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|  | |  | | --- | | **Simulation of segmented\_panel\_assembly\_test**  **Date: Sunday, April 18, 2021 Designer: Solidworks**  **Study name: segmented\_static\_test**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc69652941)  [Assumptions 2](#_Toc69652942)  [Model Information 2](#_Toc69652943)  [Study Properties 4](#_Toc69652944)  [Units 5](#_Toc69652945)  [Material Properties 6](#_Toc69652946)  [Loads and Fixtures 7](#_Toc69652947)  [Connector Definitions 8](#_Toc69652948)  [Contact Information 9](#_Toc69652949)  [Mesh information 11](#_Toc69652950)  [Sensor Details 12](#_Toc69652951)  [Resultant Forces 12](#_Toc69652952)  [Beams 12](#_Toc69652953)  [Study Results 13](#_Toc69652954)  [Conclusion 15](#_Toc69652955) | |
| Description No Data |

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| Assumptions |

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| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** segmented\_panel\_assembly\_test**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Boss-Extrude1** | **Solid Body** | ****Mass:0.0243675 kg****  ****Volume:9.025e-06 m^3****  ****Density:2,700 kg/m^3****  ****Weight:0.238802 N**** | ****C:\Users\Natha\Desktop\Caltech 2020-2024\NASA\_Big\_Idea\_Challenge\GrabCAD\Current\Mechanical\v3\_tiz\FEA\segmented\_panel\_fea\adhesive\_segmented\_test.SLDPRT****  **Apr 18 11:36:50 2021** | | **Split Line1** | **Solid Body** | ****Mass:0.423555 kg****  ****Volume:0.000168077 m^3****  ****Density:2,520 kg/m^3****  ****Weight:4.15084 N**** | ****C:\Users\Natha\Desktop\Caltech 2020-2024\NASA\_Big\_Idea\_Challenge\GrabCAD\Current\Mechanical\v3\_tiz\FEA\segmented\_panel\_fea\bplate\_segmented\_test.SLDPRT****  **Apr 18 11:36:51 2021** | | **Fillet2** | **Solid Body** | ****Mass:0.0291259 kg****  ****Volume:2.05112e-05 m^3****  ****Density:1,420 kg/m^3****  ****Weight:0.285434 N**** | ****C:\Users\Natha\Desktop\Caltech 2020-2024\NASA\_Big\_Idea\_Challenge\GrabCAD\Current\Mechanical\v3\_tiz\FEA\segmented\_panel\_fea\pcb\_mockup\_segmented\_test.SLDPRT****  **Apr 18 11:36:51 2021** | | **Split Line1** | **Solid Body** | ****Mass:0.0702145 kg****  ****Volume:1.805e-05 m^3****  ****Density:3,890 kg/m^3****  ****Weight:0.688102 N**** | ****C:\Users\Natha\Desktop\Caltech 2020-2024\NASA\_Big\_Idea\_Challenge\GrabCAD\Current\Mechanical\v3\_tiz\FEA\segmented\_panel\_fea\tplate\_segmented\_test.SLDPRT****  **Apr 18 11:36:50 2021** | | **Split Line1** | **Solid Body** | ****Mass:0.0702145 kg****  ****Volume:1.805e-05 m^3****  ****Density:3,890 kg/m^3****  ****Weight:0.688102 N**** | ****C:\Users\Natha\Desktop\Caltech 2020-2024\NASA\_Big\_Idea\_Challenge\GrabCAD\Current\Mechanical\v3\_tiz\FEA\segmented\_panel\_fea\tplate\_segmented\_test.SLDPRT****  **Apr 18 11:36:50 2021** | |

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| Study Properties  |  |  | | --- | --- | | Study name | segmented\_static\_test | | Analysis type | Static | | Mesh type | Solid Mesh | | Thermal Effect: | On | | Thermal option | Include temperature loads | | Zero strain temperature | 298 Kelvin | | Include fluid pressure effects from SOLIDWORKS Flow Simulation | Off | | Solver type | FFEPlus | | Inplane Effect: | Off | | Soft Spring: | Off | | Inertial Relief: | Off | | Incompatible bonding options | Automatic | | Large displacement | Off | | Compute free body forces | On | | Friction | Off | | Use Adaptive Method: | Off | | Result folder | SOLIDWORKS document (C:\Users\Natha\Desktop\Caltech 2020-2024\NASA\_Big\_Idea\_Challenge\GrabCAD\Current\Mechanical\v3\_tiz\FEA\segmented\_panel\_fea) | |

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| Units  |  |  | | --- | --- | | Unit system: | SI (MKS) | | Length/Displacement | mm | | Temperature | Kelvin | | Angular velocity | Rad/sec | | Pressure/Stress | N/m^2 | |

