ELMEC Differential Signal Balancer

ELMEC Corporation
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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
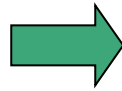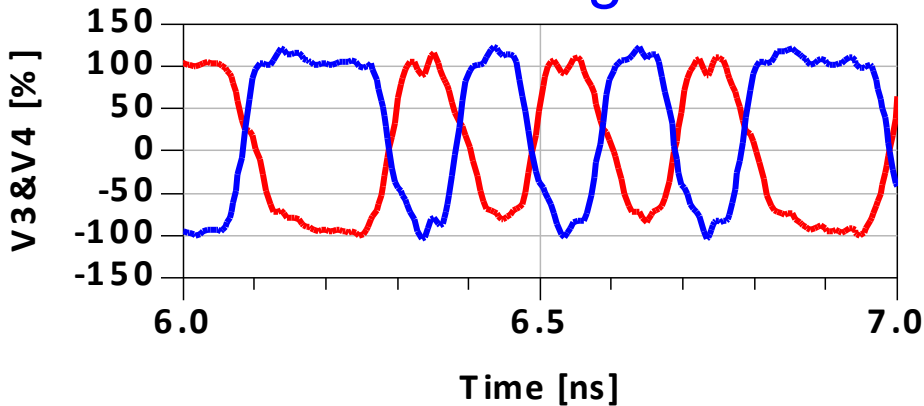5. Conclusion
6. About us

　http://www.elmectech.com

1. About Differential Signal Balancer (DSB)

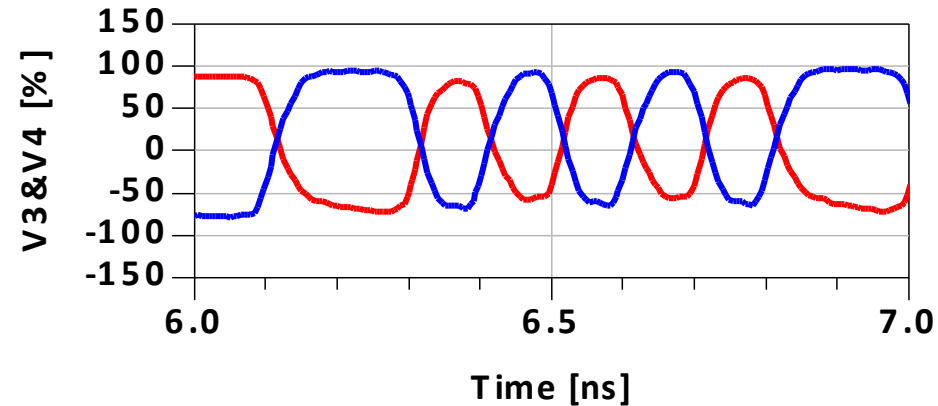## Non-Magnetic common-mode filter for 5 G to 28 Gbit/s
Application : Removing skew, tr/tf-difference, EMI solution

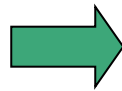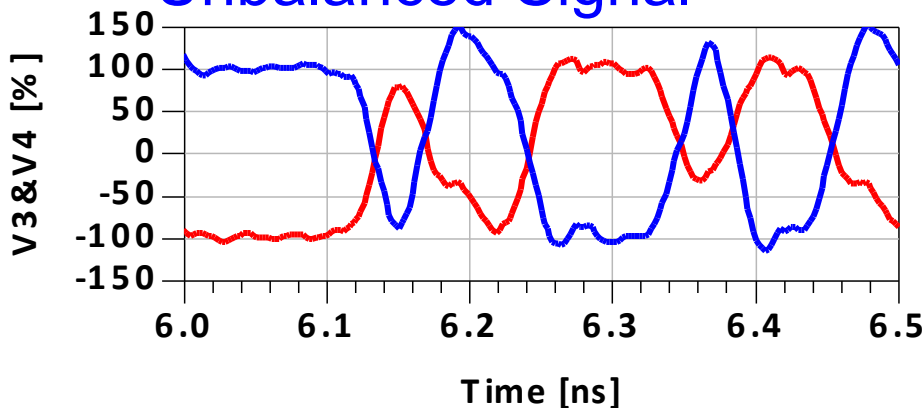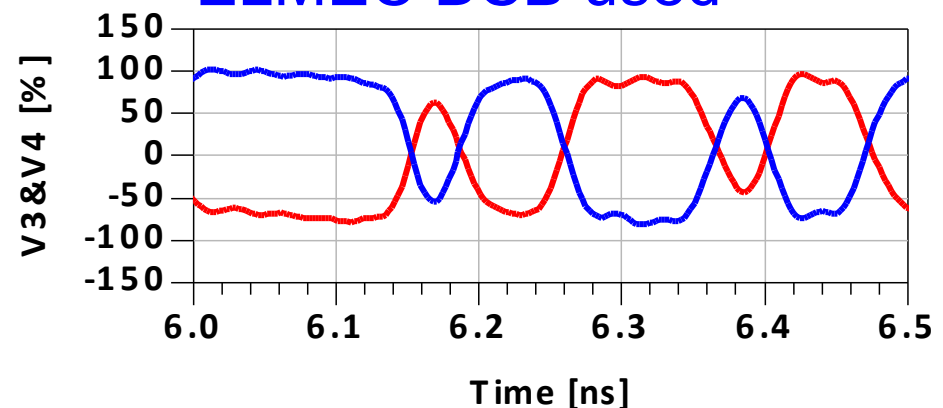### Unbalanced Signal, 10 Gbit/s, skew 10 ps, tr/tf= 15 ps/30 ps

