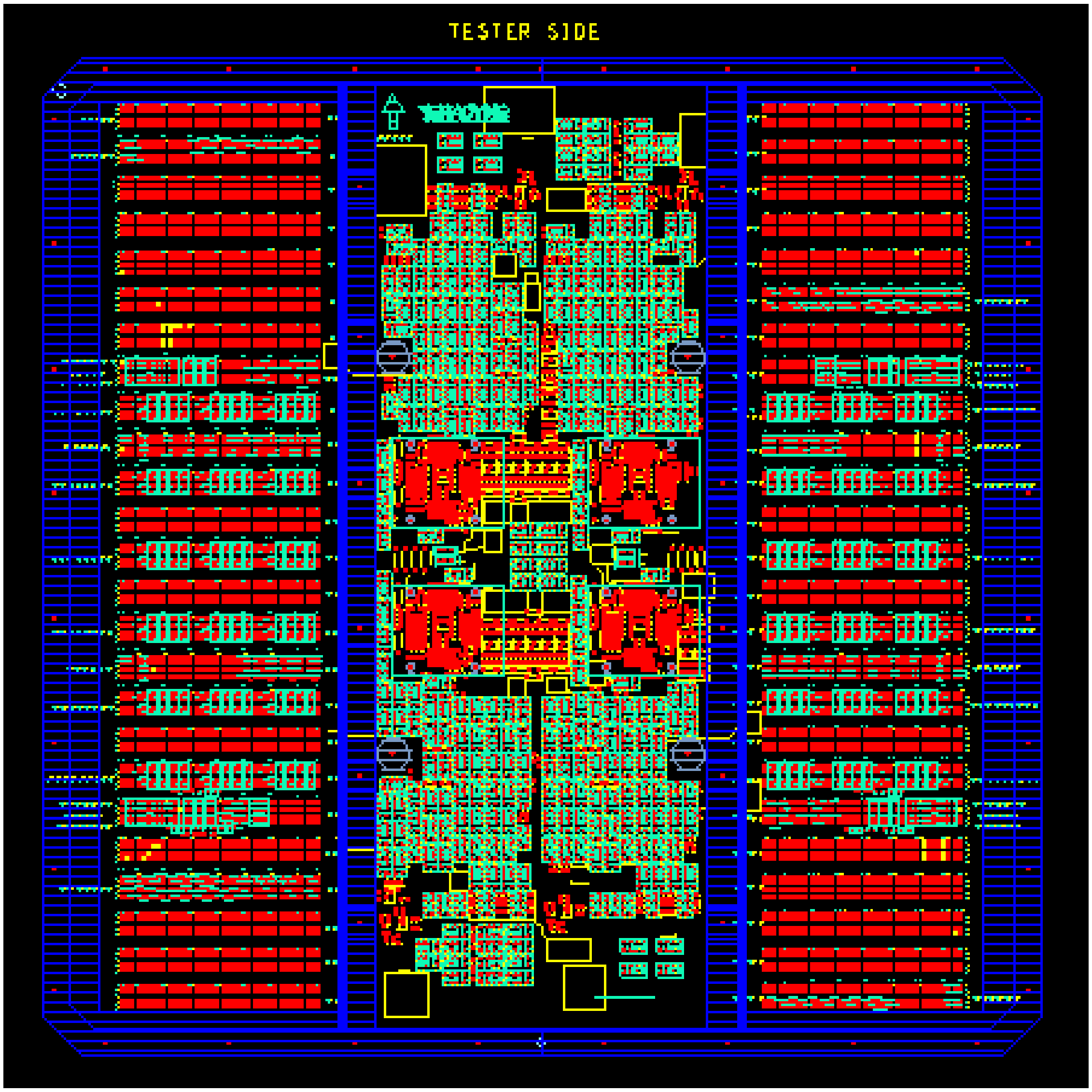
FLEX-QUAD SITE



Overview:

A **load board,** interface board, or DUT board is a circuit board designed to serve as an 'interface' circuit between the automatic test equipment (ATE) and the device under test (DUT).

Generally a load board contains the necessary components to:

- set up the DUT for correct testing by the ATE;
- route the test and response signals between the DUT and the ATE;
- provide additional test capabilities that the ATE may not be able to provide.

There are some load boards designed for testing or calibrating the ATE itself.
A brief description of designing a load board to test a mixed signal device as its follows.

Device details:

The device is a TQFP 128 pin package.
The device has following types of pins,
Digital I/O Pins – 67
Mixed signal pins – 30
PWR pins
VDDD – 12 pins
VDDA - 10 pins
AGND – 6 pins
DGND – 3 pins

Some signal pins are running at 125 MHz.

