EFD CORPORATION
易富迪科技

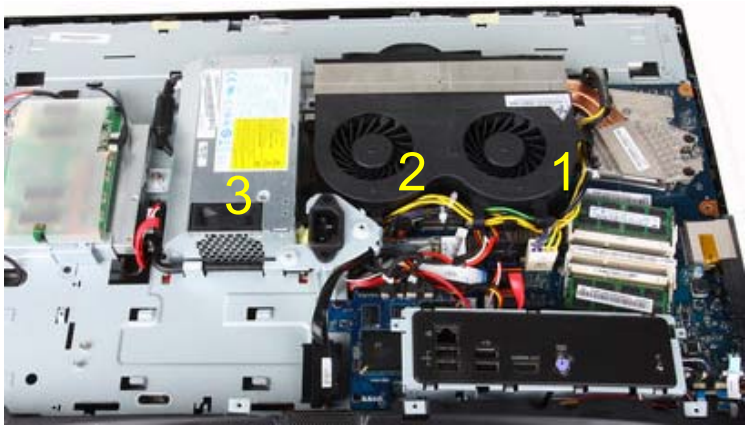
Why did you not use FT in these cases?

Purpose

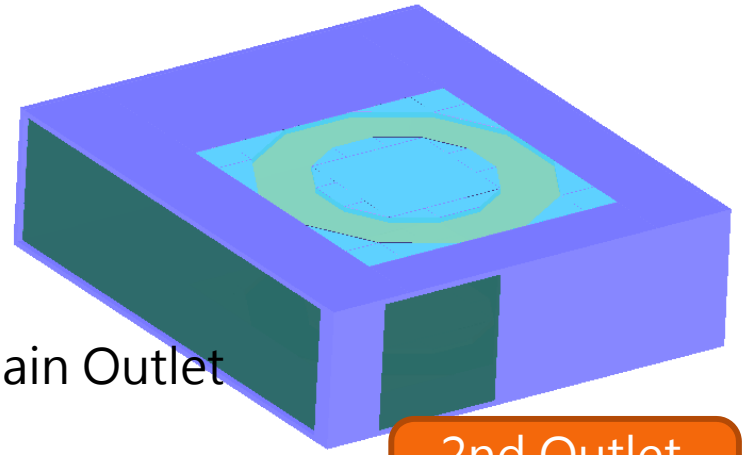
- Thermal simulation software is a **tool** to help engineers predict, identify and improve their design
- Various software was launched past years, which is the **best**?
- Many complaint of FT happened due to we know little about the software **capability**
- Three case studies to share
  - Blower Design- Rotary region
  - RHE Design- Sloped geometry
  - 2-R Model- Constant temperature B.C

Rotary Region

- Story:
  - Combine 3 small blowers to a bigger one to save money
  - Need to share main flow to the PSU



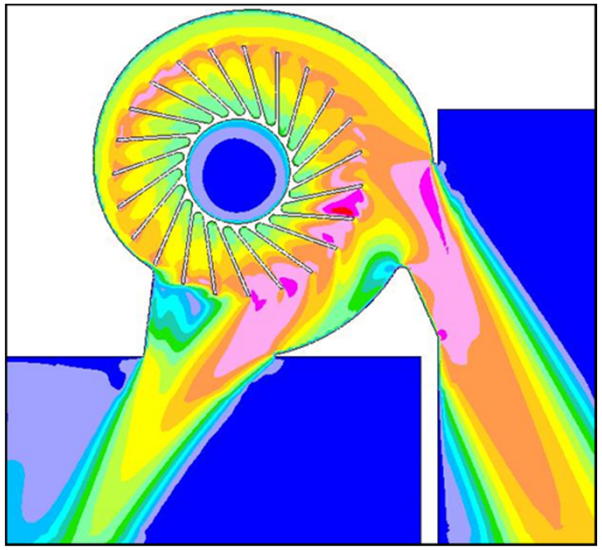
- Challenge:
  - Knowledge of Blower Design
  - How to control the flow ratio for both outlets?
  - Can FT run this model?

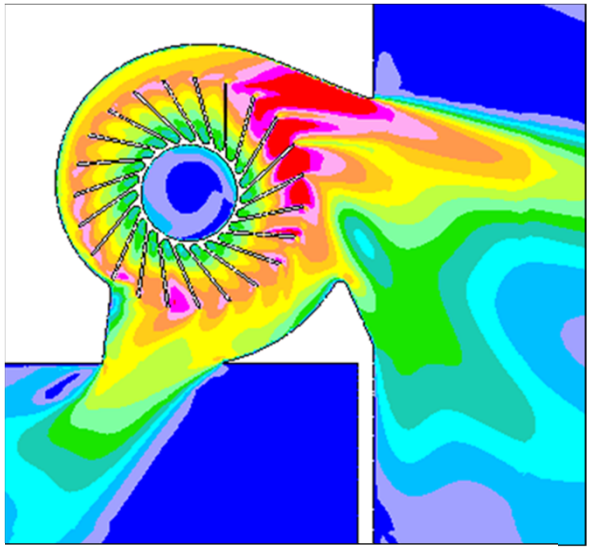


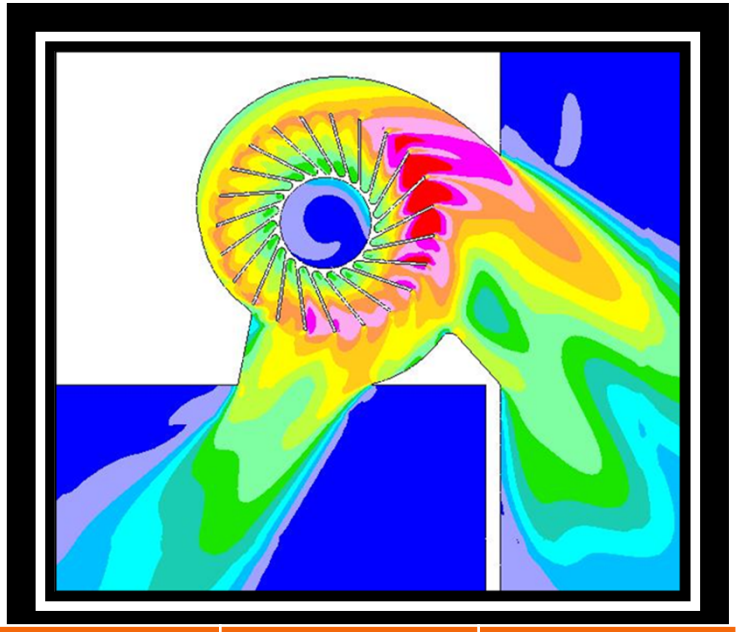
- Solution:
  - Ask fan suppliers support

