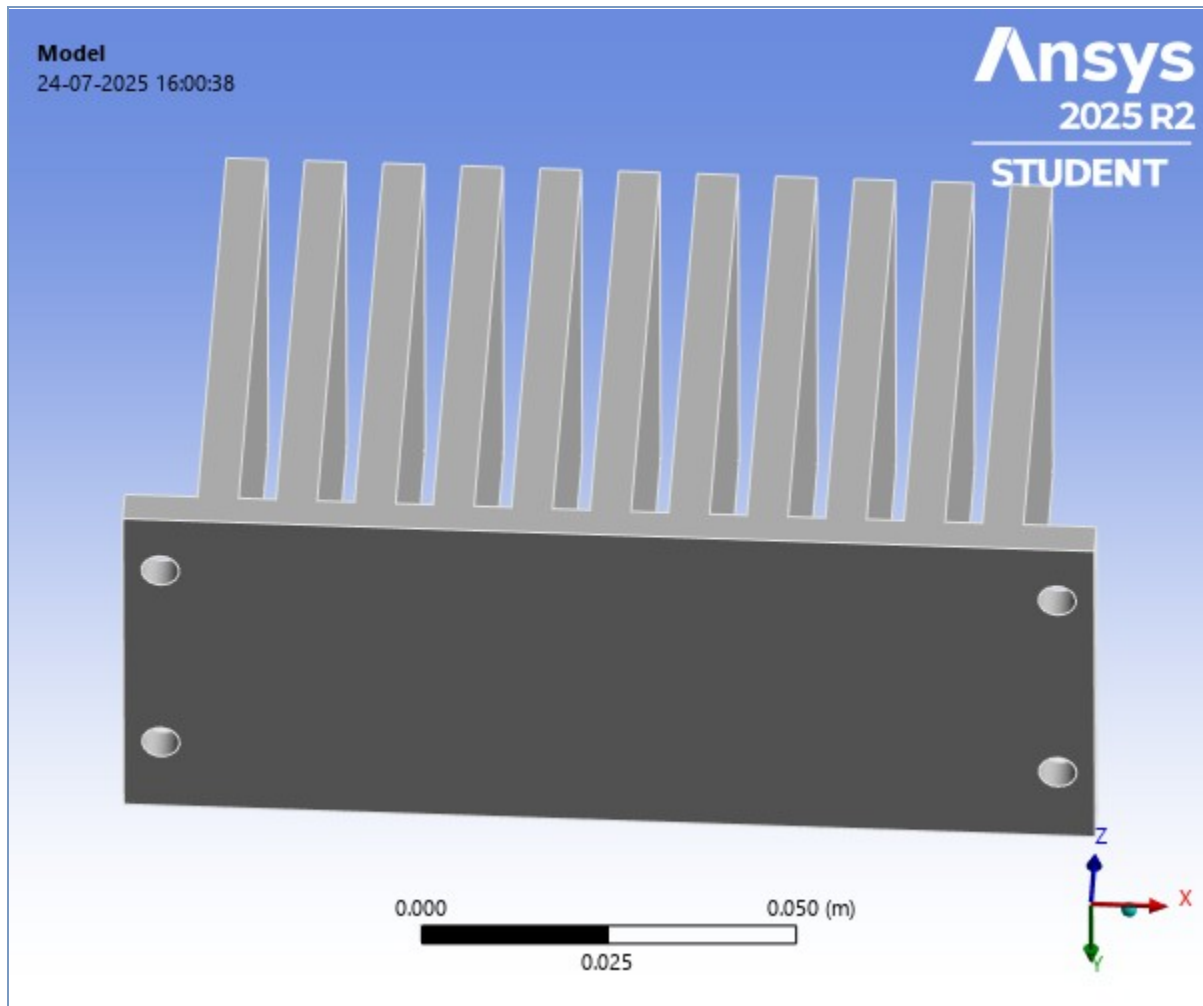




Project*

First Saved	Thursday, July 24, 2025
Last Saved	Thursday, July 24, 2025
Product Version	2025 R2
Save Project Before Solution	No
Save Project After Solution	No



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Units

TABLE 1

Unit System	Metric (m, kg, N, s, V, A) Degrees rad/s Celsius
Angle	Degrees
Rotational Velocity	rad/s
Temperature	Celsius

Model (A4, B4)

TABLE 2

Model (A4, B4) > Geometry Imports

Object Name	<i>Geometry Imports</i>
State	Solved

TABLE 3

Model (A4, B4) > Geometry Imports > Geometry Import (A3, B3)

Object Name	<i>Geometry Import (A3, B3)</i>
-------------	---------------------------------

State	Solved
Definition	
Source	D:\projects\ANSYS Projects\Thermal Analysis of a Power Electronic Heat Sink\ThermalAnalysisOfHeatSink_files\dp0\SYS\DM\SYS.dsco
Type	Discovery
Basic Geometry Options	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	Yes
Parameters	Independent
Parameter Key	
Attributes	Yes
Attribute Key	
Named Selections	Yes
Named Selection Key	
Material Properties	No
Advanced Geometry Options	
Use Associativity	Yes
Coordinate Systems	Yes
Coordinate System Key	
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D
Mixed Import Resolution	None
Import Facet Quality	Source
Clean Bodies On Import	No
Stitch Surfaces On Import	None
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

Geometry

TABLE 4
Model (A4, B4) > Geometry

Object Name	Geometry
State	Fully Defined
Definition	
Source	D:\projects\ANSYS Projects\Thermal Analysis of a Power Electronic Heat Sink\ThermalAnalysisOfHeatSink_files\dp0\SYS\DM\SYS.dsco
Type	Discovery
Length Unit	Meters
Element Control	Program Controlled
Display Style	Body Color
Bounding Box	

Length X	0.13 m
Length Y	5.e-002 m
Length Z	7.5e-002 m
Properties	
Volume	2.4386e-004 m ³
Mass	0.67548 kg
Scale Factor Value	1.
Statistics	
Bodies	1
Active Bodies	1
Nodes	36490
Elements	19832
Mesh Metric	None
Update Options	
Assign Default Material	No
Basic Geometry Options	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	Yes
Parameters	Independent
Parameter Key	
Attributes	Yes
Attribute Key	
Named Selections	Yes
Named Selection Key	
Material Properties	No
Advanced Geometry Options	
Use Associativity	Yes
Coordinate Systems	Yes
Coordinate System Key	
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D
Mixed Import Resolution	None
Import Facet Quality	Source
Clean Bodies On Import	No
Stitch Surfaces On Import	None
Decompose Disjoint Geometry	Yes
ID_GeometryPrefProcessPhysicsDefinition	No
Enclosure and Symmetry Processing	Yes

TABLE 5
Model (A4, B4) > Geometry > Parts

Object Name	<i>HeatSink\Solid</i>
State	Meshed
Graphics Properties	
Visible	Yes
Transparency	1
Definition	
Suppressed	No

Stiffness Behavior	Flexible
Coordinate System	Default Coordinate System
Reference Temperature	By Environment
Treatment	None
Material	
Assignment	Aluminum Alloy 2
Nonlinear Effects	Yes
Thermal Strain Effects	Yes
Bounding Box	
Length X	0.13 m
Length Y	5.e-002 m
Length Z	7.5e-002 m
Properties	
Volume	2.4386e-004 m ³
Mass	0.67548 kg
Centroid X	4.7489e-020 m
Centroid Y	1.7945e-006 m
Centroid Z	3.5062e-002 m
Moment of Inertia Ip1	4.8901e-004 kg·m ²
Moment of Inertia Ip2	1.1193e-003 kg·m ²
Moment of Inertia Ip3	9.1174e-004 kg·m ²
Statistics	
Nodes	36490
Elements	19832
Mesh Metric	None
CAD Attributes	
PartTolerance:	0.00000001
Color:128.128.255	

