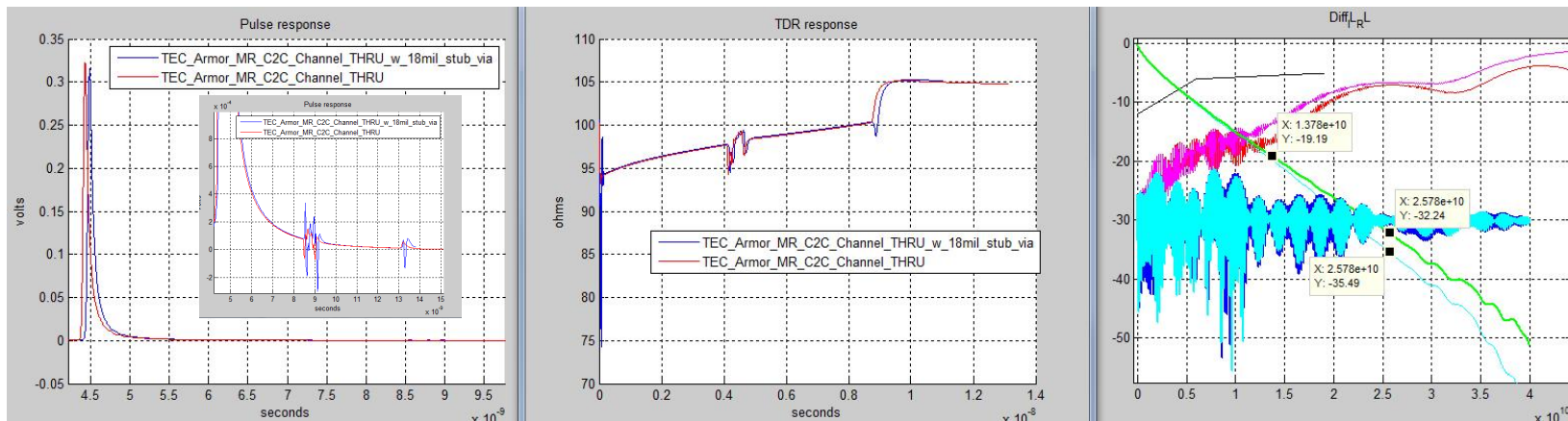


Pondering 50Gb/s Channel Design

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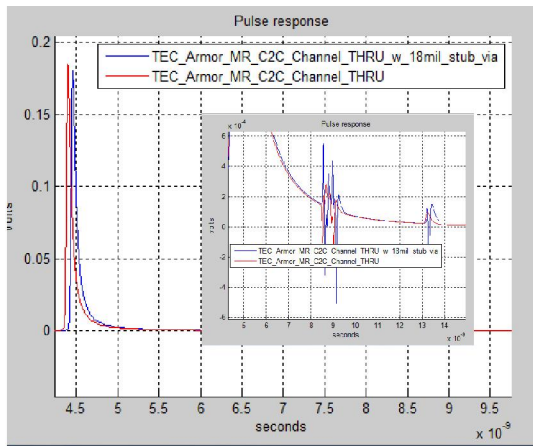
A very clean channel with and without board via under BGA FB=27.1 85GHz (PAM4 50Gb/s)



IL 32dB–35 dB

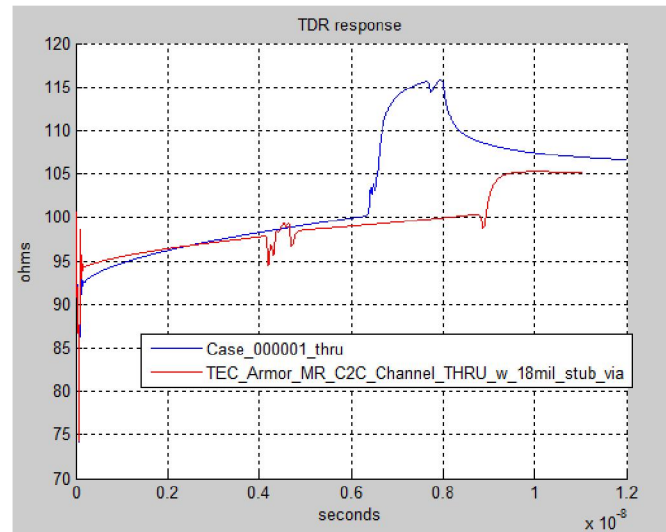
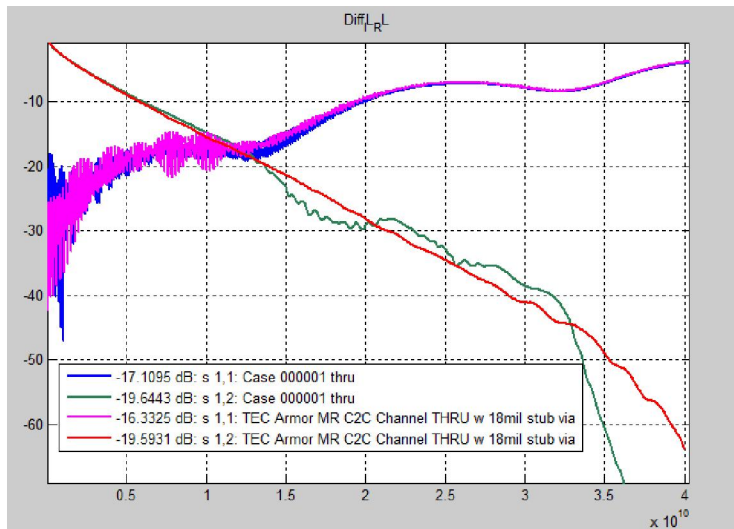
- ▶ Two board (mezzanine) topology from TEC
- ▶ Both boards are the same impedance
- ▶ With thru board via, response's reflection response's are only changed about a 1/2 mV
 - See vias in http://www.ieee802.org/3/bs/public/14_07/mellitz_3bs_01_0714.pdf

A very clean channel with and without board via under BGA FB=51.5625Ghz



- ▶ At the NRZ data rate or 51.5626Gb/s the reflection loss is double from the PAM 4 data rate to about a mv... not too bad even with the 2 vias
- ▶ So what could happen in manufacturing
 - Both board will be at different
 - Etching process in not uniform
 - Even good coupling cap routing is and impairment
 - Loss is at 25 degrees C may 25% lower than at 45 degrees C
 - BGA and connector break out has different characteristics from the main trace
 - Crosstalk between via barrel is propagated as radial transmission modes and will increase crosstalk.
 - Short line length segments with discontinuities at end introduce reverberation that suggest more demanding equalization.
 - Impedance mismatch between segments exists when any kind of volume manufacturing is considered.
 - Vias may not be centered in anti pads because of multi-laminate plane shifting.

2 Channel: Same but different?



- ▶ Channel Case 1 and TEC Armor MR C2C Thru with thru via board via is are very similar in loss up ~ 14GHz. Both have good connectors.
- ▶ Channel Case 1 has only 8% impedance variation and

Determine:

Care/don't care/how much

- ▶ Impedance tolerances
- ▶ Number and length of segment
 - Breaks out
- ▶ Material Variations
 - Dielectric
 - Conductor: Very important for low Df material.
- ▶ Board Via coupling and mode conversation
- ▶ Connector characteristics
- ▶ Board via tolerances

The package, die load, and TX/RX specs all interplay as well as coding