• Purpose

- Volute design with existing blade to control the ratio
- Minimize the internal energy loss
- **NOT predict the overall flow rate**

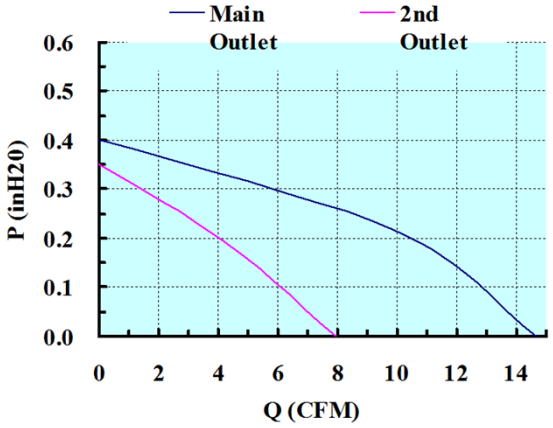




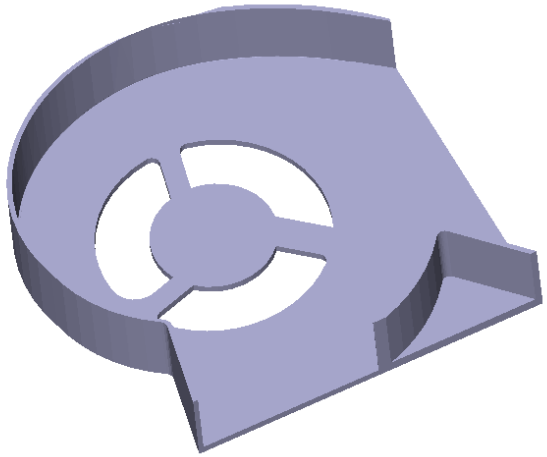


The total flow rate estimated about 22CFM for M8 type

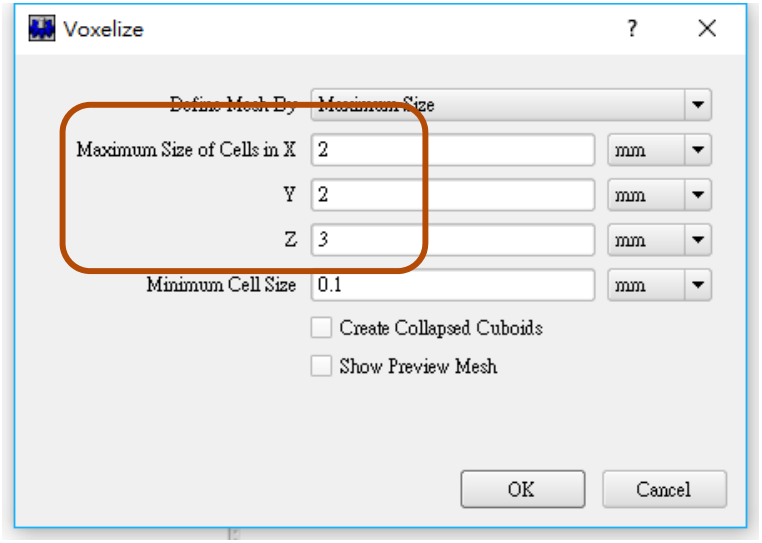
