Mitchell Stankey

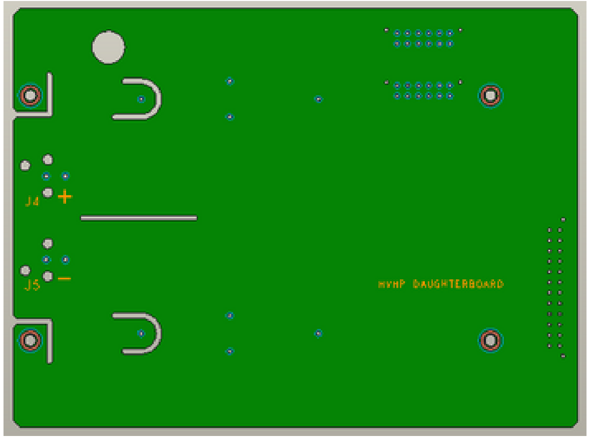
Manufacturing and Mechanical Engineering at Texas A&M University

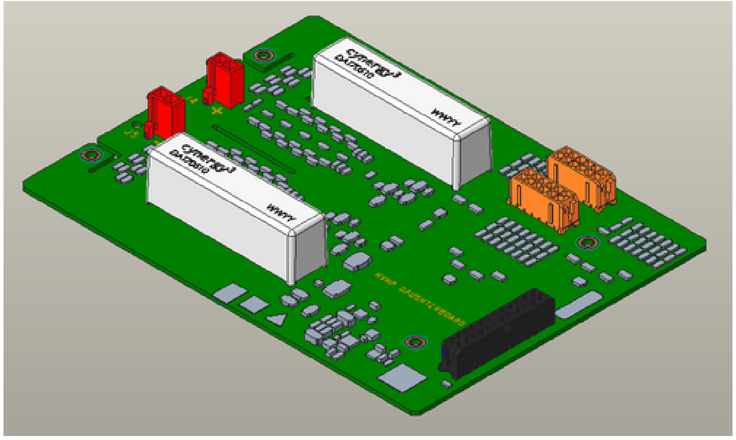
m.stankey15@gmail.com

(310) 977-9559

mitchellstankey

High Voltage Circuit Card Assembly (CCA) - National Instruments





What?

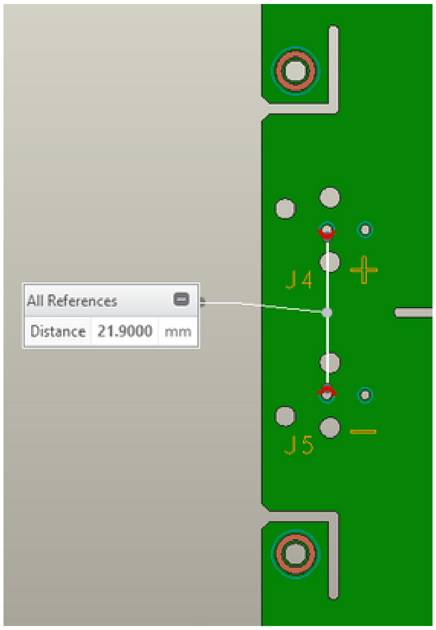
- Design a CCA that can transmit signal data while isolating 1500 DC and 230 DC voltage inputs from low voltage and ground.

How?

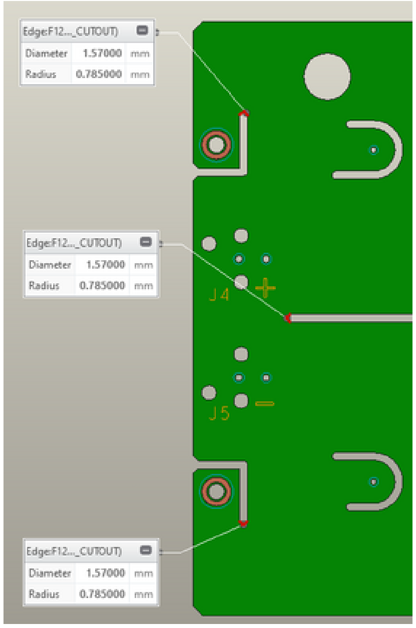
- Choose UL listed components that use CTI 600+ materials.
- Separate different voltage zones by reinforced insulation distances determined by IEC 61010.
- Define slot cutouts to prevent creepage and clearance jumps from high voltage zones.