FIGURE 1
Model (A4, B4) > Geometry > Figure

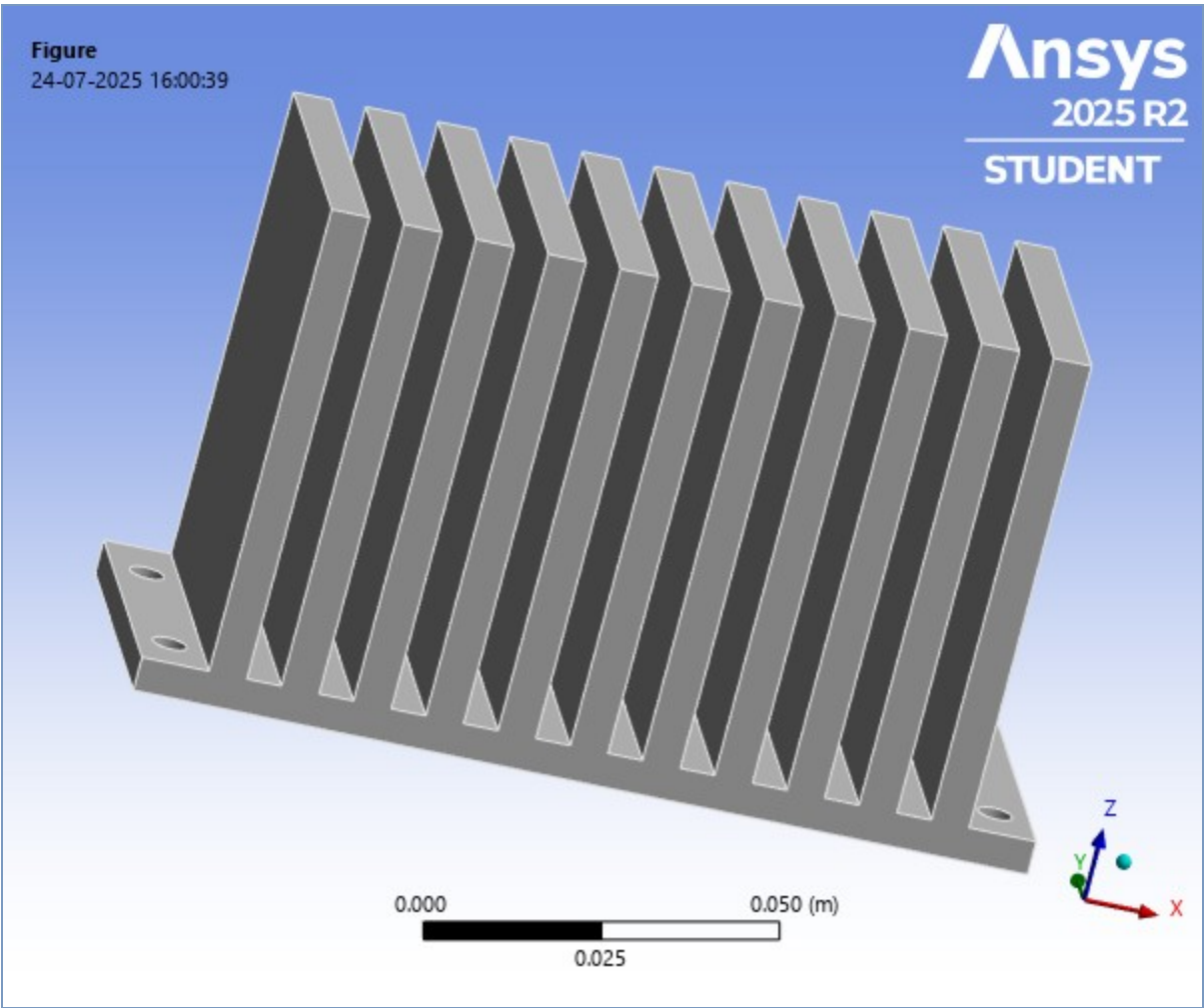


TABLE 6
Model (A4, B4) > Materials

Object Name	<i>Materials</i>
State	Fully Defined
Statistics	
Materials	4
Material Assignments	0

Coordinate Systems

TABLE 7
Model (A4, B4) > Coordinate Systems > Coordinate System

Object Name	<i>Global Coordinate System</i>
State	Fully Defined
Definition	
Type	Cartesian
Coordinate System ID	0.
Origin	
Origin X	0. m
Origin Y	0. m
Origin Z	0. m
Directional Vectors	

X Axis Data	[1. 0. 0.]
Y Axis Data	[0. 1. 0.]
Z Axis Data	[0. 0. 1.]
Transfer Properties	
Source	
Read Only	No

Mesh

TABLE 8
Model (A4, B4) > Mesh

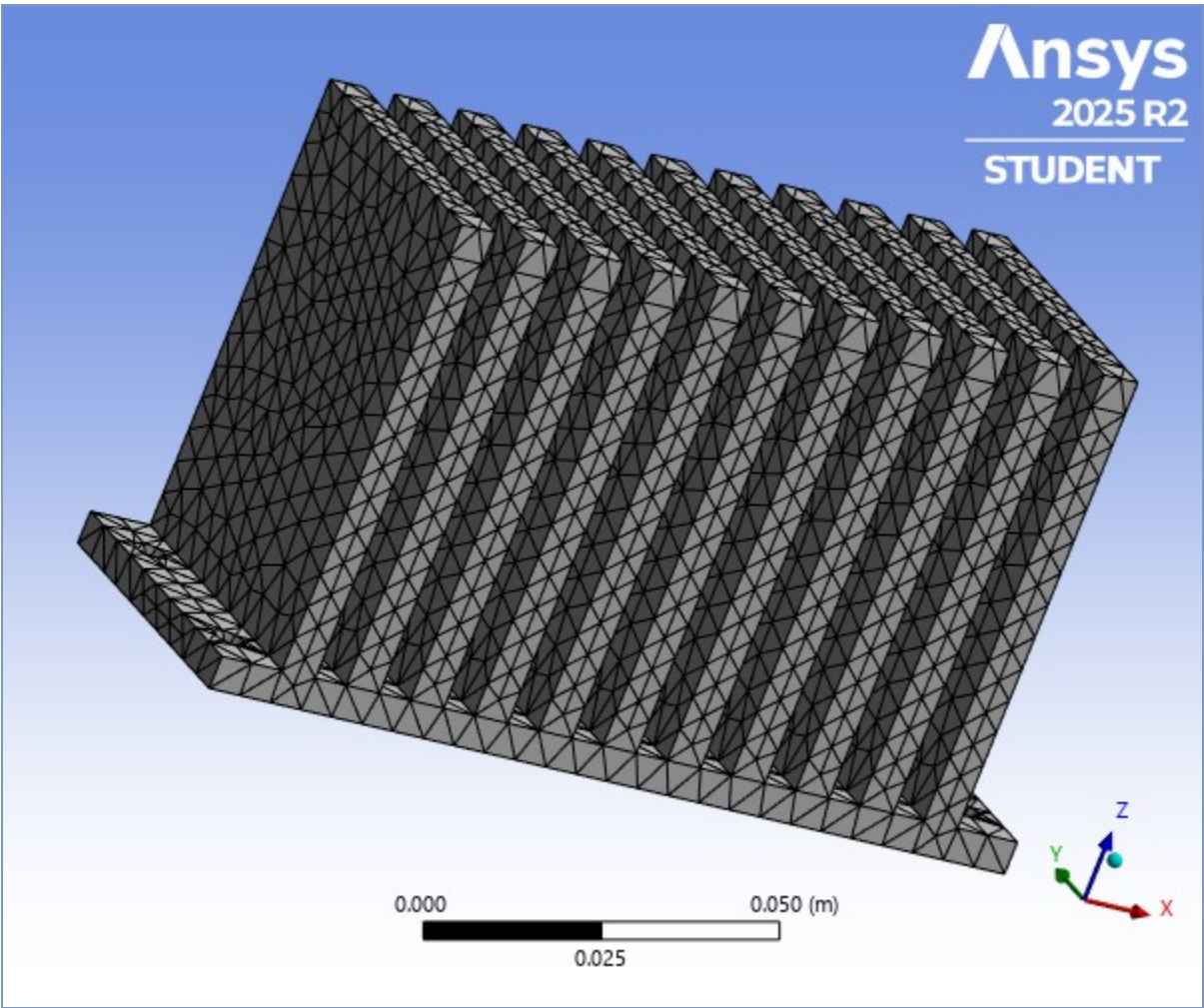
Object Name	<i>Mesh</i>
State	Solved
Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	Default
Sizing	
Use Adaptive Sizing	Yes
Resolution	Default (2)
Mesh Defeaturing	Yes
Defeature Size	Default
Transition	Fast
Span Angle Center	Coarse
Initial Size Seed	Assembly
Bounding Box Diagonal	0.15819 m
Average Surface Area	1.8598e-003 m ²
Minimum Edge Length	5.e-003 m
Quality	
Check Mesh Quality	Yes, Errors
Error Limits	Aggressive Mechanical
Target Element Quality	Default (5.e-002)
Smoothing	Medium
Mesh Metric	None
Inflation	
Use Automatic Inflation	None
Inflation Option	Smooth Transition
Transition Ratio	0.272
Maximum Layers	5
Growth Rate	1.2
Inflation Algorithm	Pre
Inflation Element Type	Wedges
View Advanced Options	No
Advanced	
Number of CPUs for Parallel Part Meshing	Program Controlled
Straight Sided Elements	No
Rigid Body Behavior	Dimensionally Reduced
Triangle Surface Mesher	Program Controlled
Topology Checking	Yes
Pinch Tolerance	Please Define

Generate Pinch on Refresh	No
Auto-Map Fillets	No
Automatic Methods	
Sheet Body Method	Prime Quad Dominant
Sweepable Body Method	Sweep
Statistics	
Nodes	36490
Elements	19832
Show Detailed Statistics	No

TABLE 9
Model (A4, B4) > Mesh > Mesh Controls

Object Name	<i>Body Sizing</i>
State	Fully Defined
Scope	
Scoping Method	Geometry Selection
Geometry	1 Body
Definition	
Suppressed	No
Type	Element Size
Element Size	5.e-003 m
Advanced	
Defeature Size	Default
Behavior	Soft

FIGURE 2
Model (A4, B4) > Mesh > Figure



Steady-State Thermal (A5)