Results provided by Sunon

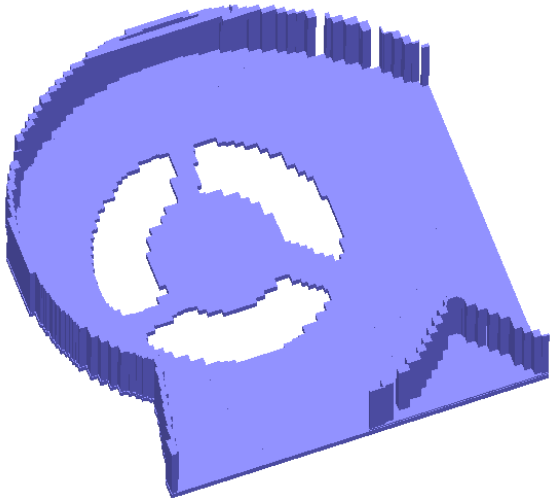


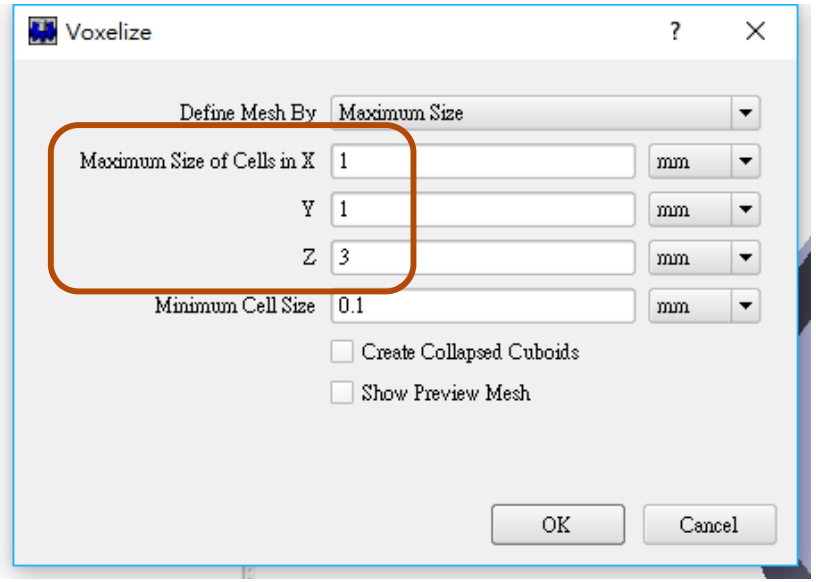
• Build CAD Model

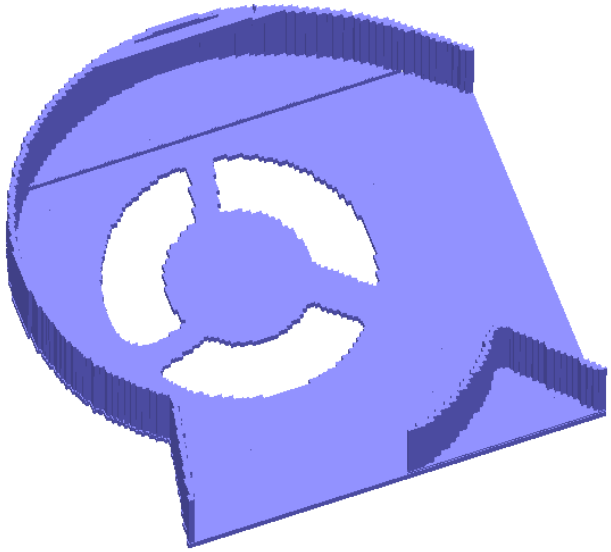


Import to FloMCAD

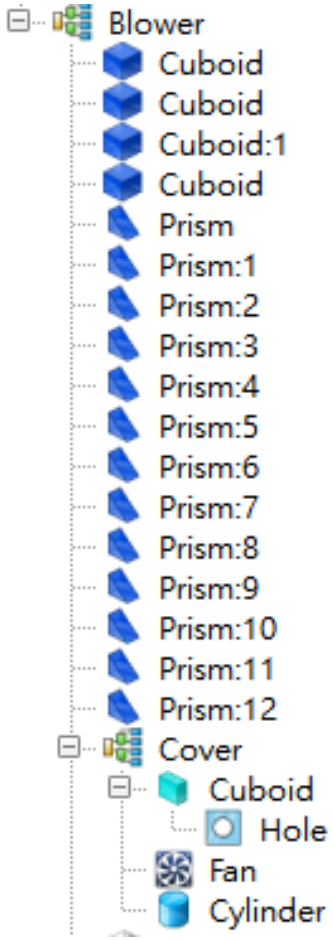


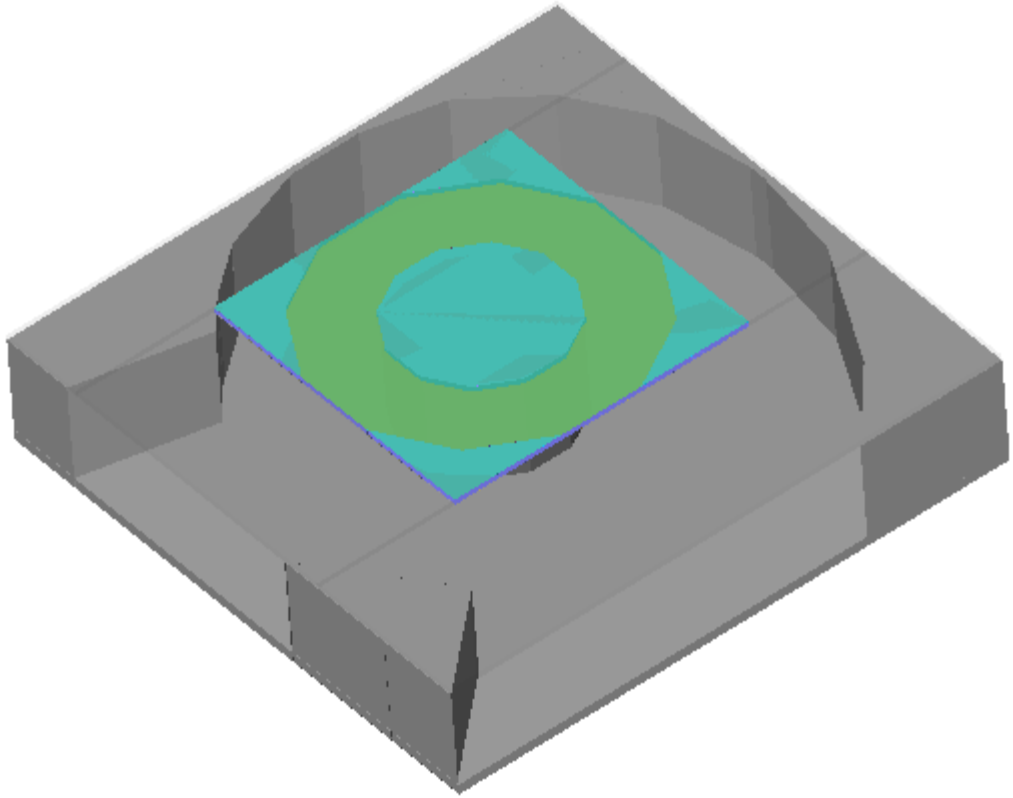




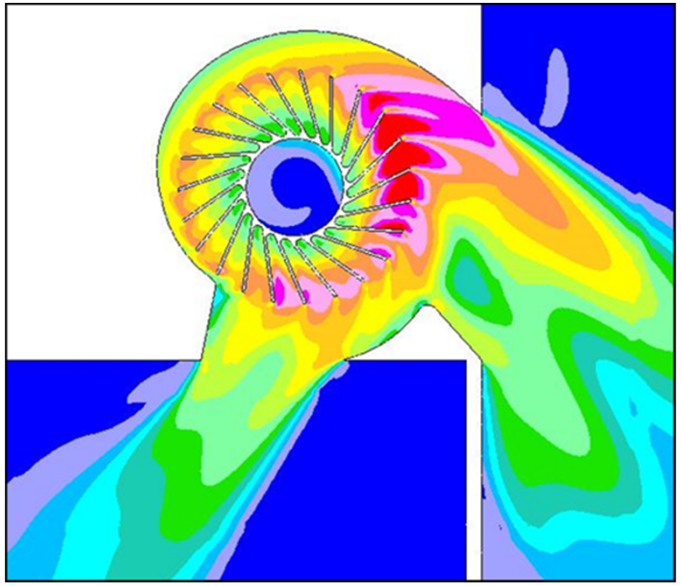