Tester:

For mixed signal device testing, the customers mostly prefer the FLEX Test System.

Since Flex system is a highly configurable production test system provides superior test performance and throughput at both package and probe.

The flex system covers the test requirements for the broad range of analog, digital, and mixed signal/ SOC devices.

The flex system has different type of instruments.

We have designed the DIB (Device Interface Board) as per available tester configuration.

This design is a quad site design.

For this mixed signal device we have used the following instruments,

HSD instruments – 6

The HSD instrument is used for digital signals.

VHFAC instruments – 2

The VHFAC instrument is used for pure analog signals.

DC30 instruments – 2

DC75 instruments -- 2

These two type of instruments used as power resources.

The master and slave Support boards are used for user power supply and utility bits.

Handler:

This load board design is a quad site design, so we have used Seiko Epson Handler NS5000.

We have implemented the mechanical holes in the load board design as per this handler mechanical information.

Netlist:

Netlist is the main input for load board design.

The net list contains device pin details & their corresponding tester resources for quad site.

The netlist shows which pins are digital I/O pins, analog, power & ground pins.

And it contains the routing instructions and impedance requirements.

The additional circuitry information is given in PDF format.

First thing we have created the schematic using this pinlist and additional circuitry details.

Socket:

For this device, the customer used QFP 128 Pin Burn In Socket.

We have created the land pattern for the socket as per the socket recommended land pattern.

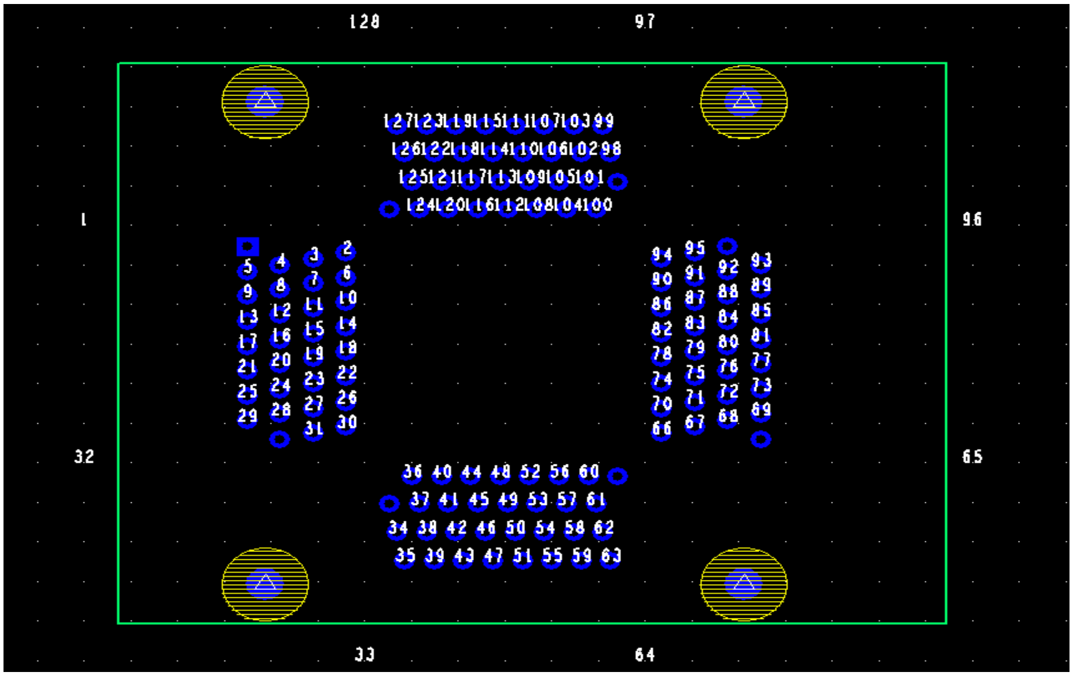


FIG1: Socket Land pattern

Additional Circuitry:

Digital Circuit:

Most of the digital I/O pins are directly connected to HSD tester channels.

Some of the digital I/O pins are connected to the tester channel through relay circuit.