TABLE 10
Model (A4, B4) > Analysis

Object Name	<i>Steady-State Thermal (A5)</i>
State	Solved
Definition	
Physics Type	Thermal
Analysis Type	Steady-State
Solver Target	Mechanical APDL
Options	
Generate Input Only	No

TABLE 11
Model (A4, B4) > Steady-State Thermal (A5) > Initial Condition

Object Name	<i>Initial Temperature</i>
State	Fully Defined
Definition	
Initial Temperature	Uniform Temperature
Initial Temperature Value	22. °C

TABLE 12

Model (A4, B4) > Steady-State Thermal (A5) > Analysis Settings

Object Name	Analysis Settings
State	Fully Defined
Step Controls	
Number Of Steps	1.
Current Step Number	1.
Step End Time	1. s
Auto Time Stepping	Program Controlled
Solver Controls	
Solver Type	Program Controlled
Solver Pivot Checking	Program Controlled
Radiosity Controls	
Radiosity Solver	Program Controlled
Flux Convergence	1.e-004
Maximum Iteration	1000.
Solver Tolerance	0.1 W/m ²
Over Relaxation	0.1
Hemicube Resolution	10.
Nonlinear Controls	
Heat Convergence	Program Controlled
Temperature Convergence	Program Controlled
Line Search	Program Controlled
Advanced	
Contact Split (DMP)	Program Controlled
Output Controls	
Output Selection	None
Calculate Thermal Flux	Yes
Contact Data	Yes
Nodal Forces	No
Volume and Energy	Yes
Euler Angles	Yes
General Miscellaneous	No
Contact Miscellaneous	No
Store Results At	All Time Points
Result File Compression	Program Controlled
Analysis Data Management	
Solver Files Directory	D:\projects\ANSYS Projects\Thermal Analysis of a Power Electronic Heat Sink\ThermalAnalysisOfHeatSink_files\dp0\SYS\MECH\
Future Analysis	None
Scratch Solver Files Directory	
Save MAPDL db	No
Contact Summary	Program Controlled
Delete Unneeded Files	Yes
Nonlinear Solution	Yes
Solver Units	Active System
Solver Unit System	mks

TABLE 13
Model (A4, B4) > Steady-State Thermal (A5) > Loads

Object Name	Temperature	Convection
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	1 Face	1 Body
Definition		
Type	Temperature	Convection
Magnitude	95. °C (ramped)	
Suppressed	No	
Film Coefficient		30. W/m ² .°C (step applied)
Ambient Temperature		22. °C (ramped)
Convection Matrix		Program Controlled
Element APDL Name		