Results

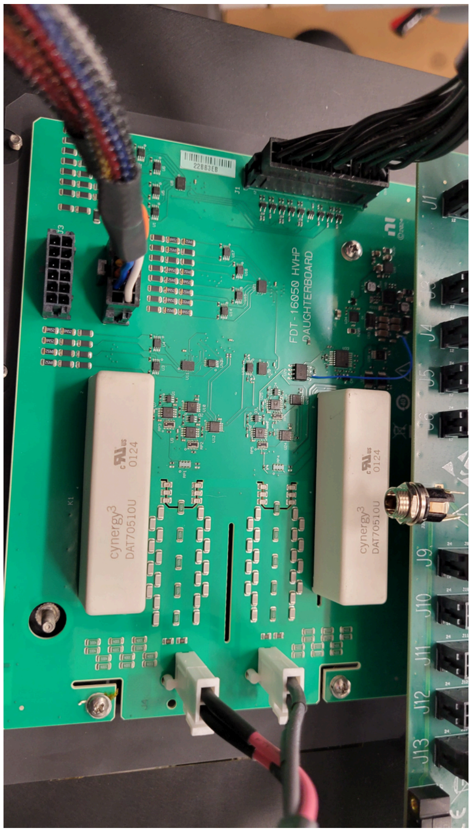
- The CCA passed HIPOT testing from safety and compliance.
- Voltage zones are sufficiently insulated and do not short to other voltage zones or ground.
- The user is protected from electrical shock in the case of single fault failure.



- The edges of the solder pads for the +/- 1500 VDC connectors are >14 mm apart. This is the minimum reinforced insulation distance required for secondary circuits with CTI 600+ materials in pollution group 2 per IEC 61010-1.



- Slot cutouts in this region provide a >1 mm gap between 1500 VDC and ground using a standard mill bit from the manufacturer.
- This value comes from IEC 61010-1, annex C, table C.1.



Mitchell Stankey

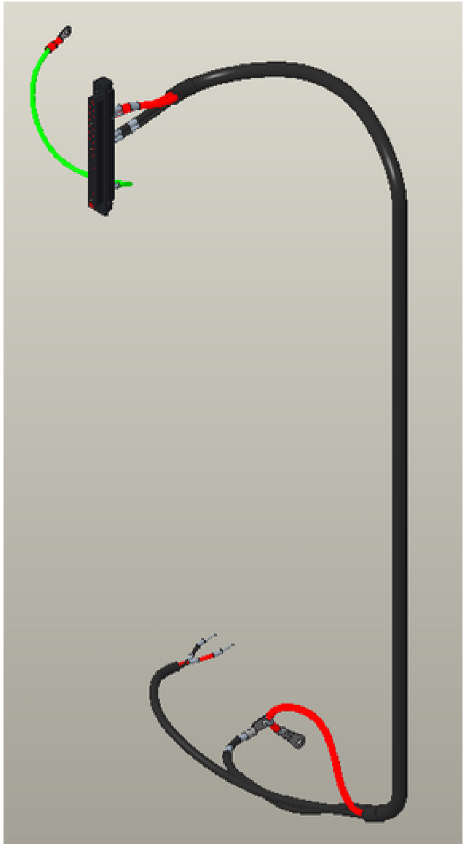
Manufacturing and Mechanical Engineering at Texas A&M University