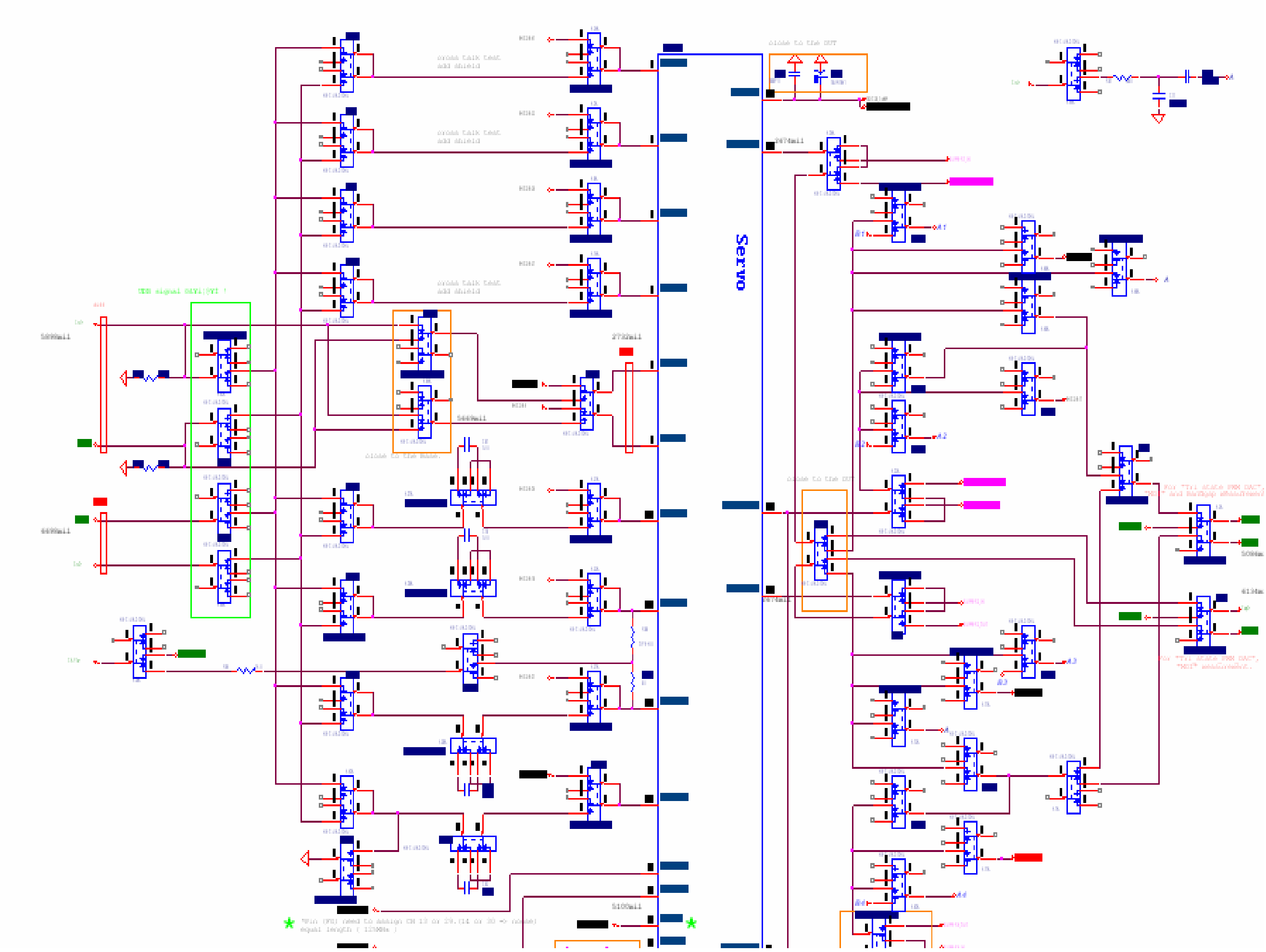


FIG2: digital circuit

Analog Circuit:

Additional buffer circuits and the comparator circuits are used.

All analog devices pins are connected to VHFAC instrument through additional circuit.