FIGURE 3
Model (A4, B4) > Steady-State Thermal (A5) > Temperature

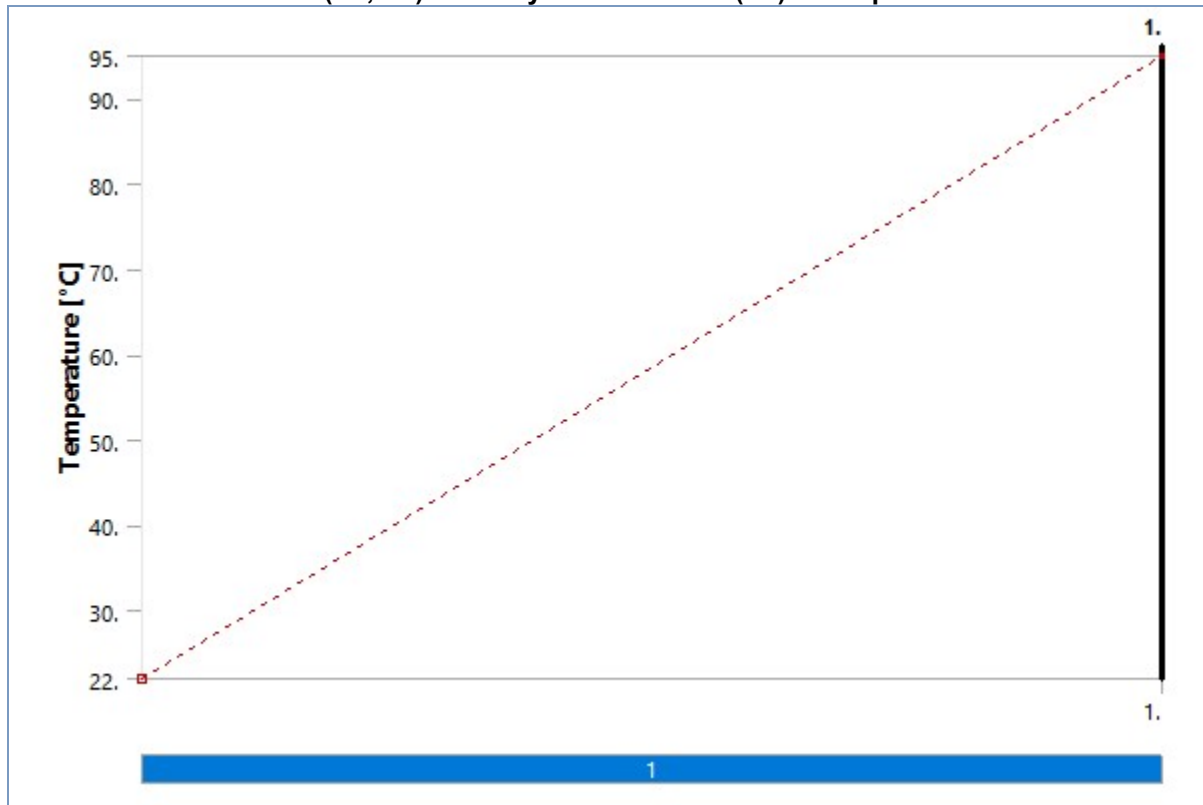


FIGURE 4
Model (A4, B4) > Steady-State Thermal (A5) > Temperature > Figure

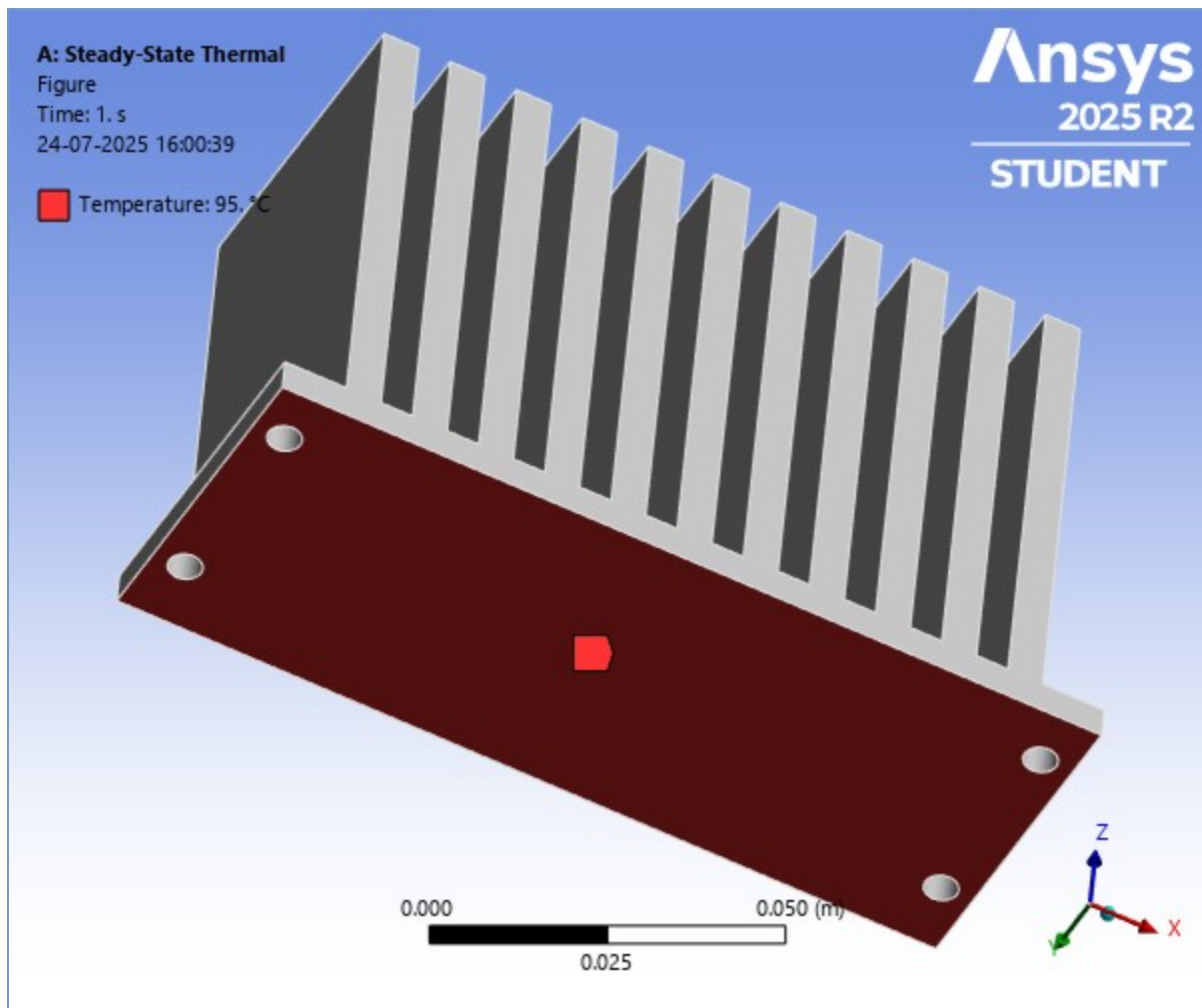


FIGURE 5
Model (A4, B4) > Steady-State Thermal (A5) > Convection

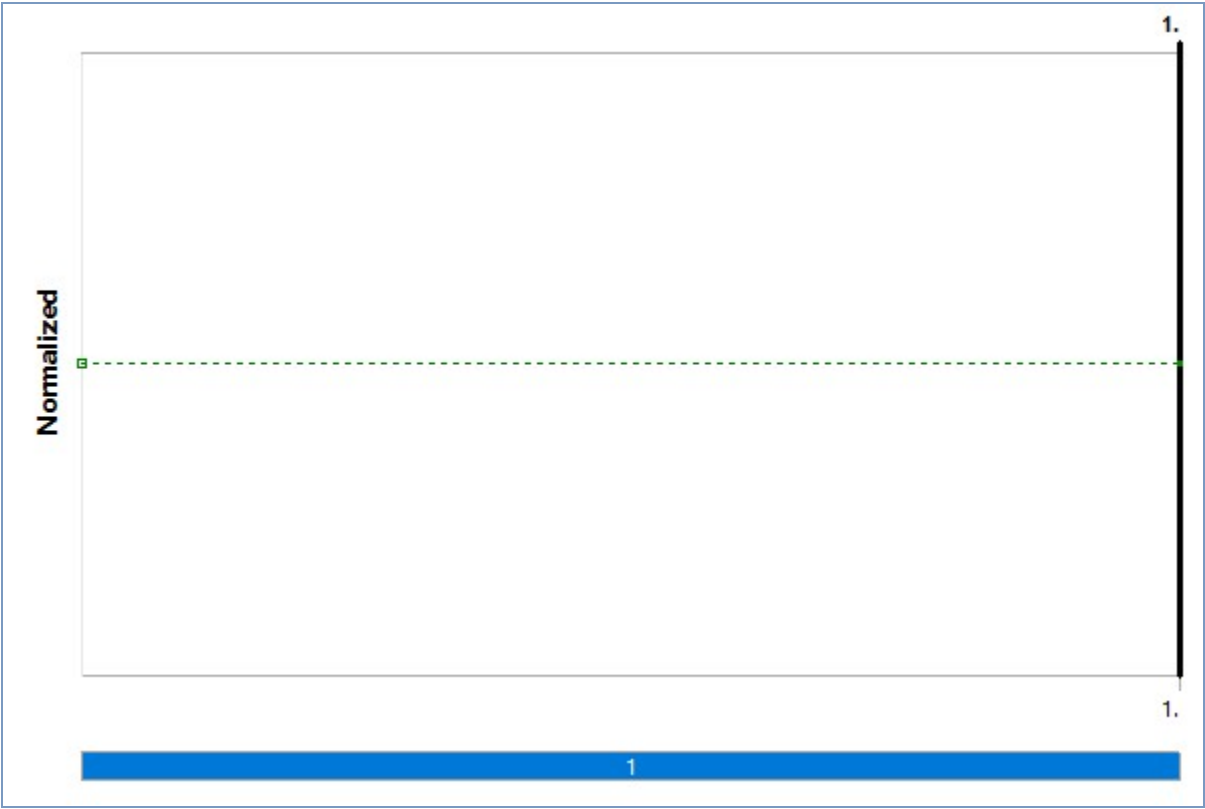


TABLE 14
Model (A4, B4) > Steady-State Thermal (A5) > Convection

Steps	Time [s]	Convection Coefficient [W/m ² .°C]	Temperature [°C]
1	0.	= 30.	= 22.
	1.	30.	22.

FIGURE 6
Model (A4, B4) > Steady-State Thermal (A5) > Convection > Figure



Object Name	<i>Solution (A6)</i>
State	Solved
Adaptive Mesh Refinement	
Max Refinement Loops	1.
Refinement Depth	2.
Information	
Status	Done
MAPDL Elapsed Time	11. s
MAPDL Memory Used	453. MB
MAPDL Result File Size	10.688 MB
Post Processing	
Beam Section Results	No
On Demand Stress/Strain	No

Object Name	Solution Information
State	Solved

Solution Information	
Solution Output	Solver Output
Update Interval	2.5 s
Display Points	All
FE Connection Visibility	
Activate Visibility	Yes
Display	All FE Connectors
Draw Connections Attached To	All Nodes
Line Color	Connection Type
Visible on Results	No
Line Thickness	Single
Display Type	Lines

TABLE 17
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Results

Object Name	Temperature	Total Heat Flux
State	Solved	
Scope		
Scoping Method	Geometry Selection	
Geometry	All Bodies	
Definition		
Type	Temperature	Total Heat Flux
By	Time	
Display Time	Last	
Separate Data by Entity	No	
Calculate Time History	Yes	
Identifier		
Suppressed	No	
Results		
Minimum	81.713 °C	1312.9 W/m²
Maximum	95. °C	57898 W/m²
Average	87.051 °C	27267 W/m²
Minimum Occurs On	HeatSink\Solid	
Maximum Occurs On	HeatSink\Solid	
Information		
Time	1. s	
Load Step	1	
Substep	1	
Iteration Number	2	
Integration Point Results		
Display Option		Averaged
Average Across Bodies		No

FIGURE 7
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Temperature

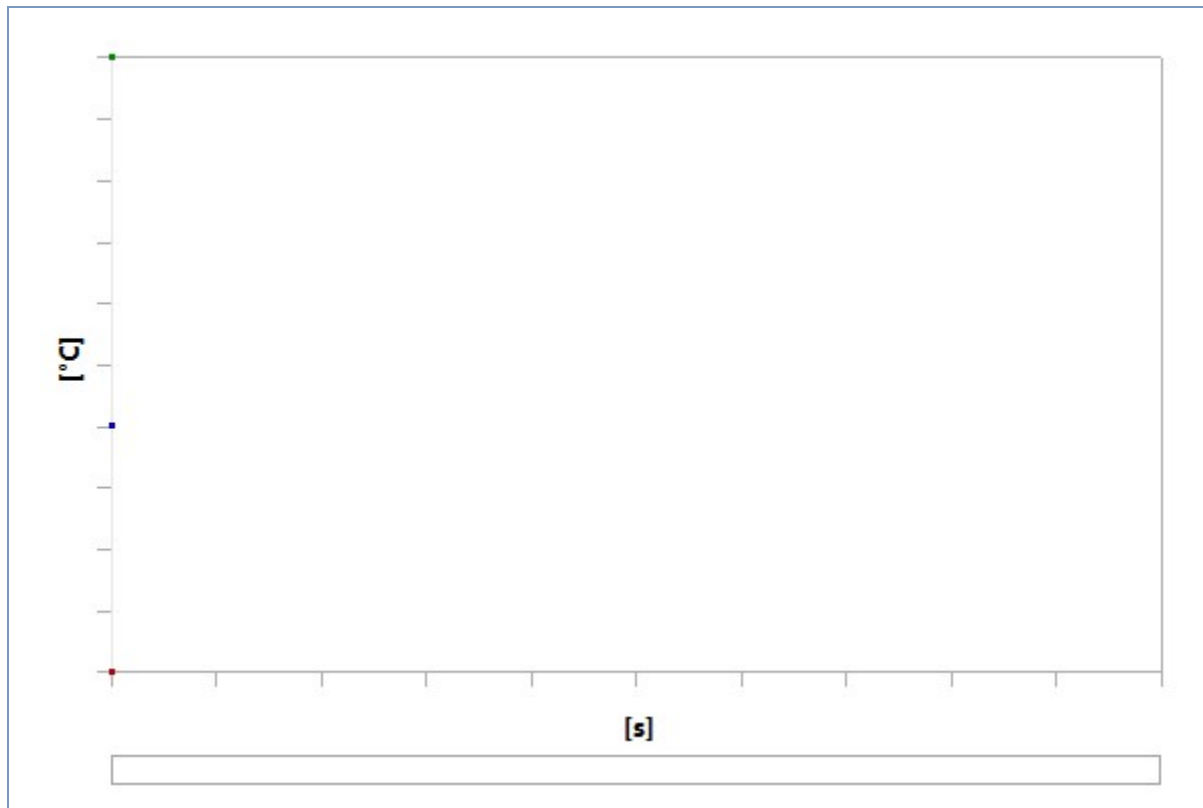


TABLE 18
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Temperature

Time [s]	Minimum [$^{\circ}\text{C}$]	Maximum [$^{\circ}\text{C}$]	Average [$^{\circ}\text{C}$]
1.	81.713	95.	87.051

FIGURE 8
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Temperature > Figure