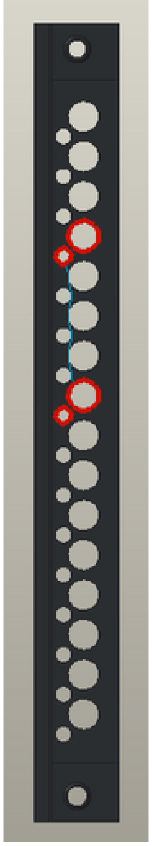
m.stankey15@gmail.com

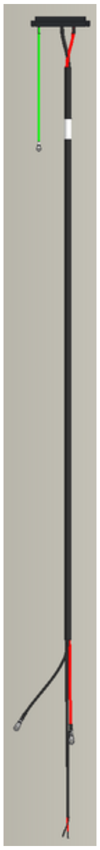
(310) 977-9559

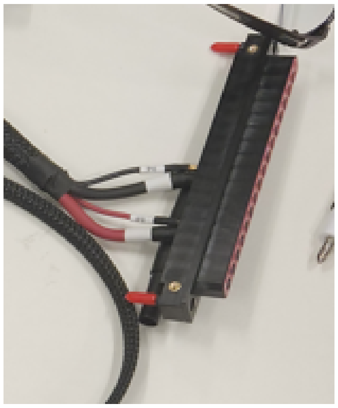
mitchellstankey

High Power Cable Assembly - National Instruments









What?

- Design a cable assembly with power lines and signal lines that connect a high voltage power supply to a connector panel to provide DC power for automotive inverter testing. All components must be rated to carry up to 1500 DC volts and the power line components must be rated to carry up to 30 Amps.

How?

- Chose UL 3817 wire spool. 8 gauge wire can handle up to 50 Amps for the power lines. 18 gauge wire can handle the voltage needs of the signal lines.
- Heat shrink covers any exposed wire to prevent shorting to nearby connectors.
- Positive and negative connector pins are separated by >15 mm, the minimum basic insulation distanced for 1500 DC volts as defined by IEC 61010-1 for secondary circuits, pollution degree 2, material group III.
- Defined the minimum cable length and routing via the PTC Creo cabling application. Allows us to define bend radius and density.
- Modeled a flattened version for easy cable drawings to send to the manufacturer.

Results

- The cable assembly passed HIPOT testing from safety and compliance and does not short between positive and negative pins and from any charged pin to ground.
- The cable is UL recognized to carry up to 1500 VDC and 30 Amps because it was built by a supplier under the UL 758 wiring harness program with electrical testing requirements as defined by the safety and compliance team.
- Signal lines verify the power lines are producing the expected voltage.

Mitchell Stankey

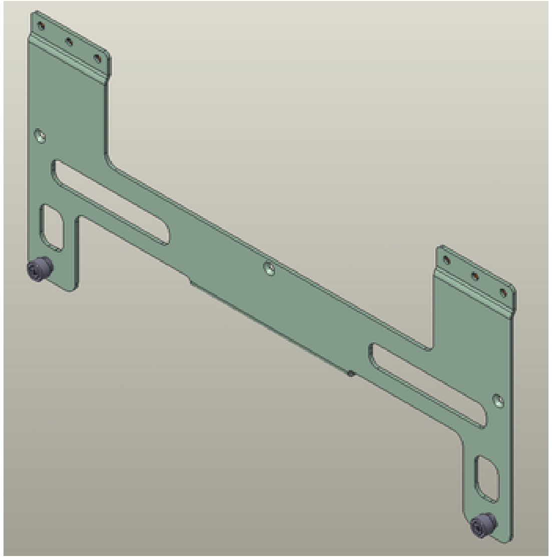
Manufacturing and Mechanical Engineering at Texas A&M University

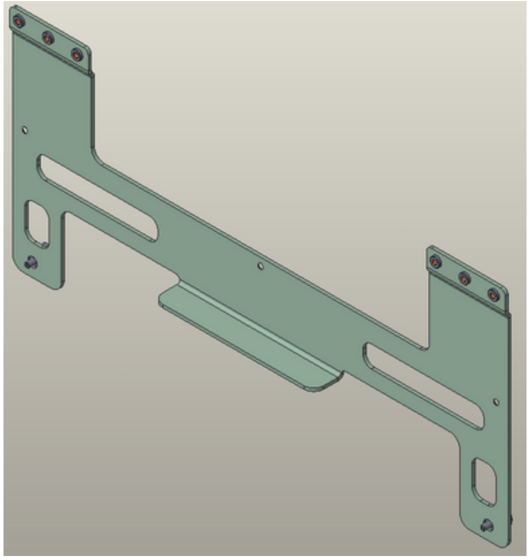
m.stankey15@gmail.com

(310) 977-9559

mitchellstankey

Test-Bench Side Bracket Sheet Metal - National Instruments





What?