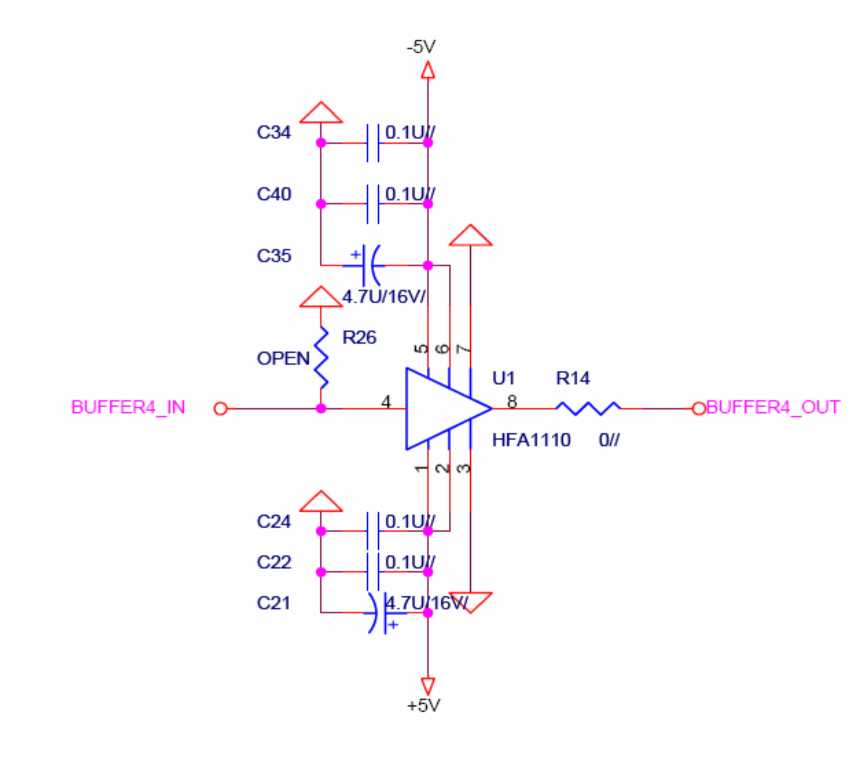


FIG3: Buffer circuit

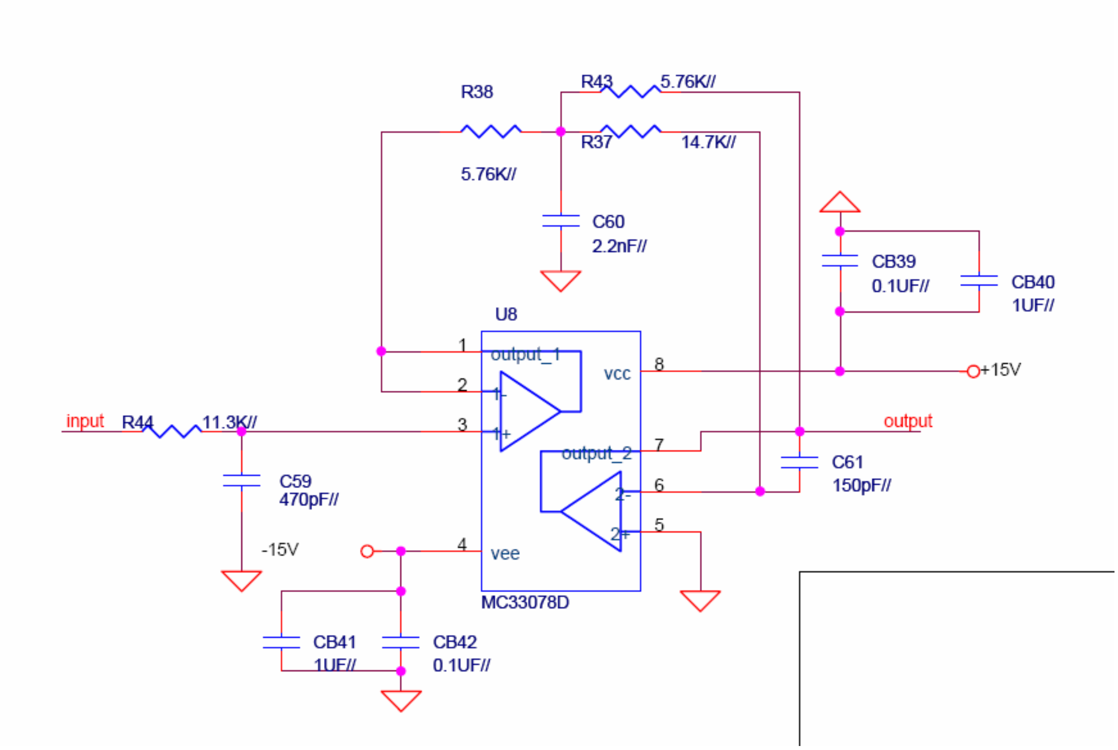


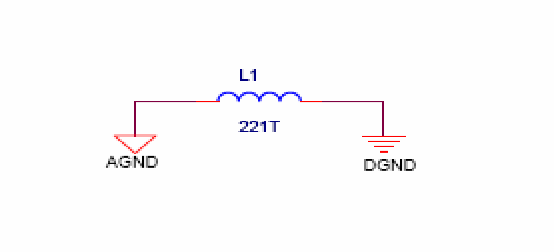
FIG4: Comparator circuit.