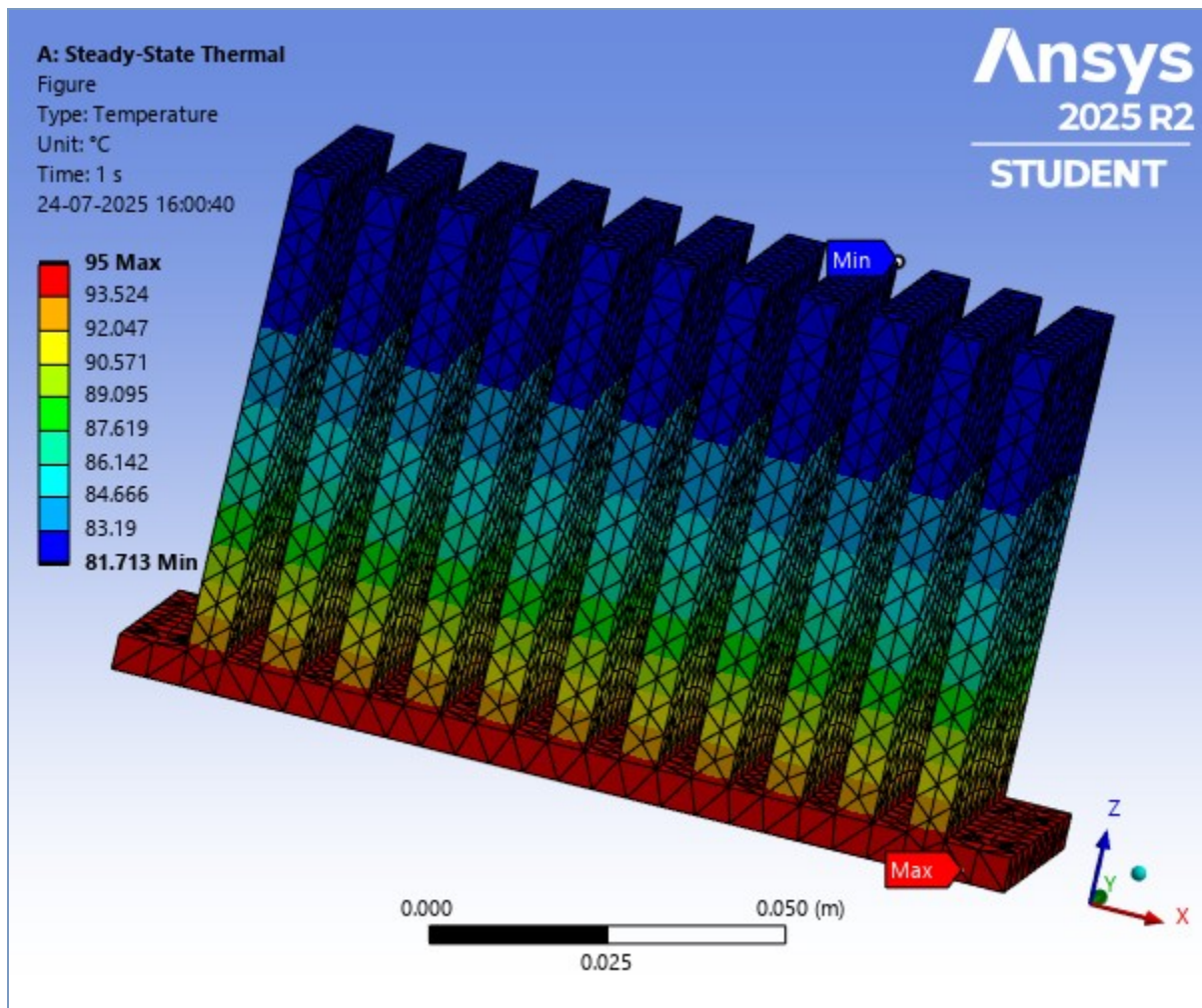
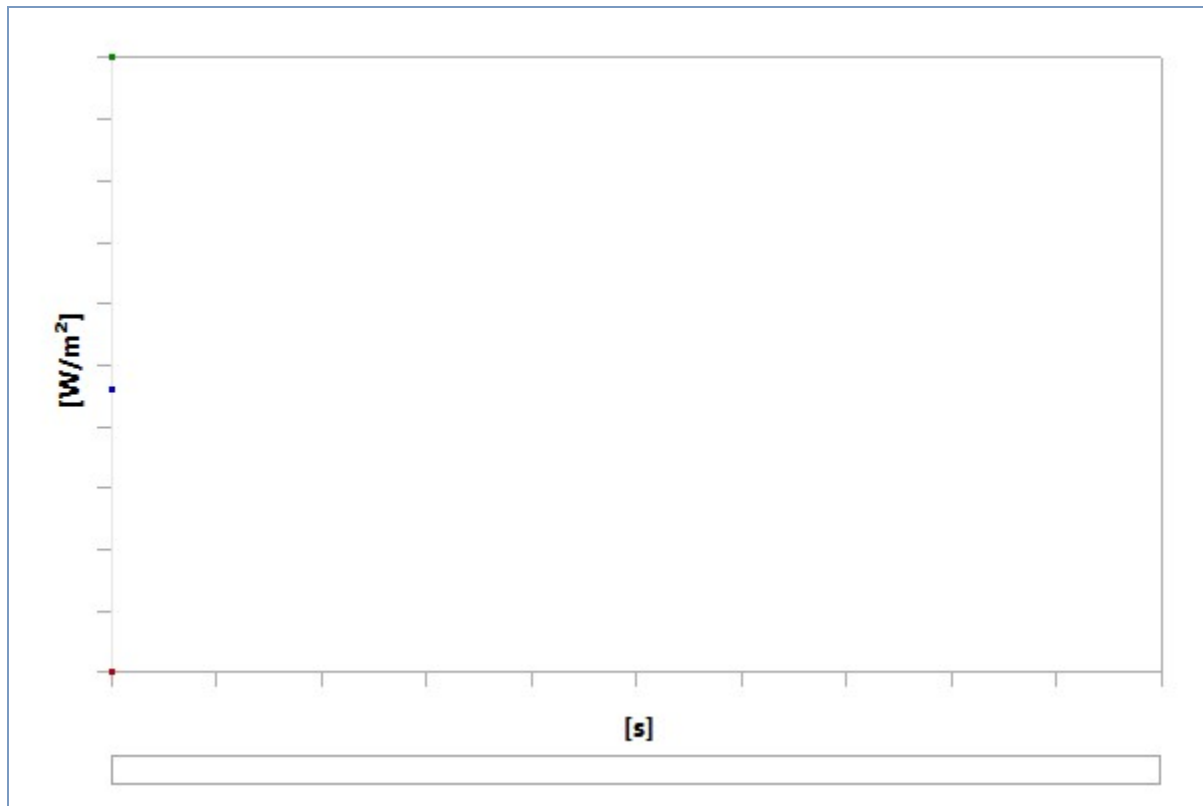
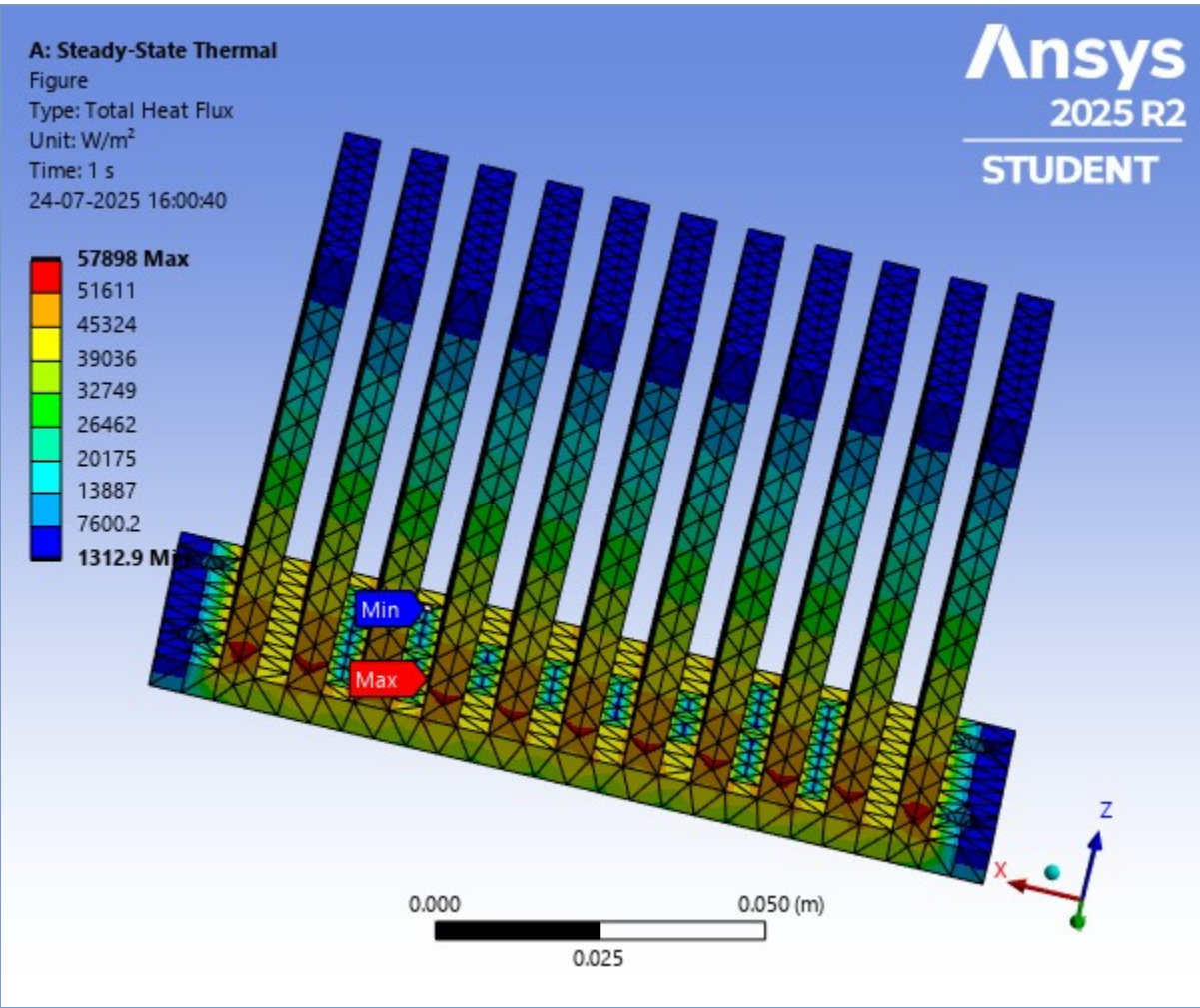