- Simplify by Prism

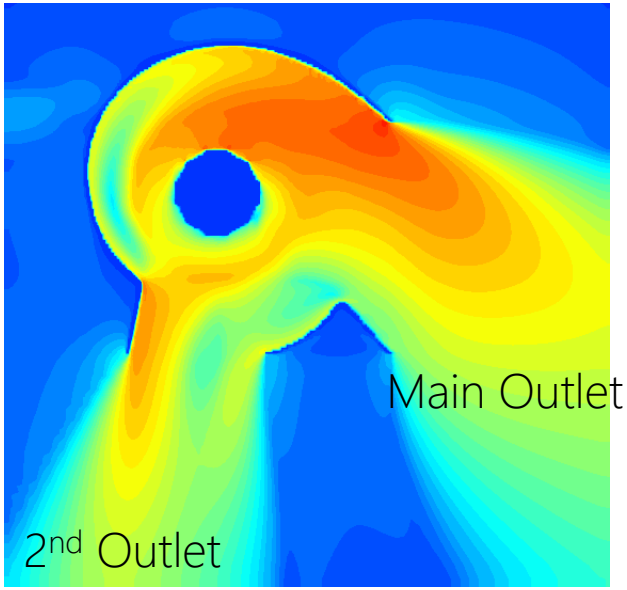




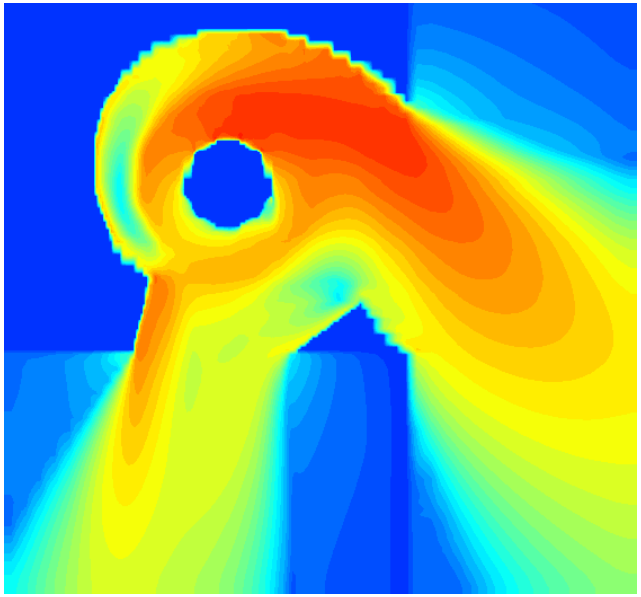
- Fixed 22CFM



Fluent



#1



#2

- FT did work to design the blower volute to optimize the flow rate ratio

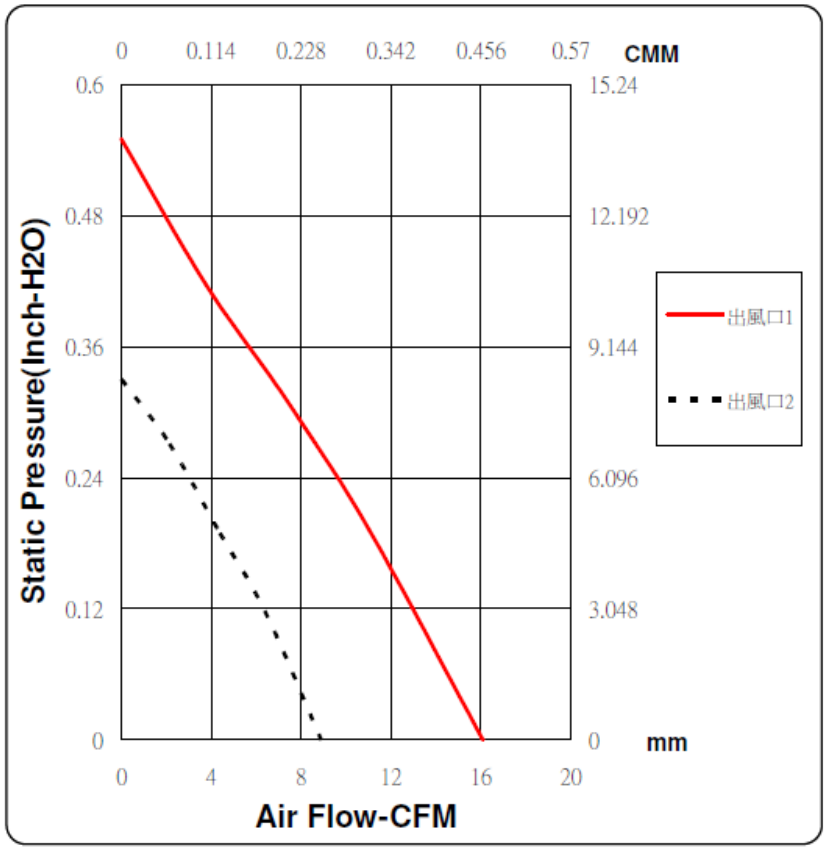
• Physical Blower Data (Reference)