Decoupling Requirements:

We have added minimum one 0.01uF & one 0.1uF for each power pins & One 4.7uF caps for each power.

Grounding:

The AGND & DGND are connected through a ferrite bead at one point.



Placement:

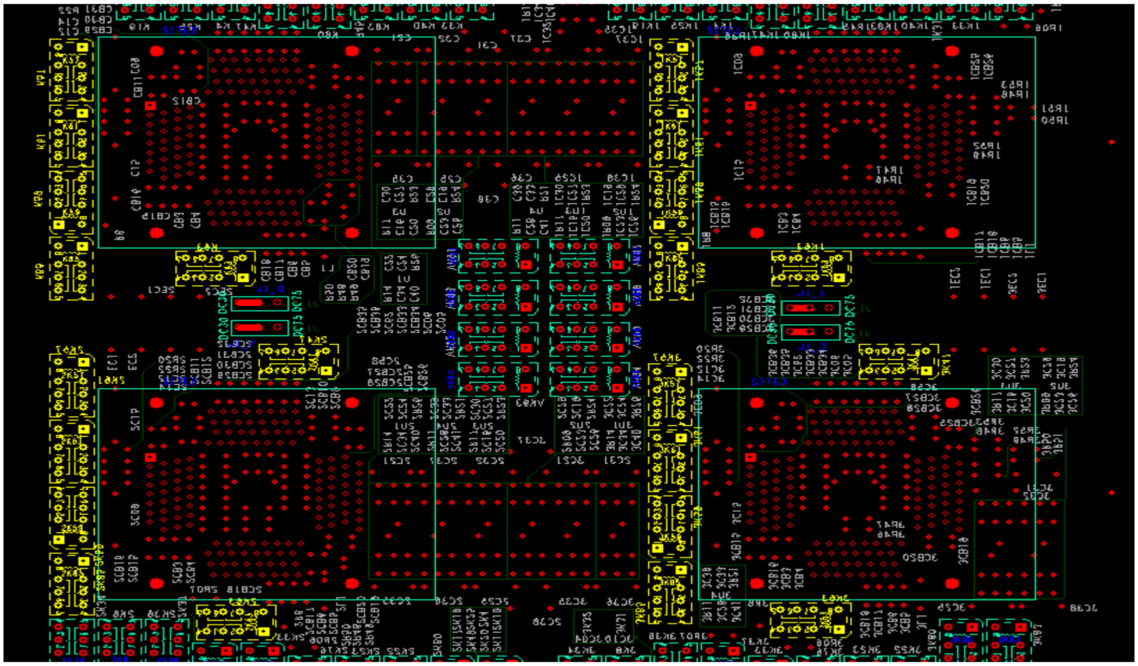
This design has totally 384 relays.

We have done the placement as per the customer requirements.

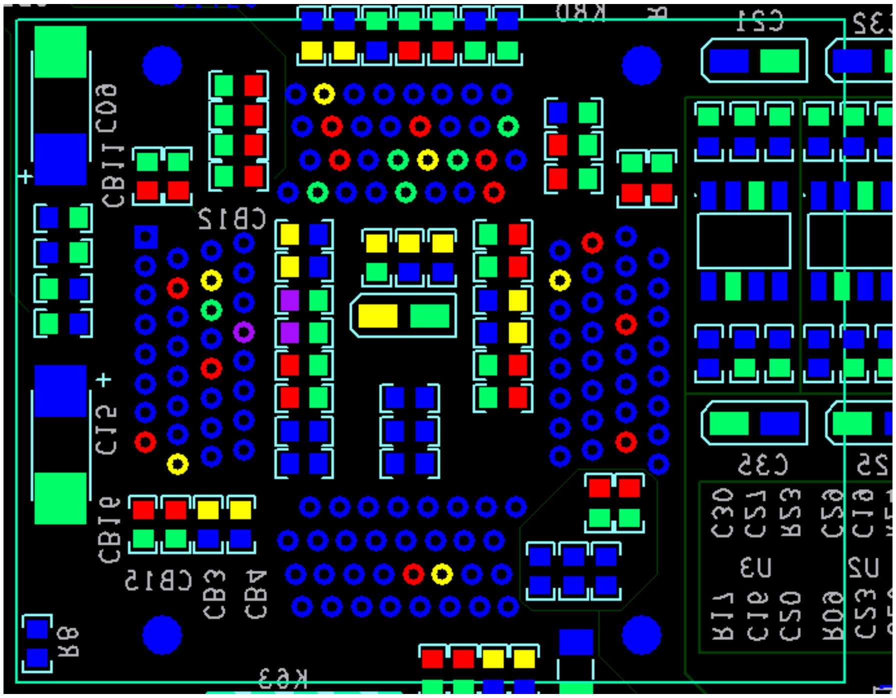
We have placed the critical circuit components as close as possible to the DUT.