FIGURE 9
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Total Heat Flux

**TABLE 19****Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Total Heat Flux**

Time [s]	Minimum [W/m ²]	Maximum [W/m ²]	Average [W/m ²]
1.	1312.9	57898	27267

FIGURE 10**Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Total Heat Flux > Figure**



Static Structural (B5)

TABLE 20
Model (A4, B4) > Analysis

Object Name	Static Structural (B5)
State	Solved
Definition	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
Options	
Environment Temperature	22. °C
Generate Input Only	No

TABLE 21
Model (A4, B4) > Static Structural (B5) > Analysis Settings

Object Name	Analysis Settings
State	Fully Defined
Step Controls	
Number Of Steps	1.
Current Step Number	1.
Step End Time	1. s

Auto Time Stepping	Program Controlled
Solver Controls	
Solver Type	Program Controlled
Weak Springs	Off
Solver Pivot Checking	Program Controlled
Large Deflection	Off
Inertia Relief	Off
Quasi-Static Solution	Off
Rotordynamics Controls	
Coriolis Effect	Off
Restart Controls	
Generate Restart Points	Program Controlled
Retain Files After Full Solve	No
Combine Restart Files	Program Controlled
Nonlinear Controls	
Newton-Raphson Option	Program Controlled
Force Convergence	Program Controlled
Moment Convergence	Program Controlled
Displacement Convergence	Program Controlled
Rotation Convergence	Program Controlled
Line Search	Program Controlled
Stabilization	Program Controlled
Advanced	
Inverse Option	No
Contact Split (DMP)	Program Controlled
Output Controls	
Output Selection	None
Stress	Yes
Back Stress	No
Strain	Yes
Contact Data	Yes
Nonlinear Data	No
Nodal Forces	No
Volume and Energy	Yes
Euler Angles	Yes
General Miscellaneous	No
Contact Miscellaneous	No
Store Results At	All Time Points
Result File Compression	Program Controlled
Analysis Data Management	
Solver Files Directory	D:\projects\ANSYS Projects\Thermal Analysis of a Power Electronic Heat Sink\ThermalAnalysisOfHeatSink_files\dp0\SYS-2\MECH\
Future Analysis	None
Scratch Solver Files Directory	

Save MAPDL db	No
Contact Summary	Program Controlled
Delete Unneeded Files	Yes
Nonlinear Solution	No
Solver Units	Active System
Solver Unit System	mks

TABLE 22
Model (A4, B4) > Static Structural (B5) > Loads

Object Name	<i>Fixed Support</i>
State	Fully Defined
Scope	
Scoping Method	Geometry Selection
Geometry	4 Faces
Definition	
Type	Fixed Support
Suppressed	No

FIGURE 11
Model (A4, B4) > Static Structural (B5) > Fixed Support > Figure

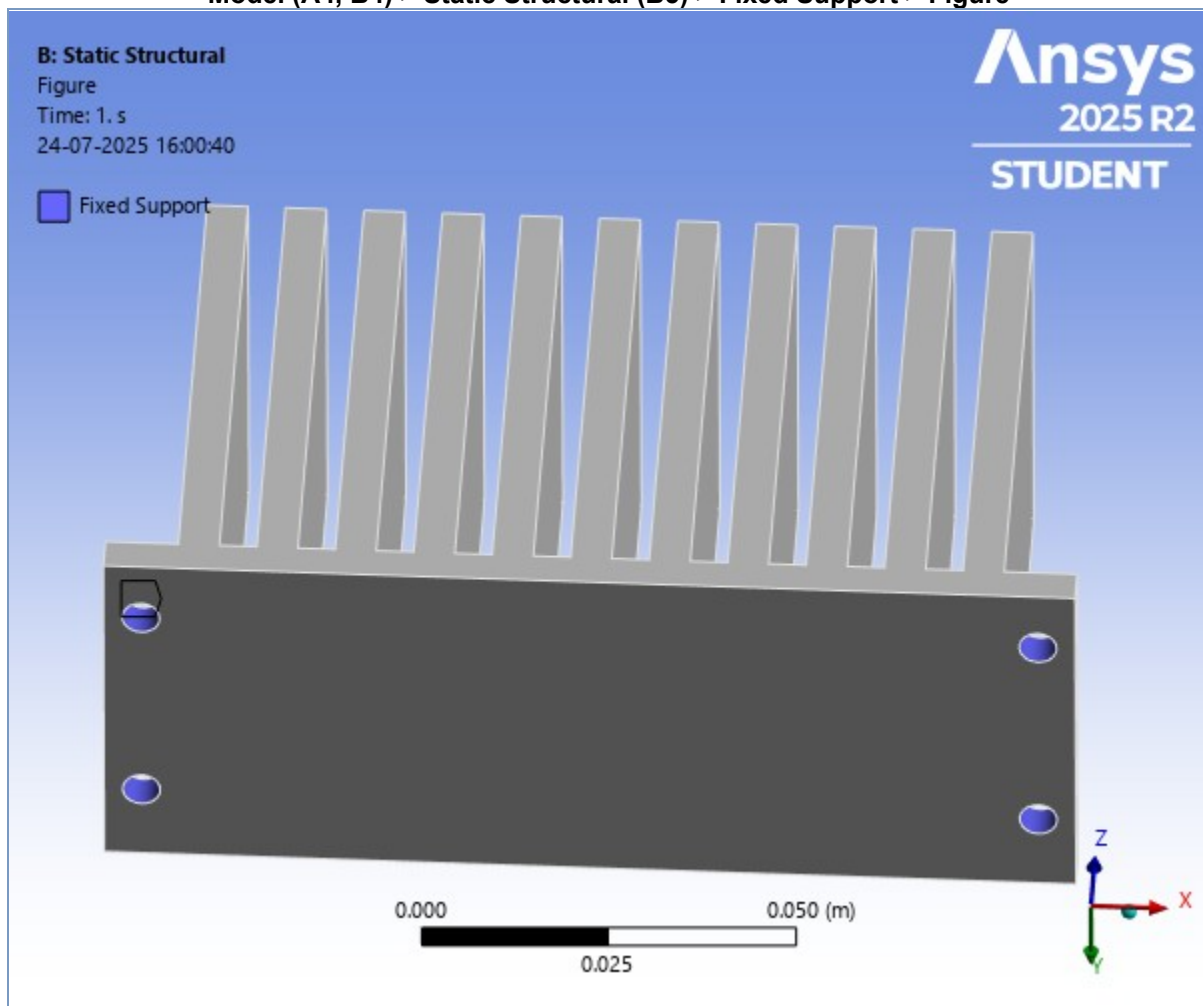
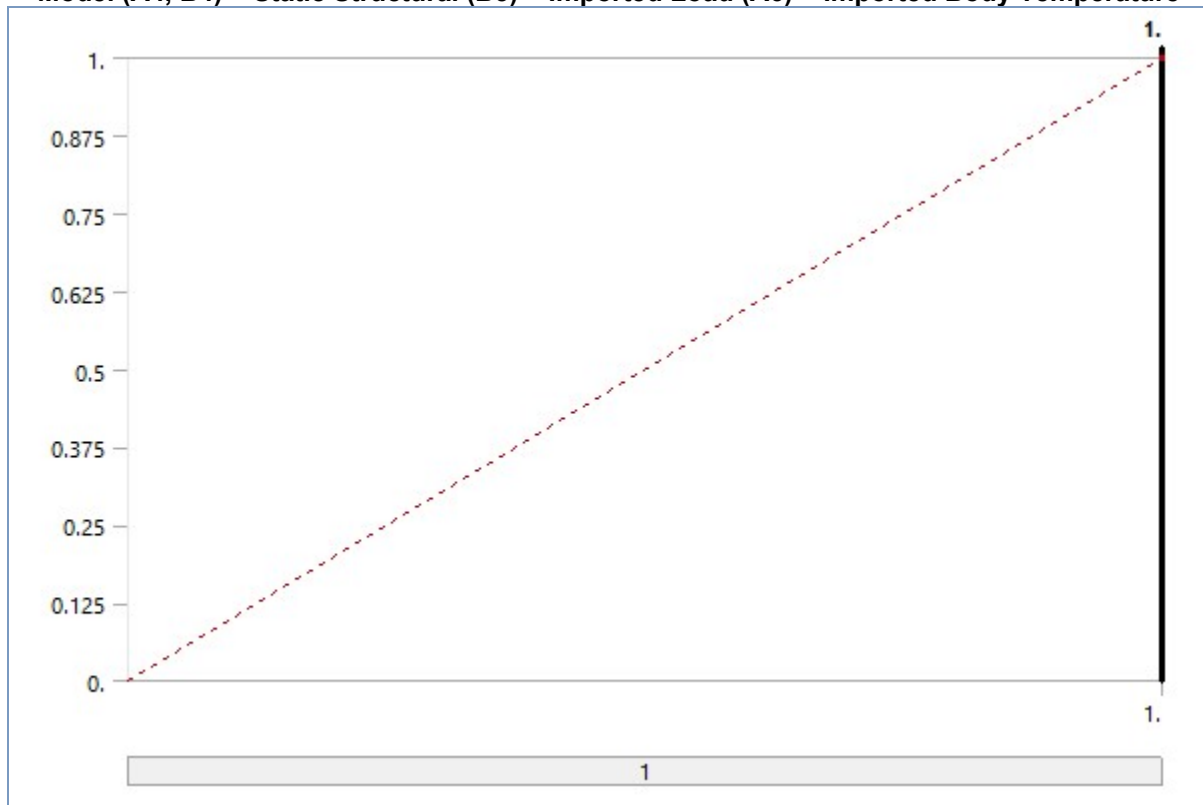