3. PERFORMANCE CHARACTERISTIC

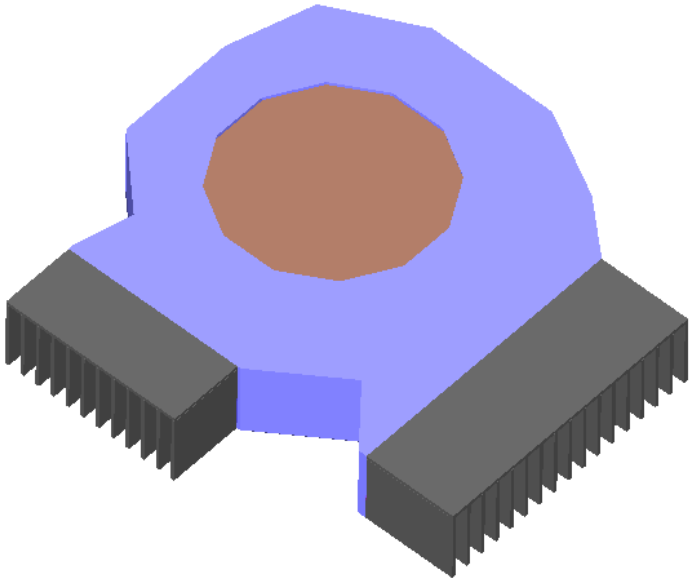
	合體	出風口 1	出風口 2
RATED SPEED	3500 RPM ± 250 at rated voltage		
AIR FLOW	25.0 CFM	16.1 CFM	8.9 CFM
STATIC PRESSURE	0.88 Inch-H2O	0.55 Inch-H2O	0.33Inch-H2O
ACOUSTIC NOISE	45.1 dB(A)		
AIR FLOW V.S. PRESSURE	See Page 5		
INSULATION CLASS	UL Class A		
INSULATION RESISTANCE PLASTIC HOUSING	10M ohm at 500 VDC between internal stator and lead wire (+)		
DIELECTRIC STRENGTH	Applied AC 500 V for one minute or AC 600 V for 2 Seconds between housing and lead wire (+)		
LIFE EXPECTANCY	60,000 hours at 40 deg. C, 65% humidity, 90% CL.		
PROTECTION	☑Automatic Restart Note: In a situation where the fan is locked by an external force while the electricity is on, an increase in coil temperature will be prevented by temporarily turning off the electrical power to the motor. The fan will automatically restart when the locked rotor condition is released.		
	☑Polarity Protection		