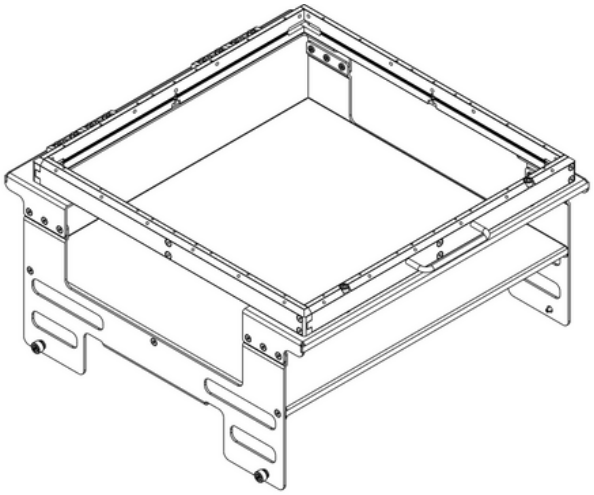
- Design a bracket to mount on a new test and measurement chassis that is compatible with an existing semiconductor test-bench assembly for an older chassis.

How?

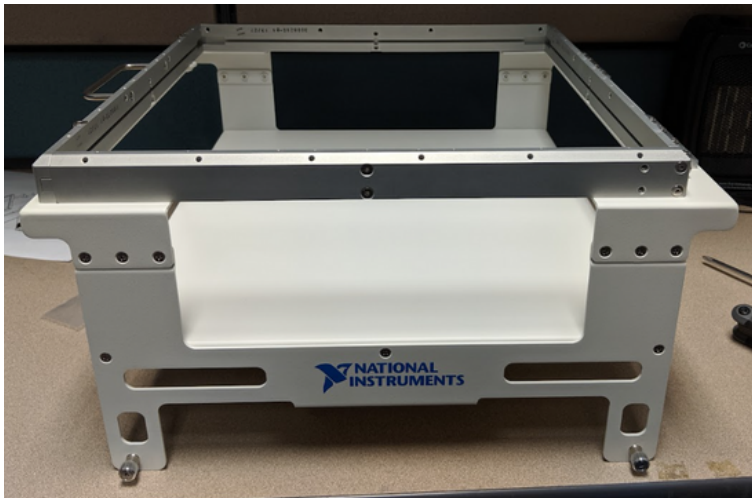
- Utilize existing side bracket geometry for old chassis, modify chassis mounting points to be compatible with the new chassis.
- Self-clinching PEM hardware enables easy assembly.
- Built from cold rolled steel sheet metal to carry heavy test hardware.
- Electroplated zinc surface prevents corrosion.
- L-bend helps take shear load off of the captive thumb screws by resting on top of the chassis.

Results

- The old test bench assembly meant for the PXIe-1085 chassis can be re-used with the PXIe-1095 chassis just by swapping out the side brackets
- This saves around $500 per test-bench, letting users purchase only the new side-brackets instead of a different test-bench assembly.
- The side brackets are symmetrical, reducing manufacturing cost.



- Drawing ISO view of old test-bench assembly (including old side brackets).



- New side brackets on old test-bench assembly.