Particularly the customer asked to place some relays as close to the dut.

We have placed those relays as near to the dut.



And we have placed the decoupling capacitors near the dut pins.



Routing:

We have routed the digital and analog signals in different layers.

We have routed single ended 50 Ohm signals with 5 mil trace width

We have followed 3 x Trace width spacing for all critical signals.

All digital signals are routed in 5 layers & analog signals are routed in 3 layers.

All single ended 50 Ohm signals traces are length matched.

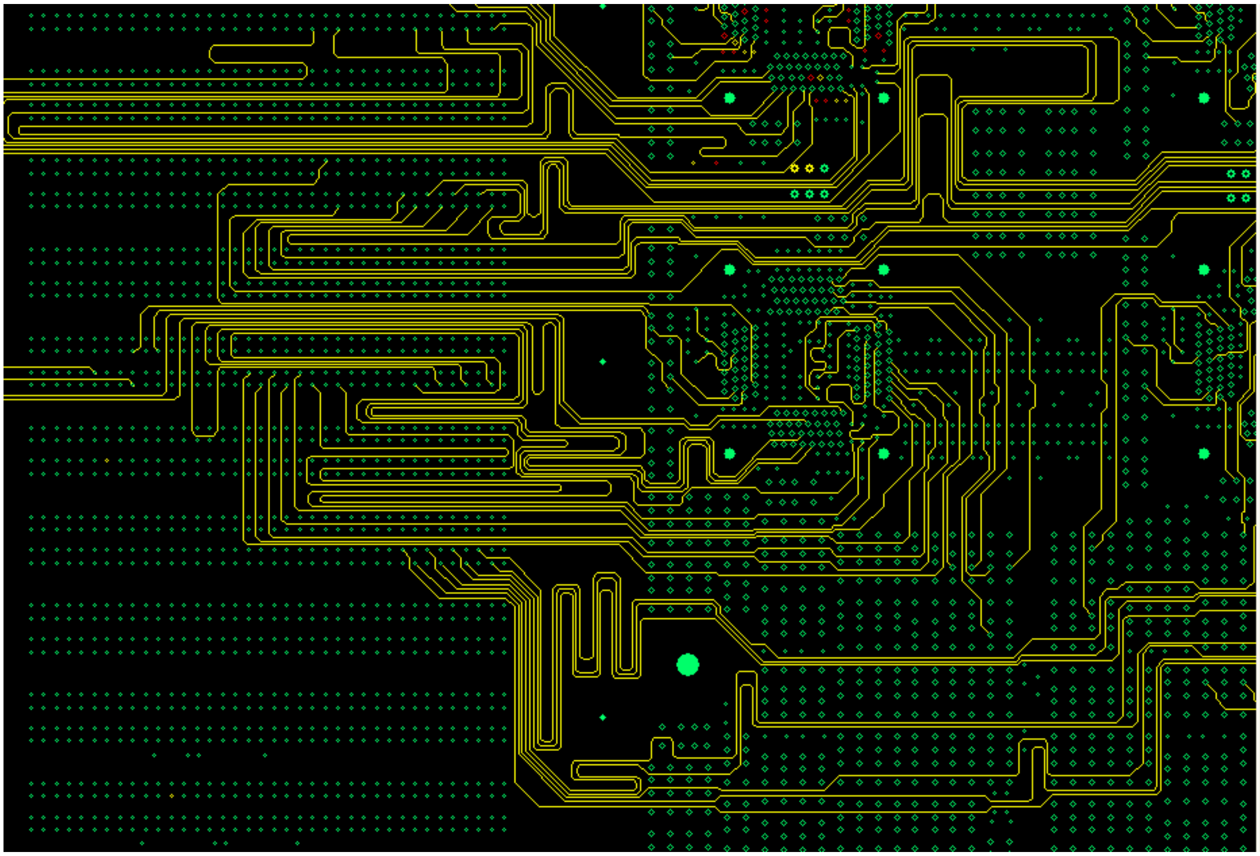


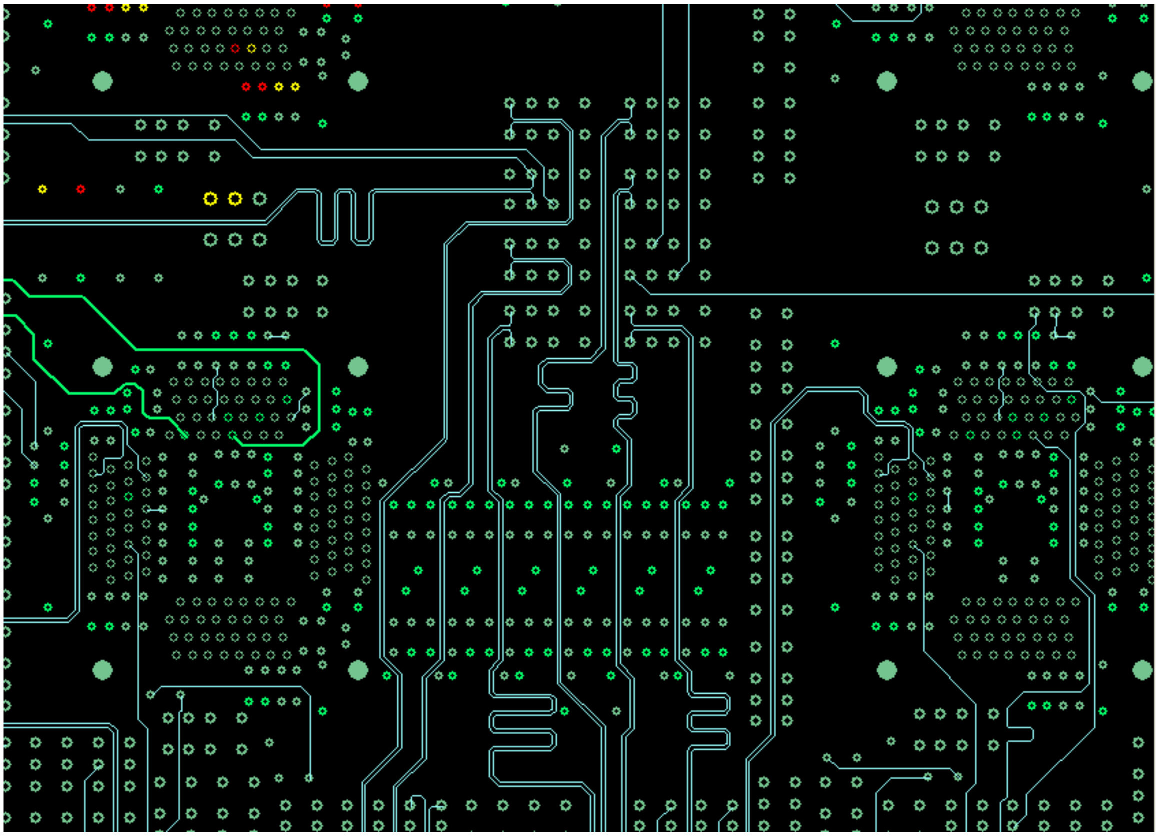
FIG: length matching of all HSD signals

Differential pairs:

All VHFAC signals are routed as differential pairs with 100 Ohm.

All 100 ohm differential pairs are routed with 5 mil tacewidth/10 mil spacing.

We have done the within pair length matching and pair to pair matching for diff pairs.



Power and Ground Plane:

DC75 power (VDDD) of all sites is segmented in two power planes.

+5v, +12V & -5V are spitted in one more power plane.

Dc30 force & sense are routed with 20 mil trace width as per the Kelvin connections.

Ground Plane:

We have poured the DGND & AGND in separate planes.

Sense Connection:

All power senses are connected to the dut power pin through traces.

And all DGS pins are connected to the dut gnd pins through traces.