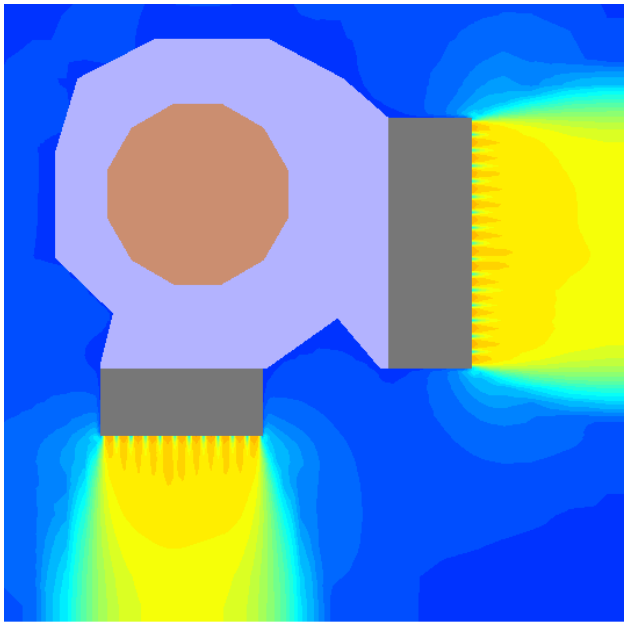
MODEL : EFA0201S1-C010-S9A

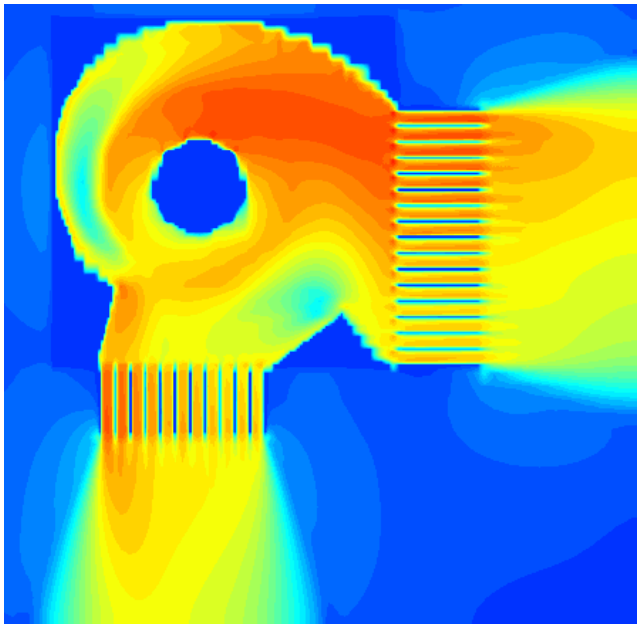
PERFORMANCE CURVES



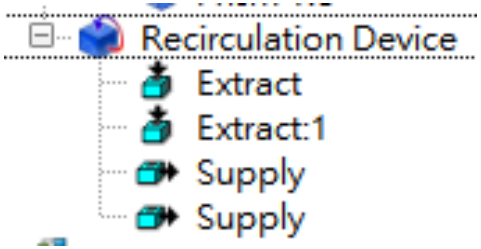
- Build Blower in System Level





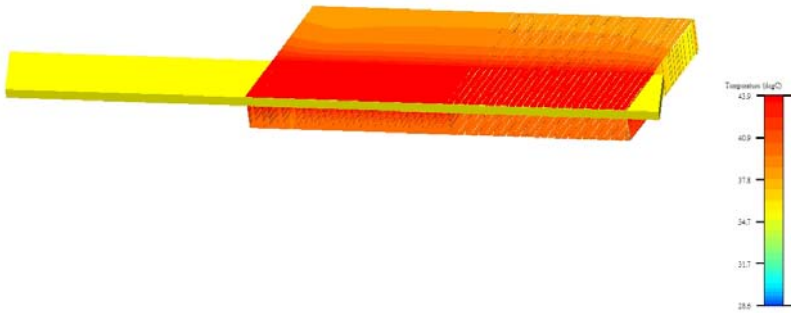


Recirculation Device



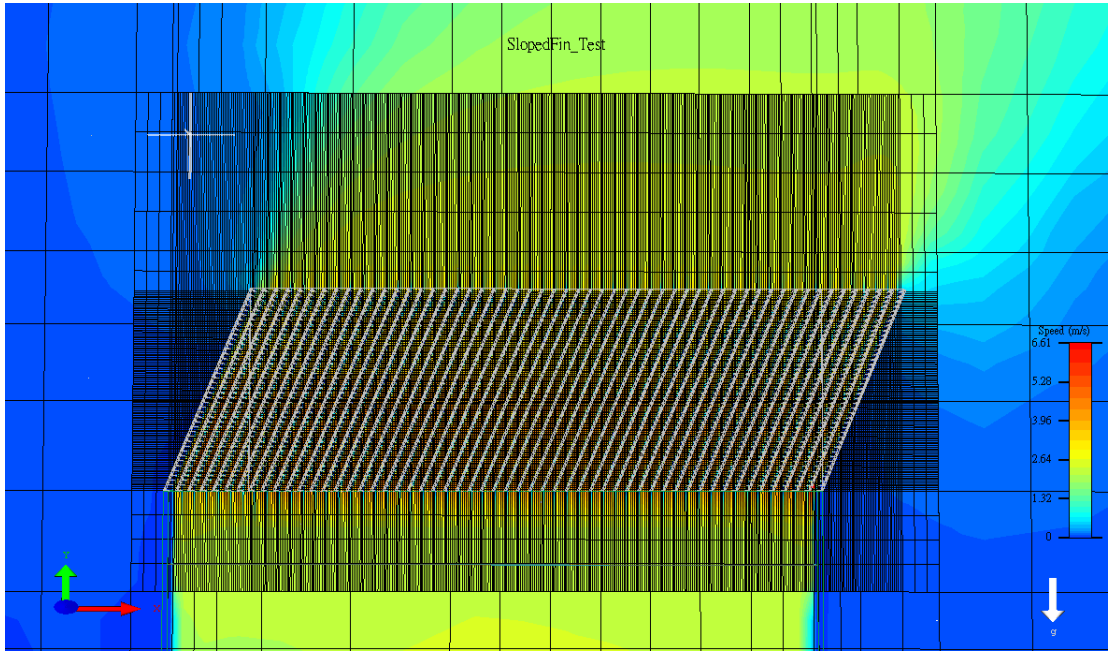
Sloped Geometry

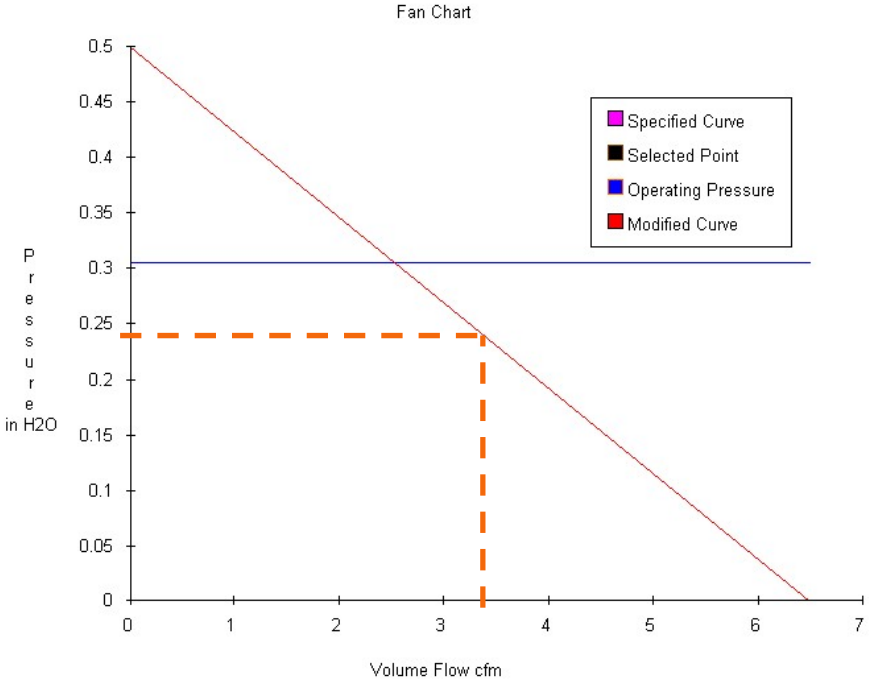
- Story:
  - The RHE must design sloped due to the space constrained by hinge
  - How to build a simulation model at system level?
  - Compare the performance between straight fin and slope ones
- Challenge:
  - Over 1.3 million grid number
    - ☆ Take 30min to display surface temperature
  - Compare to experiment data, the result is not match