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| Material Properties  |  |  |  | | --- | --- | --- | | ****Model Reference**** | ****Properties**** | ****Components**** | |  | |  |  | | --- | --- | | ****Name:**** | **STYCAST 2850FT/Catalyst 23LV** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Tensile strength:**** | **1.0549e+08 N/m^2** | | ****Compressive strength:**** | **1.19969e+08 N/m^2** | | ****Elastic modulus:**** | **9e+10 N/m^2** | | ****Poisson's ratio:**** | **0.3** | | ****Mass density:**** | **2,700 kg/m^3** | | **SolidBody 1(Boss-Extrude1)(adhesive\_segmented\_test-1)** | | **Curve Data:N/A** | | | |  | |  |  | | --- | --- | | ****Name:**** | **Macor** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Yield strength:**** | **9.4e+07 N/m^2** | | ****Tensile strength:**** | **3.5e+07 N/m^2** | | ****Compressive strength:**** | **3.45e+08 N/m^2** | | ****Elastic modulus:**** | **6.68791e+10 N/m^2** | | ****Poisson's ratio:**** | **0.29** | | ****Mass density:**** | **2,520 kg/m^3** | | ****Shear modulus:**** | **2.55106e+10 N/m^2** | | **SolidBody 1(Split Line1)(bplate\_segmented\_test-1)** | | **Curve Data:N/A** | | | |  | |  |  | | --- | --- | | ****Name:**** | **Kapton** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Yield strength:**** | **6.9e+07 N/m^2** | | ****Tensile strength:**** | **2.31e+08 N/m^2** | | ****Compressive strength:**** | **2.31e+08 N/m^2** | | ****Elastic modulus:**** | **2.76e+09 N/m^2** | | ****Poisson's ratio:**** | **0.34** | | ****Mass density:**** | **1,420 kg/m^3** | | ****Thermal expansion coefficient:**** | **20 /Kelvin** | | **SolidBody 1(Fillet2)(pcb\_mockup\_segmented\_test-1)** | | **Curve Data:N/A** | | | |  | |  |  | | --- | --- | | ****Name:**** | **99.5% Aluminum Oxide** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Tensile strength:**** | **5.72e+08 N/m^2** | | ****Compressive strength:**** | **2.60002e+09 N/m^2** | | ****Elastic modulus:**** | **3.75002e+11 N/m^2** | | ****Poisson's ratio:**** | **0.22** | | ****Mass density:**** | **3,890 kg/m^3** | | ****Shear modulus:**** | **1.52001e+11 N/m^2** | | ****Thermal expansion coefficient:**** | **8e-06 /Kelvin** | | **SolidBody 1(Split Line1)(tplate\_segmented\_test-1),**  **SolidBody 1(Split Line1)(tplate\_segmented\_test-2)** | | **Curve Data:N/A** | | | |

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| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **2 face(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **-0.000314713** | **972** | **6.19888e-06** | **972** | | **Reaction Moment(N.m)** | **0** | **0** | **0** | **0** | | | |  | ****Load name**** | ****Load Image**** | ****Load Details**** | | --- | --- | --- | | **Force-1** |  | |  |  | | --- | --- | | Entities: | **2 face(s)** | | Type: | **Apply normal force** | | Value: | **486 N** | | |

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| Connector Definitions  | ****Connector Name**** | ****Connector Details**** | ****Connector Image**** | | --- | --- | --- | | **Spring Connector-1** | |  |  | | --- | --- | | Entities: | **2 face(s)** | | Type: | **Spring(Flat parallel faces)(Compression & Extension)** | | Normal stiffness value: | **2.565e+13 (N/m)/m^2** | | Tangential Stiffness: | **2e+12 (N/m)/m^2** | | |  | | --- | |  | | **Spring Connector-1** | | |

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| Contact Information  | Contact | Contact Image | Contact Properties | | --- | --- | --- | | Contact Set-1 |  | |  |  | | --- | --- | | Type: | **Bonded contact pair** | | Entities: | **3 face(s)** | | | ****Contact/Friction force****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Contact Force(N)** | **0** | **-18.223** | **0** | **18.223** | | | | | Contact Set-2 |  | |  |  | | --- | --- | | Type: | **Bonded contact pair** | | Entities: | **10 face(s)** | | | ****Contact/Friction force****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Contact Force(N)** | **1.6062E-09** | **16.634** | **-8.421E-05** | **16.634** | | | | | Global Contact |  | |  |  | | --- | --- | | Type: | **Bonded** | | Components: | **1 component(s)** | | Options: | **Compatible mesh** | | | Component Contact-1 |  | |  |  | | --- | --- | | Type: | **No penetration (Surface to surface)** | | Components: | **5 component(s)** | | |

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| Mesh information  |  |  | | --- | --- | | Mesh type | Solid Mesh | | Mesher Used: | Standard mesh | | Automatic Transition: | Off | | Include Mesh Auto Loops: | Off | | Jacobian points | 4 Points | | Element Size | 0.195 in | | Tolerance | 0.00975 in | | Mesh Quality Plot | High | | Remesh failed parts with incompatible mesh | Off |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 86341 | | Total Elements | 42977 | | Maximum Aspect Ratio | 92.65 | | % of elements with Aspect Ratio < 3 | 26.4 | | % of elements with Aspect Ratio > 10 | 39.6 | | % of distorted elements(Jacobian) | 0 | | Time to complete mesh(hh;mm;ss): | 00:00:12 | | Computer name: | THICCO | |  | | |

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| Sensor Details No Data |

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| Resultant ForcesReaction forces  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N | -0.000314713 | 972 | 6.19888e-06 | 972 |  Reaction Moments  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N.m | 0 | 0 | 0 | 0 | |
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| Study Results  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000e+00 mm  Node: 19333 | 1.597e-01 mm  Node: 71566 | | **segmented\_panel\_assembly\_test-segmented\_static\_test-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 2.995e-09  Element: 15150 | 3.633e-04  Element: 24596 | | **segmented\_panel\_assembly\_test-segmented\_static\_test-Strain-Strain1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Factor of Safety1 | Automatic | 3.144e+00  Node: 21615 | 1.000e+01  Node: 1 | | **segmented\_panel\_assembly\_test-segmented\_static\_test-Factor of Safety-Factor of Safety1** | | | | |

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| Conclusion |