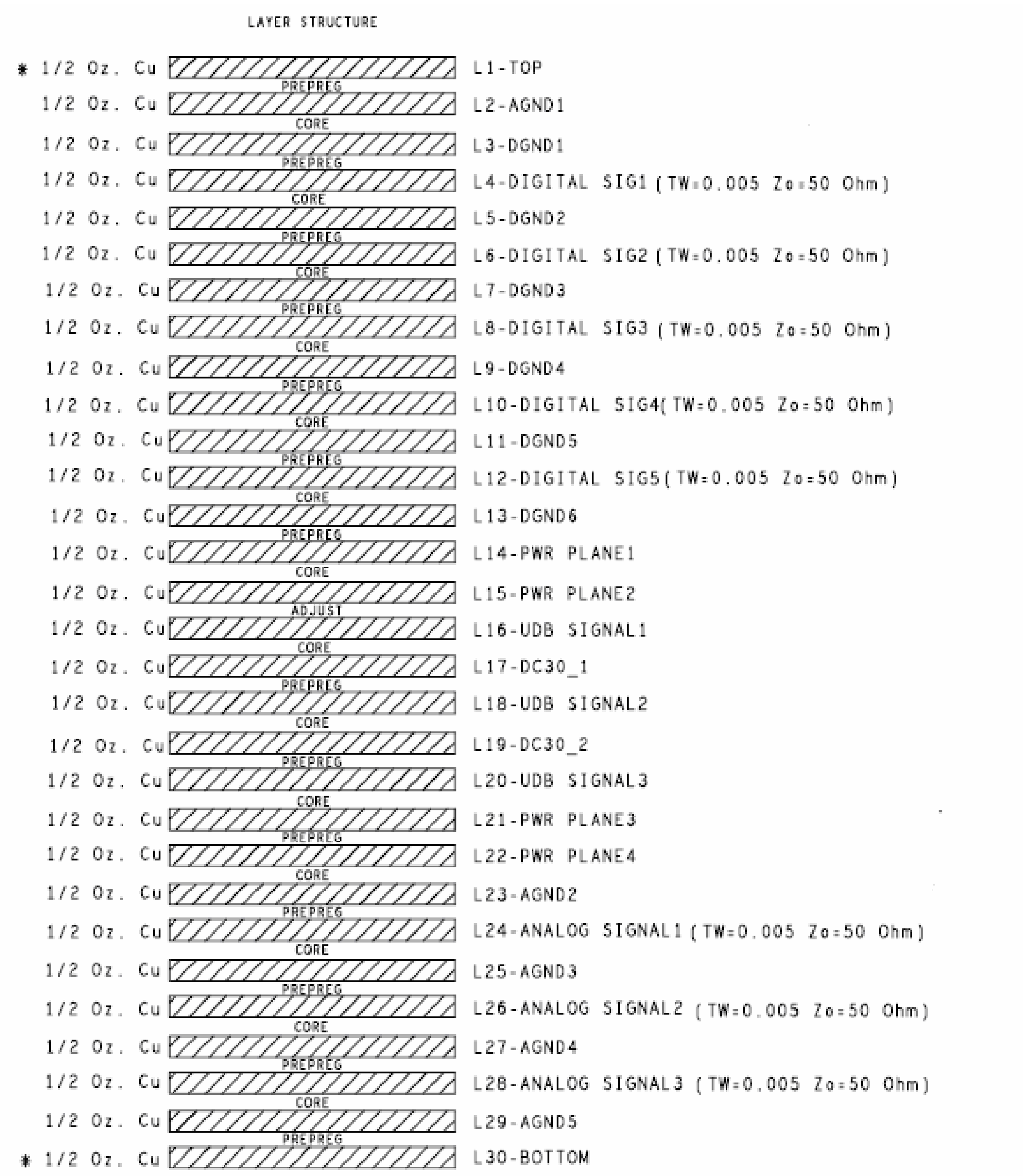
Board Stackup:

This design is a 30 layer board.

The board thickness is 0.200 +/-0.01".

Each signal layers has ground reference on adjacent layer.

The board stackup is as bellow,



INPUTS:

1. Pin list
2. Tester configuration file
3. Package drawing and socket datasheet
4. Handler mechanical information
5. Additional circuit drawing.
6. Placement & routing instructions for critical part.

OUTPUTS:

1. Schematic files (OrCAD .dsn)
2. Design files (Cadence Allegro ".brd").
3. Artwork files for all layers (Gerber 274X).
4. NCDrill files.
5. NCDrill log file.
6. Artwork parameter file.
7. NCDrill parameter file.
8. IPC356 files (not IPC356A).
9. Schematic PDF files
10. All layers in PDF format
11. Laminate drawing (AutoCAD ".dwg").

Team Players:

The design was handled by five persons where one person worked in schematic creation at the same time other person worked creating component creation for layout. Other three persons are involved in routing part.

Analog routing was done by one person. Other two persons had done the digital part and planes. At finally Gerber generation were carried out and also Quality check done by QC person at various stages to ensure that package quality.

Design Period:

We have done the design within a week.

Summary:

The design was completed as per the customer specification and guidelines with in a due date. The routing was done as per the requirement. All Artwork files and the design files are delivered to the customer in their specified format.