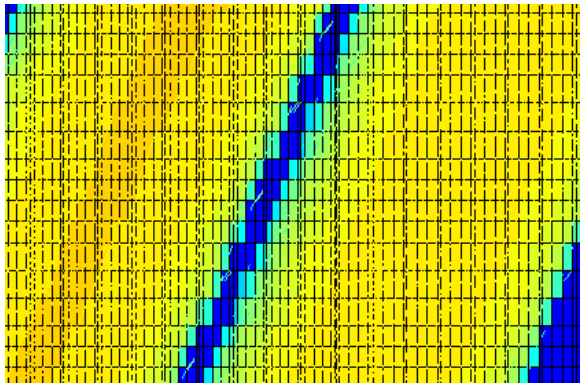


• Data Comparison

- Exact test result is 3.31CFM, FT calculated is 2.54CFM

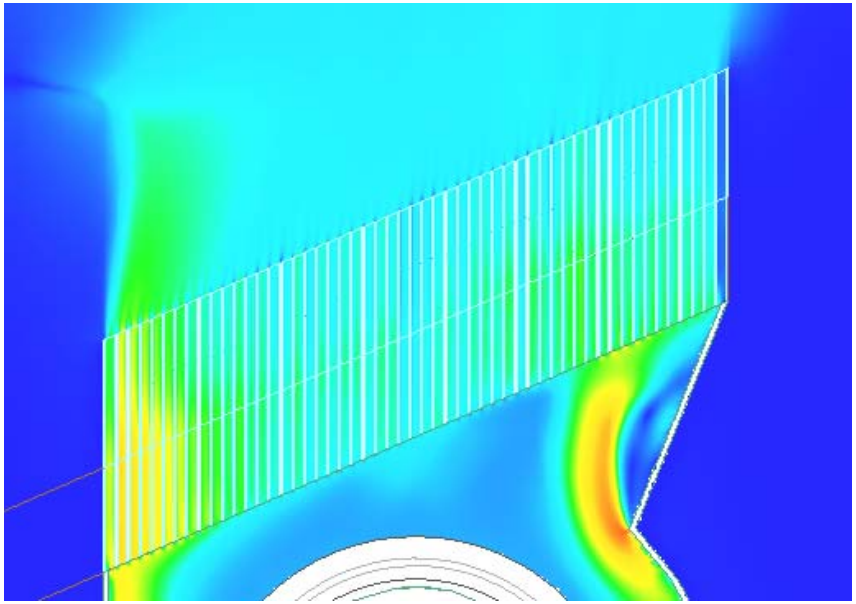


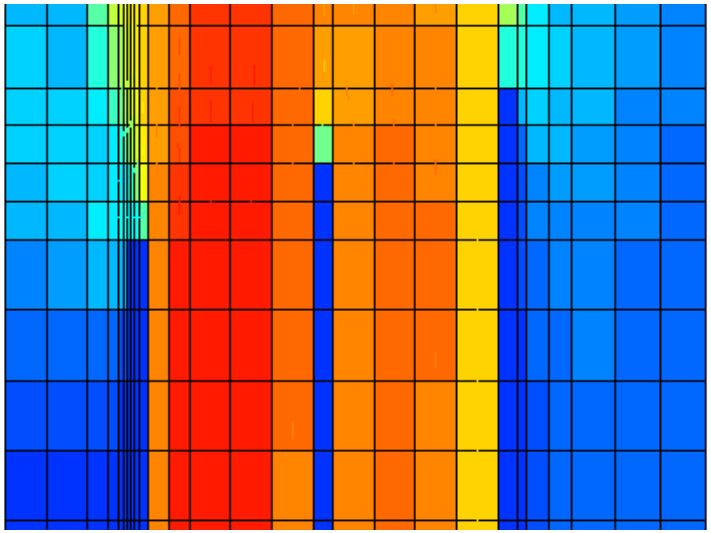


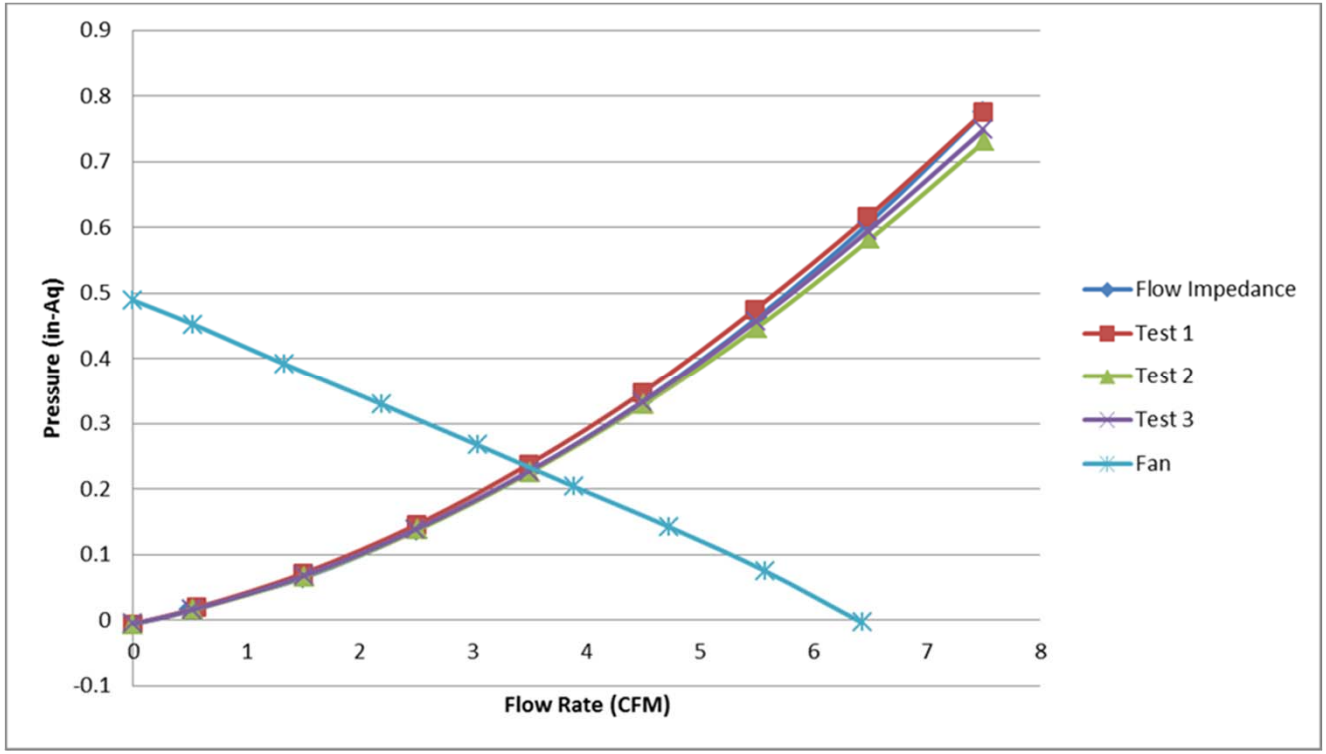


- Step-stair grid cause the higher flow impedance

• Change Model Orientation







- Rebuild fin geometry parallel to Cartesian coordinate system can solve this issue

• System Level Modelling

- Calculate the flow impedance by CFD model with fin geometry parallel to Cartesian system
- Use macro tool to get FT compact heat sink model
  - With flow impedance
  - With thermal resistance
- Build air duct to simulate the sloped geometry

http://www.efd.com.tw/uploads/1/3/2/1/13213742/apply_compact_heatsink_model.pdf

• Severe Challenge

- Customer’ s prototype system test fail
- Add a fan try to solve, improved but still fail
- Need consulted solution by simulation

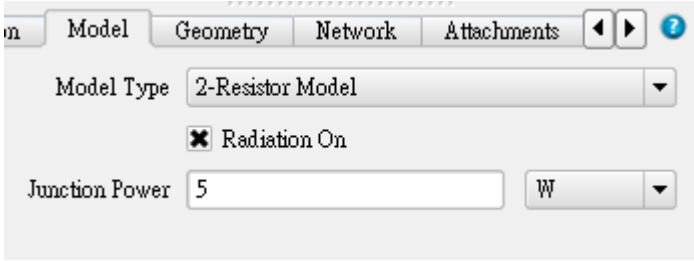
Component	Fan Off	Change Fan
U31	55.1	?
R969	54.8	
U2	62.1	
Q17	79.3	
U3	28.4	
Q704S	60.1	
L4	62.5	
U7	65.4	
C843	62.4	

