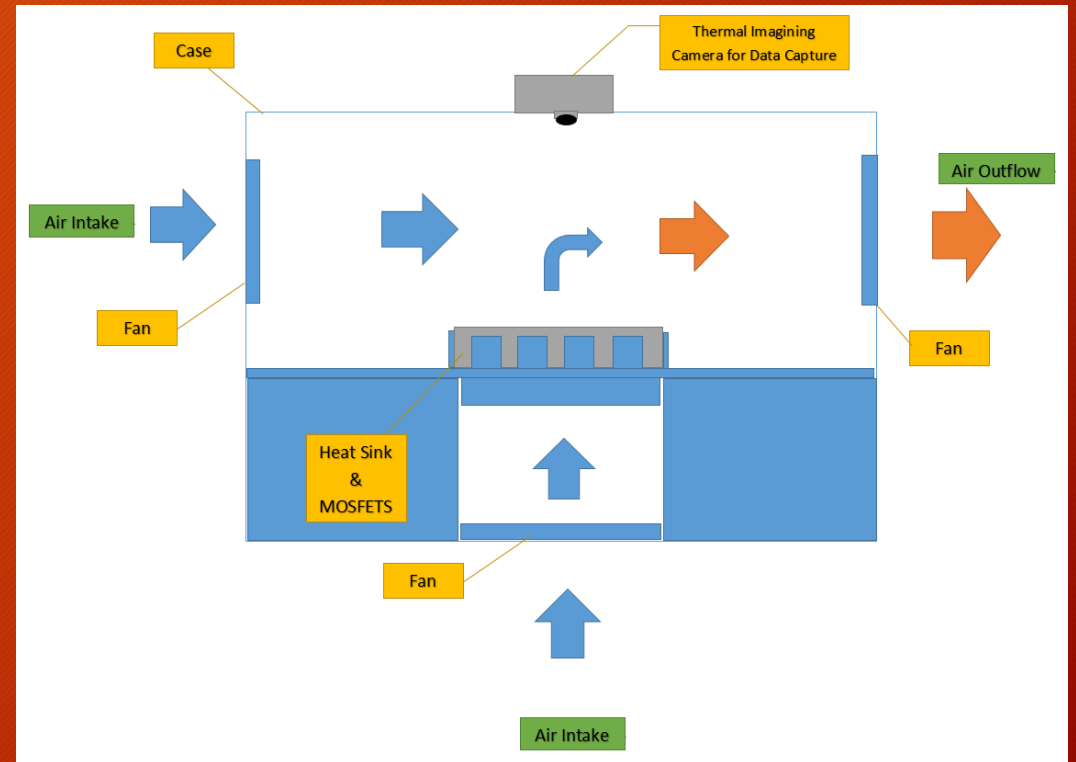
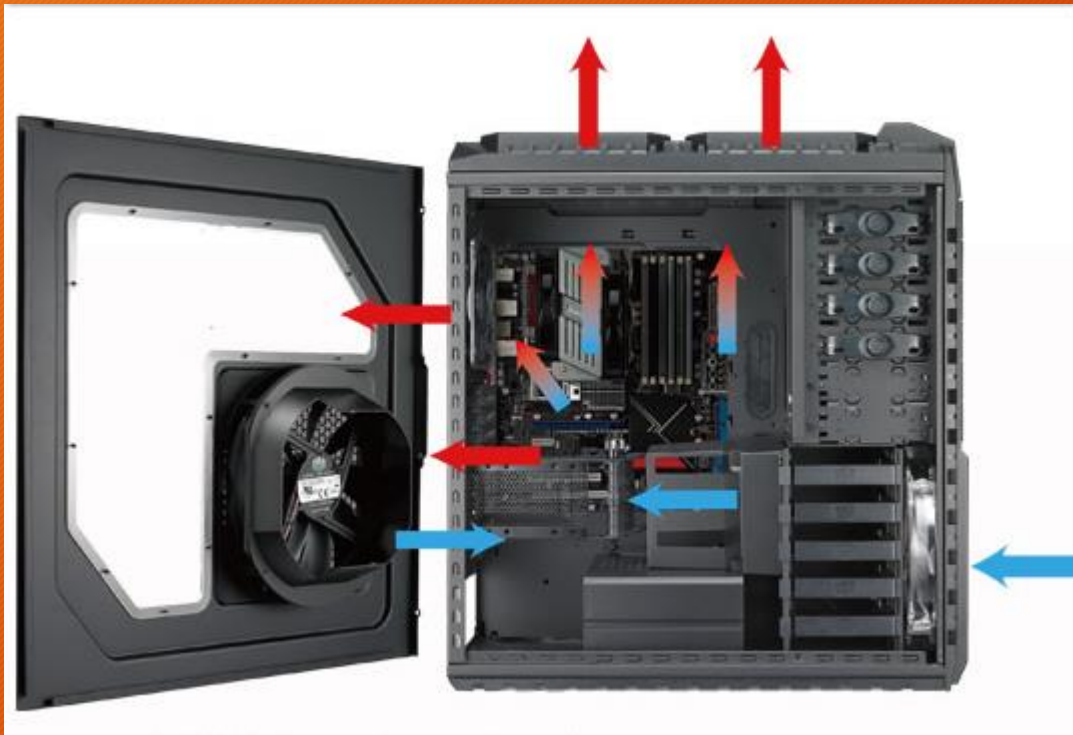
Design Cons:

Less Fin stability

Lots of excess mass at ends

Difficult to machine longer fins

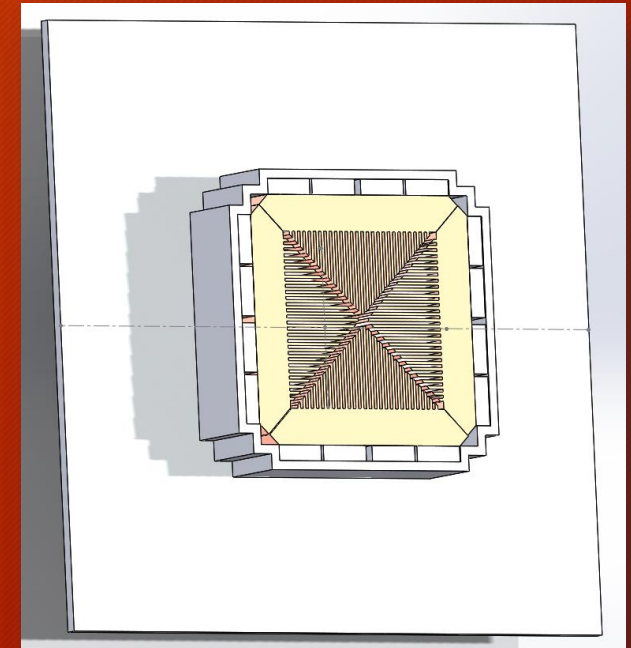
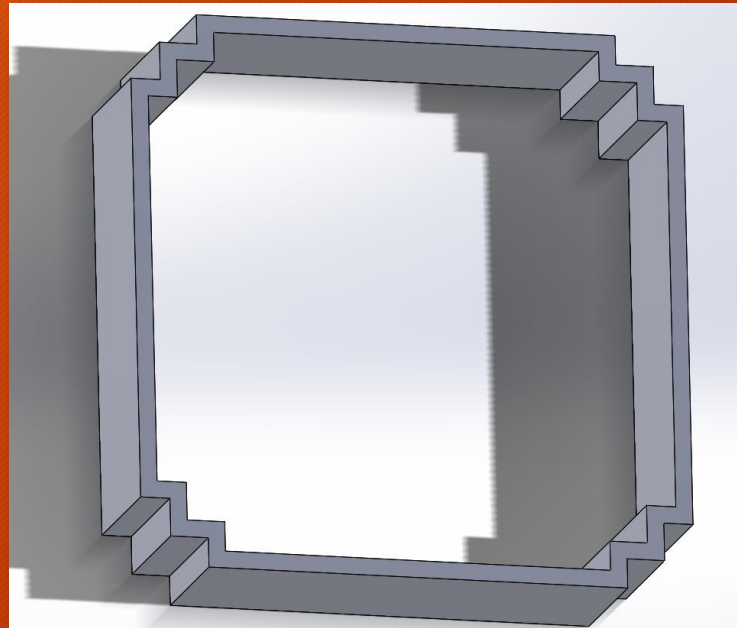
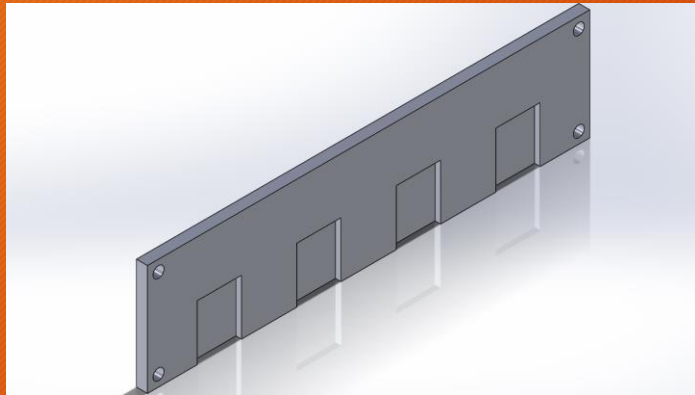
Case design brain storming



<http://www.gamersnexus.net/guides/692-how-many-case-fans-should-you-have>

Attaching to MOSFET's

- Sleeve to attach MOSFET's to heatsink and board



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