ELMEC Differential Signal Balancer

ELMEC Corporation
President, CEO&CTO, Masaaki Kameya

ELMEC Technology of America
Vice President, COO, Ion Cenuse

Agenda
1. About Differential Signal Balancer (DSB)
2. Application Example: Printed Circuit Board Transmission
3. Application Example: Insert DSB before Transmission Line
4. Application Example: Insert DSB after Transmission Line
5. Conclusion
6. About us

http://www.elmectech.com
1. About Differential Signal Balancer (DSB)

Non-Magnetic common-mode filter for 5 G to 28 Gbit/s 
Application : Removing skew, tr/tf-difference, EMI solution

Unbalanced Signal, 10 Gbit/s, skew 10 ps, tr/tf= 15 ps/30 ps

Unbalanced Signal

Unbalanced Signal, 28 Gbit/s, skew 8 ps, tr/tf= 10 ps/20 ps

Unbalanced Signal

ELMEC DSB used

ELMEC DSB used
1. About Differential Signal Balancer (DSB)

Load Map

CDLD Type
2 mm x 1.25 mm

Available Now
External Component for Reference Board
Strong Noise Absorbing

New Product
0.8 mm x 0.6 mm
Two Metal Layers

External Component Sample: 1Q-2017
Built into Interposer
IP Core: ~ 3Q-2016

New Product
0.1 mm x 0.1 mm
~ 0.2 mm x 0.2 mm
Four Metal Layers

Built into Silicon Die
IP Core: ~ 3Q-2016
2. Application Example: Printed Circuit Board Transmission

Equivalent Circuit with GND discontinuity

- LSI 1
- GND Plane 1
- GND Plane 2
- GND Plane 3
- PCB (PPE)
- GND plane discontinuity (Inductive)

- LSI 1
- Vcc
- Vee
- L1

- LSI 2
- Vcc
- Vee
- 50Ω
- Pad, ESD Diode
- L2

GND Plane 1
GND Plane 2
GND Plane 3
2. Application Example: Printed Circuit Board Transmission

Unbalanced Signal, 10 Gbit/s, skew 10 ps, tr/tf = 15 ps/30 ps

Noise Spectrum

Received Signal

Strong Spike

DSB Inserted (Next Page)
3. Application Example: Insert DSB **before** Transmission Line

CDLD30R Inserted

Noise? Skew?

PPE, 2 inch

Noise Spectrum with DSB

Received Signal with DSB

Completely Removed

Well Balanced

V3 & V4 [%]
3. Application Example : Insert DSB *before* Transmission Line

IP Core, 0.1 mm x 0.1 mm, Built into Die

Noise? Skew?

V3 & V4 [%]

Enough Removed

Almost Balanced
4. Application Example: Insert DSB after Transmission Line

Effective to remove unbalance in PCB

Received Signal without DSB

Received Signal with DSB

Balanced
4. Application Example: Insert DSB after Transmission Line

IP Core, 0.1 mm x 0.1 mm, Built into Die

Received Signal without DSB

Received Signal with DSB

Balanced
4. Application Example: Insert DSB after Transmission Line

Unbalanced Signal, 28Gbit/s, skew 8 ps, tr/τf= 10 ps/20 ps
IP Core, 0.1 mm x 0.1 mm, Built into Die

Received Signal with DSB

Almost Balanced
5. Conclusion

(1) ELMEC Differential Signal Balancer (DSB) is very effective to remove skew, tr/tf difference for ultra high speed signals exceeding 10 G bit/s.

(2) ELMEC Differential Signal Balancer (DSB) is available up to 28 Gbit/s ultra high speed transmission.

(3) ELMEC is preparing New DSB by IP Core which is very small size 0.1 mm x 0.1 mm, and is easily built into silicon dies.
6. About us

【Established】 Feb. 1981
【President】 Masaaki Kameya

Business Career
CEO (@ ELMEC Corp. 2013–Now)
Research of Noise Absorber (@ Matsue ELMEC Corp. 2009–2013)
Research of LTCC Chip Delay Line (@ ELMEC Corp. 1998–2009)
Research of Traditional Delay Line (@ ELMEC Corp. 1988–1992)

Education : Tokyo Institute of Technology (Master degree)

【Office】
Head Office (Kawasaki Japan)  Factory (Shimane Japan)  USA
ELMEC Corporation         Matsue ELMEC Corporation     ELMEC Technology of America, Inc.