	Location	Fan1 Off	Fan1 On
Chassis	G1	43.3	42.2
	G2	48.5	47
	G3	52.7	47.3
	G4	52.1	48.2
	G5	45.2	43.5
	G6	42.8	40.8
	G7	48.2	45.4
	G8	50.3	46
	G9	50	47.3
	G10	43.7	42.2
	G11	39.1	37.3
	G12	44.6	42.4
	G13	44.7	42.5
	G14	46.7	45.6
	G15	41.2	39.7
	G16	40.1	38.4
	G17	32.5	31.4
	G18	33.2	32
	G19	33.6	32.4
	G20	34	32.8
	G21	33.3	32.3

• Constant Temperature B.C

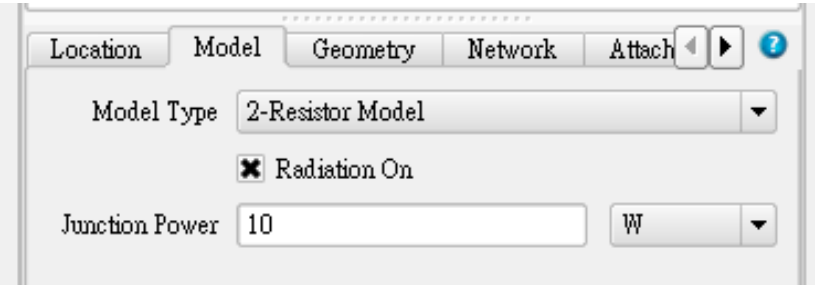
- Story:
  - To create a system simulation model to improve thermal performance of existing system
  - Already got thermal test results of original design

- Challenge:
  - How to modify the power consumption of every component to fit the test results
  - Simulation exactness easily checked by data



	TCase (degC)	TPcb (degC)	TLeads (degC)	Hottest Junction	Hottest Junction Temperature (degC)	Junction 1 Temperature (degC)
Compact Component	58.481	53.629	n/a	1	58.515	58.515

- Before

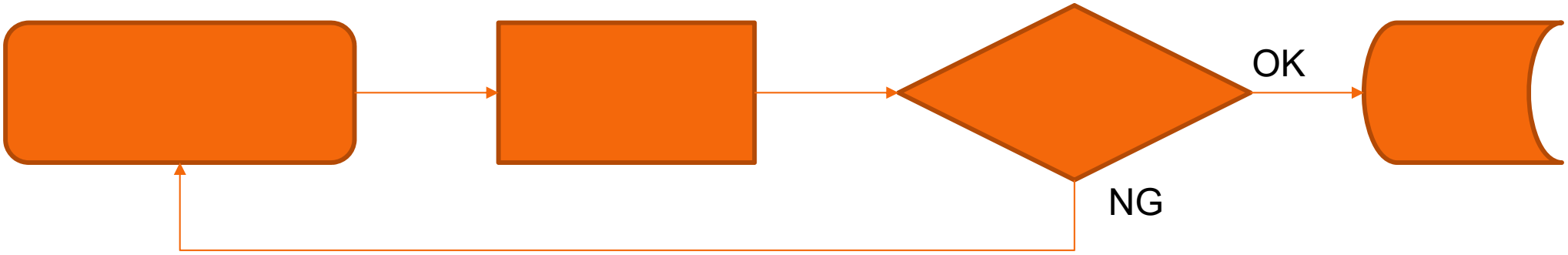


Compact Component | Component Fluxes | Network Assemblies

	TCase (degC)	TPcb (degC)	TLeads (degC)	Hottest Junction	Hottest Junction Temperature (degC)	Junction 1 Temperature (degC)
Compact Component	64.664	67.573	n/a	1	67.643	67.643

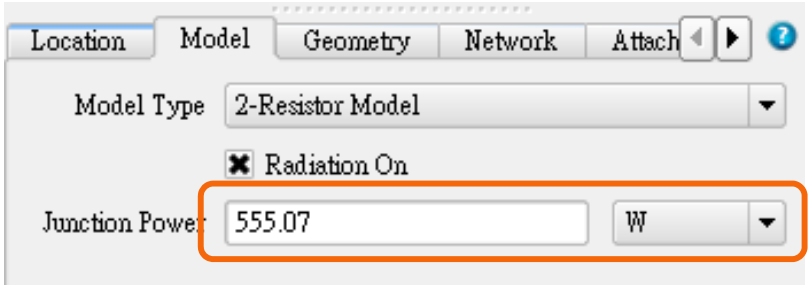
Compact Component | Component Fluxes | Network Assemblies

	Case Flow (Top) (W)	Case Flow (Sides) (W)	PCB Flow (W)	Leads Flow (W)	Total Power (W)
Compact Component	9.9304	0	0.069469	0	10



Try and error, calculating time waste

- After

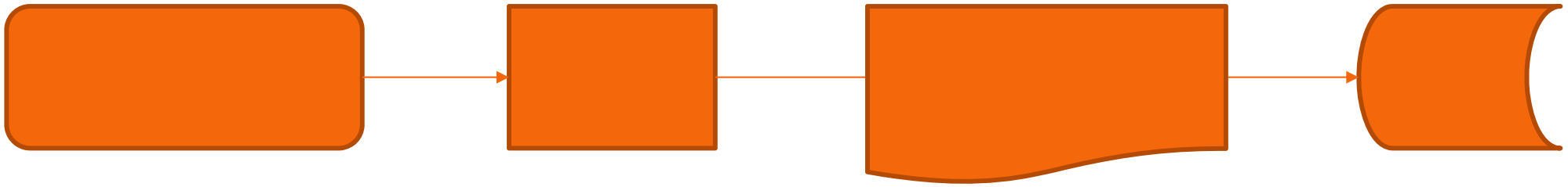


Compact Component | Component Fluxes | Network Assemblies

	Case Flow (Top) (W)	Case Flow (Sides) (W)	PCB Flow (W)	Leads Flow (W)	Total Power (W)
Compact Component	10.979	0	0.076081	0	?

Compact Component | Component Fluxes | Network Assemblies

	TCase (degC)	TPcb (degC)	TLeads (degC)	Hottest Junction	Hottest Junction Temperature (degC)	Junction 1 Temperature (degC)
Compact Component	66.714	69.931	n/a	1	70.007	70.007



聯絡我們

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