TABLE 23
Model (A4, B4) > Static Structural (B5) > Imported Load (A6)

Object Name	<i>Imported Load (A6)</i>
State	Fully Defined
Definition	
Type	Imported Data
Interpolation Type	Mechanical Results Transfer
Suppressed	No
Source	A6::Solution
Data Management	
Delete Mapped Data Files	Yes

TABLE 24**Model (A4, B4) > Static Structural (B5) > Imported Load (A6) > Imported Body Temperature**

Object Name	<i>Imported Body Temperature</i>
State	Solved
Scope	
Scoping Method	Geometry Selection
Geometry	1 Body
Definition	
Type	Imported Body Temperature
Tabular Loading	Program Controlled
Mapped Data	To Input File
Suppressed	No
Source Environment	Steady-State Thermal (A5)
Source Time	Worksheet

FIGURE 12**Model (A4, B4) > Static Structural (B5) > Imported Load (A6) > Imported Body Temperature****Model (A4, B4) > Static Structural (B5) > Imported Load (A6) > Imported Body Temperature**

	Source Time (s)	Analysis Time (s)	Scale	Offset ($\Delta^{\circ}\text{C}$)
1	End Time	1	1	0
*				

Solution (B6)

TABLE 25
Model (A4, B4) > Static Structural (B5) > Solution

Object Name	<i>Solution (B6)</i>
State	Solved
Adaptive Mesh Refinement	
Max Refinement Loops	1.
Refinement Depth	2.
Information	
Status	Done
MAPDL Elapsed Time	12. s
MAPDL Memory Used	607. MB
MAPDL Result File Size	14.188 MB
Post Processing	
Beam Section Results	No
On Demand Stress/Strain	No

TABLE 26
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Solution Information

Object Name	<i>Solution Information</i>
State	Solved
Solution Information	
Solution Output	Solver Output
Newton-Raphson Residuals	0
Identify Element Violations	0
Update Interval	2.5 s
Display Points	All
FE Connection Visibility	
Activate Visibility	Yes
Display	All FE Connectors
Draw Connections Attached To	All Nodes
Line Color	Connection Type
Visible on Results	No
Line Thickness	Single
Display Type	Lines

TABLE 27
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Results

Object Name	Total Deformation	Equivalent Stress
State	Solved	
Scope		
Scoping Method	Geometry Selection	
Geometry	All Bodies	
Definition		
Type	Total Deformation	Equivalent (von-Mises) Stress
By	Time	
Display Time	Last	
Separate Data by Entity	No	

Calculate Time History	Yes	
Identifier		
Suppressed	No	
Results		
Minimum	0. m	10249 Pa
Maximum	1.3001e-004 m	5.1221e+008 Pa
Average	6.9344e-005 m	2.1941e+007 Pa
Minimum Occurs On	HeatSink\Solid	
Maximum Occurs On	HeatSink\Solid	
Information		
Time	1. s	
Load Step	1	
Substep	1	
Iteration Number	1	
Integration Point Results		
Display Option		Averaged
Average Across Bodies		No

FIGURE 13
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Total Deformation

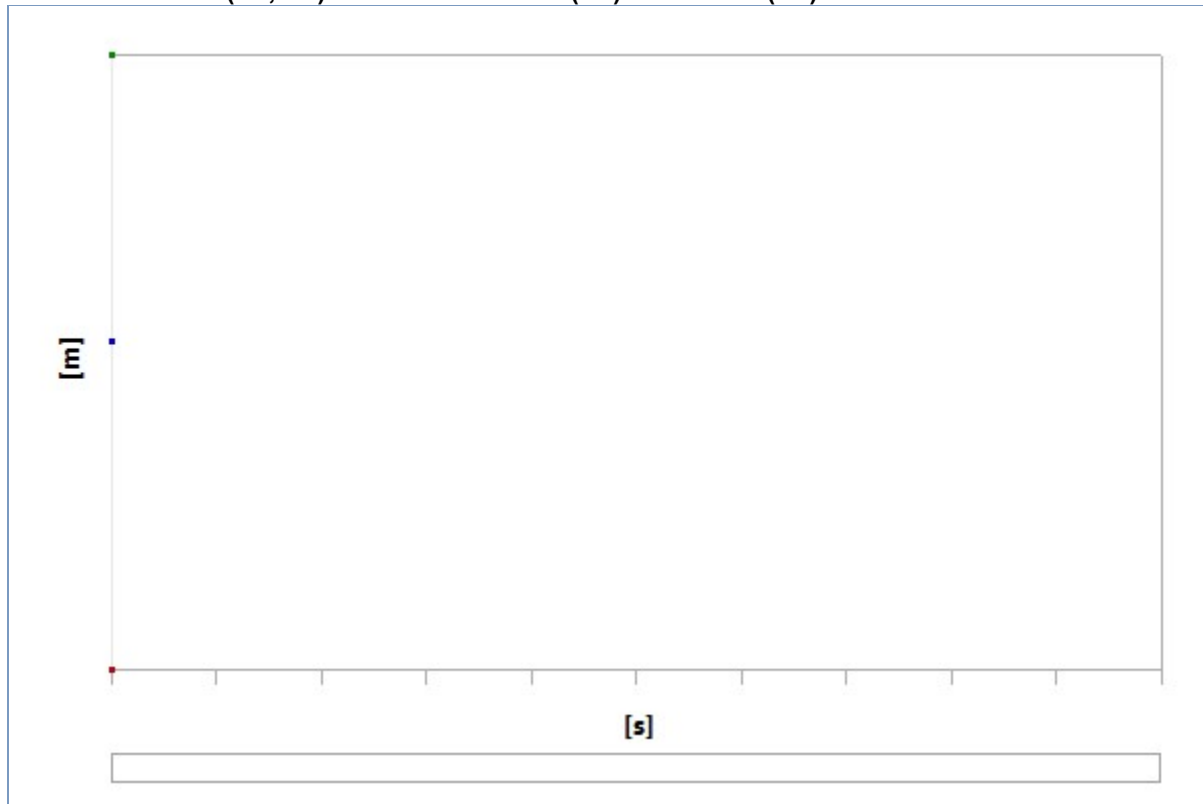


TABLE 28
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Total Deformation

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1.	0.	1.3001e-004	6.9344e-005

FIGURE 14
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Total Deformation > Figure