Mitchell Stankey

Manufacturing and Mechanical Engineering at Texas A&M University

m.stankey15@gmail.com

(310) 977-9559

mitchellstankey

System Level Thermal Testing - National Instruments

Selected Channels				
Name	CritChannel	CritArithmeticMean	CritComponentOper...	CritMargin
Group name	Statistical Info Critical	Statistical Info Critical	Statistical Info Critical	Statistical Info Critical
Length	36	36	36	36
Unit		°C	°C	°C
Channel Contents				
1	[3]/ColdAmb-eLoad	26.2823682977249	40	13.7176317022751
2	[3]/ColdAmb-PXIe	26.8362225818892	40	13.1637774181108
3	[3]/ColdAmb-RM26999	27.2484496500166	55	27.7515503499834
4	[3]/Coupler	25.8444948116608	55	29.1555051883392
5	[3]/eLoad-inFar	24.8748474005948	40	15.1251525994052
6	[3]/eLoad-inUI	24.2896594089508	40	15.7103405910492
7	[3]/HVPWR-in3	25.0787273847539	50	24.9212726152461
8	[3]/HVPWR-in4	23.5651996018308	50	26.4348003981692
9	[3]/HVPWR-inDial	22.8182287329321	50	27.1817712670679
10	[3]/HVPWR-inSR	22.7230045605302	50	27.2769954394698
11	[3]/LBoostB-in1	23.0344591184274	40	16.9655408815726
12	[3]/LBoostB-in3	22.607056792619	40	17.392943207381
13	[3]/LBoostM-in1	22.7361637983027	40	17.2638362016973
14	[3]/LBoostM-in3	22.5813218321718	40	17.4186781678282
15	[3]/LBoostT-in1	24.3149158398262	40	15.6850841601738
16	[3]/LBoostT-in2	22.6475857846077	40	17.3524142153923
17	[3]/LBoostT-in3	22.6123256067427	40	17.3876743932573
18	[3]/LBoostT-in4	22.5842048572136	40	17.4157951427864
19	[3]/PulseMux-C0+	37.1476149916685	65	27.8523850083315
20	[3]/PulseMux-C2-	27.404218952329	65	37.595781047671
21	[3]/PulseMux-USB	33.4338125225254	45	11.5661874774746
22	[3]/PulseMux-ventFar	26.2619888588162	40	13.7380111411838
23	[3]/PulseMux-ventIO	29.4307898491993	40	10.5692101508007
24	[3]/PulseMux-ventSR	25.9742173684091	40	14.0257826315909
25	[3]/PXI-in-center	26.9689678164221	40	13.0310321835779
26	[3]/PXI-in-far	27.6313911847951	40	12.3686088152049
27	[3]/PXI-in-SR	27.1112142236704	40	12.8887857763296
28	[3]/PXI-out-side-far	25.8877507262903	40	14.1122492737097
29	[3]/RackIntake	22.7888202107096	0	-22.7888202107096
30	[3]/RM-26999-CurAmb	25.8459354197073	55	29.1540645802927
31	[3]/RM-26999-GenAmb	26.5762036210255	55	28.4237963789745
32	[3]/RM-26999-Under...	27.4010839022195	55	27.5989160977805
33	[3]/RMX4101-intake	27.7489232389088	50	22.2510767610912
34	[3]/RMX4104-intake	27.4768875153371	50	22.5231124846629
35	[3]/RMX4122-inSwitch	27.3834357157229	50	22.6165642842771
36	[3]/RMX4122-inUI	27.0311436092126	50	22.9688563907874

What?

- Run thermal testing on a high voltage test system. Output must contain operating and storage temperature ranges.

How?

- Find power dissipation, operating temp, and storage temp ranges of components within system to help identify what needs to be instrumented.
- Instrument the system with thermocouples and connect power supplies to electric loads, strain relieve running wires with Kapton tape and zip ties.
- Write thermal test plans that stress the system in expected worse-case scenarios. Work with software engineers to write applications that will stress the system.
- Collect and analyze thermal data to find rise over ambient temperature.

Results

- Upper limit operating temperature was found by finding which component got closest to reaching its operating temperature across all test runs. The difference was added to the test environment ambient temperature to find the maximum environment operating temperature.
- Lower limit operating temp and storage temps were determined by the ratings of the components.
- Process and results were presented to the project manager and project tech leads. They all found the thermal tests and results were satisfactory for project completion.