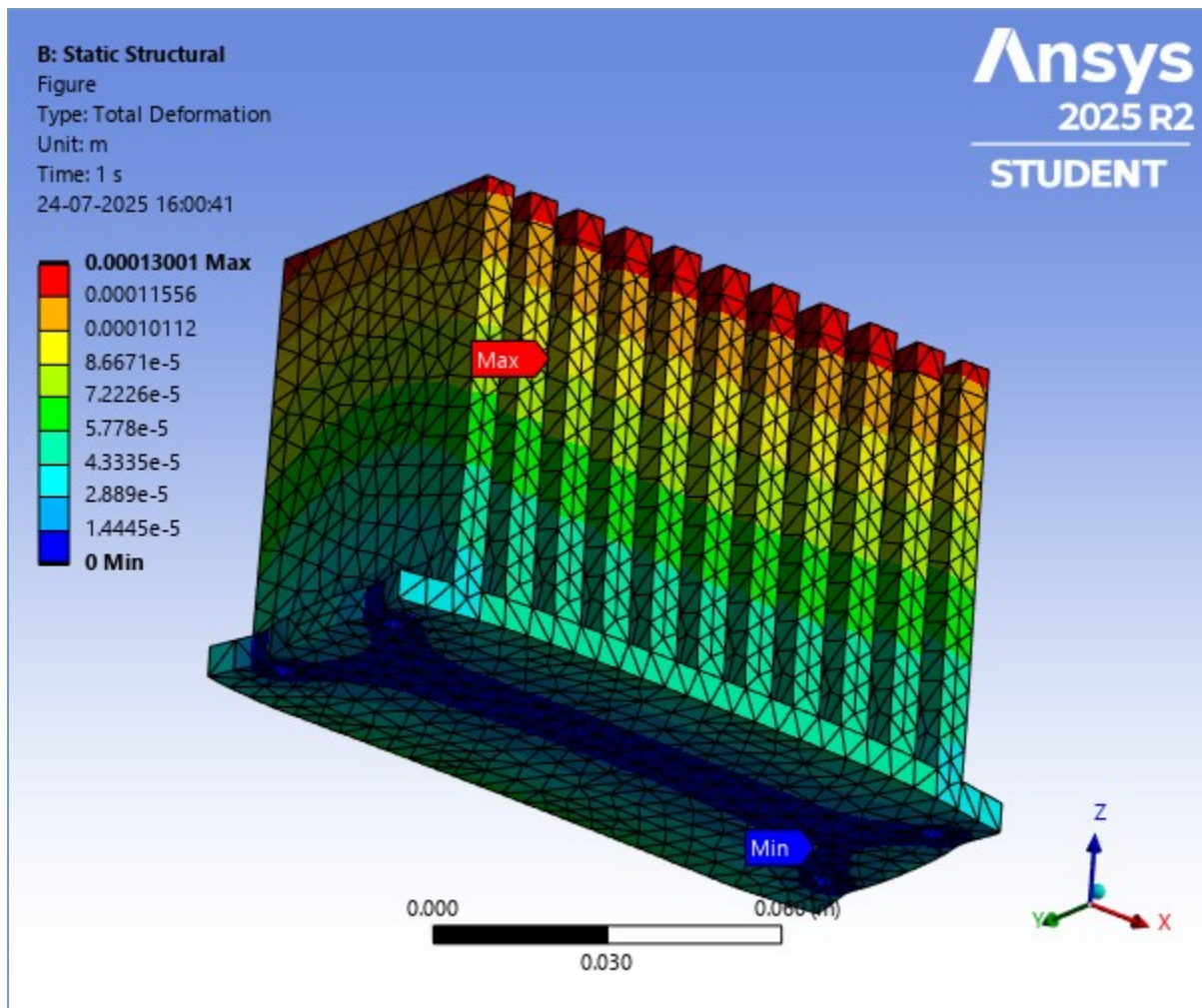


FIGURE 15
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress

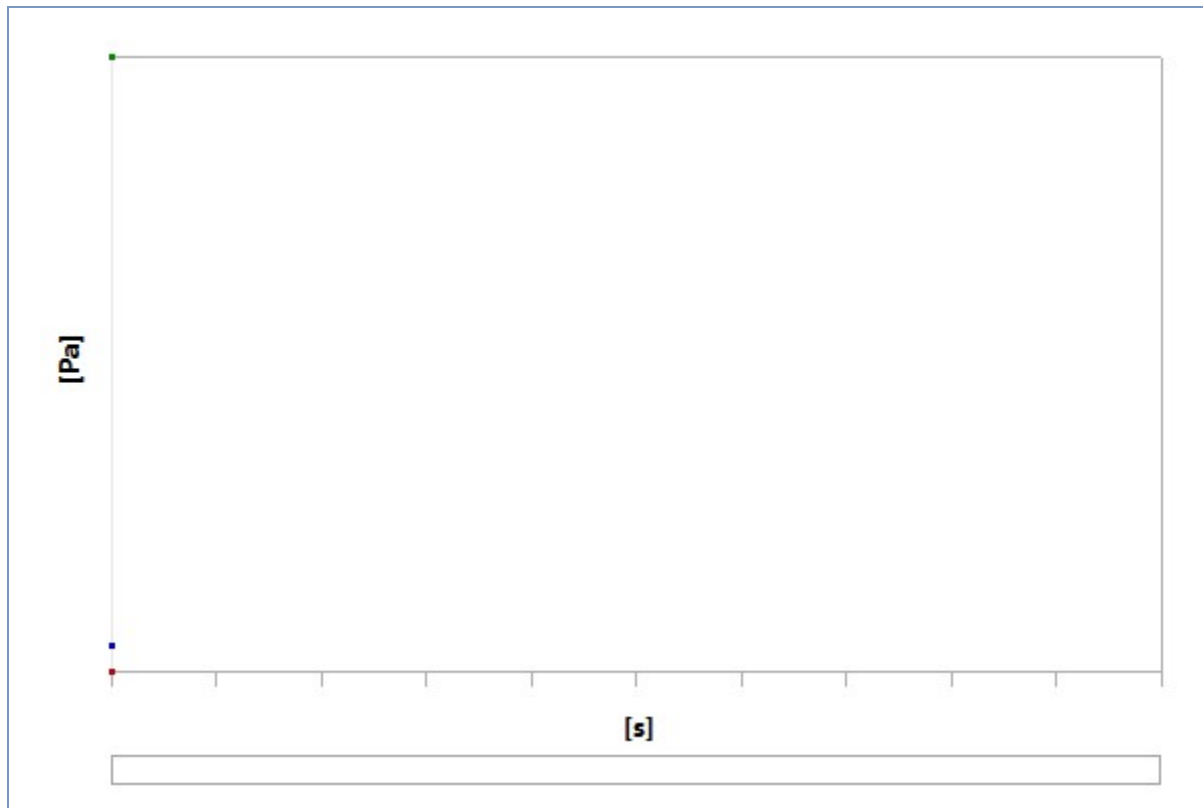


TABLE 29
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress

Time [s]	Minimum [Pa]	Maximum [Pa]	Average [Pa]
1.	10249	5.1221e+008	2.1941e+007

FIGURE 16
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress > Figure



TABLE 30
Aluminum Alloy 2 > Constants

TABLE 31
Aluminum Alloy 2 > Appearance

TABLE 32
Aluminum Alloy 2 > Compressive Ultimate Strength

TABLE 33
Aluminum Alloy 2 > Compressive Yield Strength

Compressive Yield Strength Pa
2.8e+008

TABLE 34
Aluminum Alloy 2 > Tensile Yield Strength

Tensile Yield Strength Pa
2.8e+008

TABLE 35
Aluminum Alloy 2 > Tensile Ultimate Strength

Tensile Ultimate Strength Pa
3.1e+008

TABLE 36
Aluminum Alloy 2 > Isotropic Secant Coefficient of Thermal Expansion

Zero-Thermal-Strain Reference Temperature C
22

TABLE 37
Aluminum Alloy 2 > Isotropic Thermal Conductivity

Thermal Conductivity W m ⁻¹ C ⁻¹	Temperature C
114	-100
144	0
165	100
175	200

TABLE 38
Aluminum Alloy 2 > S-N Curve

Alternating Stress Pa	Cycles	R-Ratio
2.758e+008	1700	-1
2.413e+008	5000	-1
2.068e+008	34000	-1
1.724e+008	1.4e+005	-1
1.379e+008	8.e+005	-1
1.172e+008	2.4e+006	-1
8.963e+007	5.5e+007	-1
8.274e+007	1.e+008	-1
1.706e+008	50000	-0.5
1.396e+008	3.5e+005	-0.5
1.086e+008	3.7e+006	-0.5
8.791e+007	1.4e+007	-0.5
7.757e+007	5.e+007	-0.5
7.239e+007	1.e+008	-0.5
1.448e+008	50000	0
1.207e+008	1.9e+005	0
1.034e+008	1.3e+006	0
9.308e+007	4.4e+006	0
8.618e+007	1.2e+007	0
7.239e+007	1.e+008	0
7.412e+007	3.e+005	0.5
7.067e+007	1.5e+006	0.5
6.636e+007	1.2e+007	0.5
6.205e+007	1.e+008	0.5

TABLE 39
Aluminum Alloy 2 > Isotropic Resistivity

Resistivity kg m ³ A ⁻² s ⁻³	Temperature C
2.43e-008	0
2.67e-008	20
3.63e-008	100

TABLE 40
Aluminum Alloy 2 > Isotropic Elasticity

Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa	Temperature C
7.1e+010	0.33	6.9608e+010	2.6692e+010	

TABLE 41
Aluminum Alloy 2 > Isotropic Relative Permeability

Relative Permeability
1