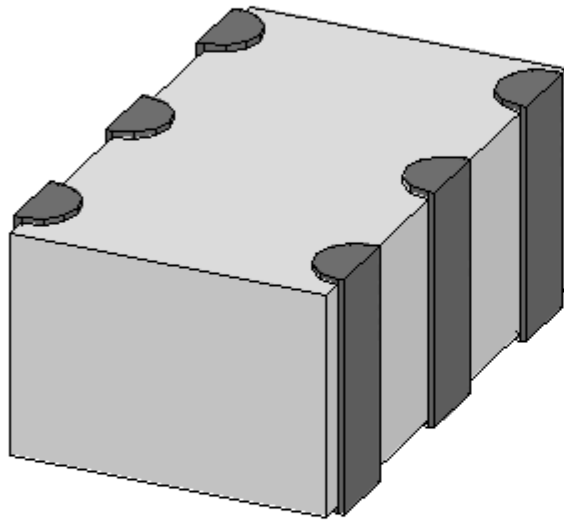### Unbalanced Signal, 28 Gbit/s, skew 8 ps, tr/tf= 10 ps/20 ps

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1. About Differential Signal Balancer (DSB)

Load Map
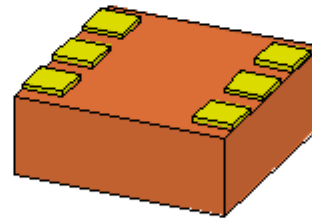
**CDLD Type
2 mm x 1.25 mm**

Available Now

**External Component
for Reference Board**

Strong Noise Absorbing

**New Product
0.8 mm x 0.6 mm
Two Metal Layers**
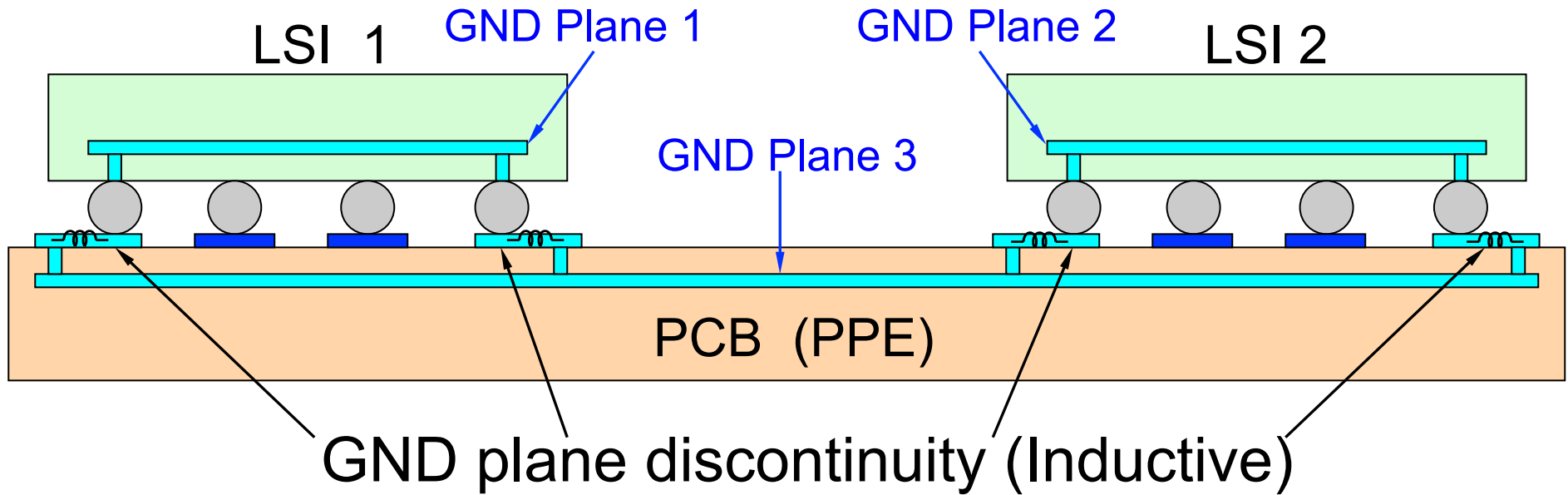

**External Component
Sample:1Q-2017**

**Built into Interposer
IP Core: ～ 3Q-2016**

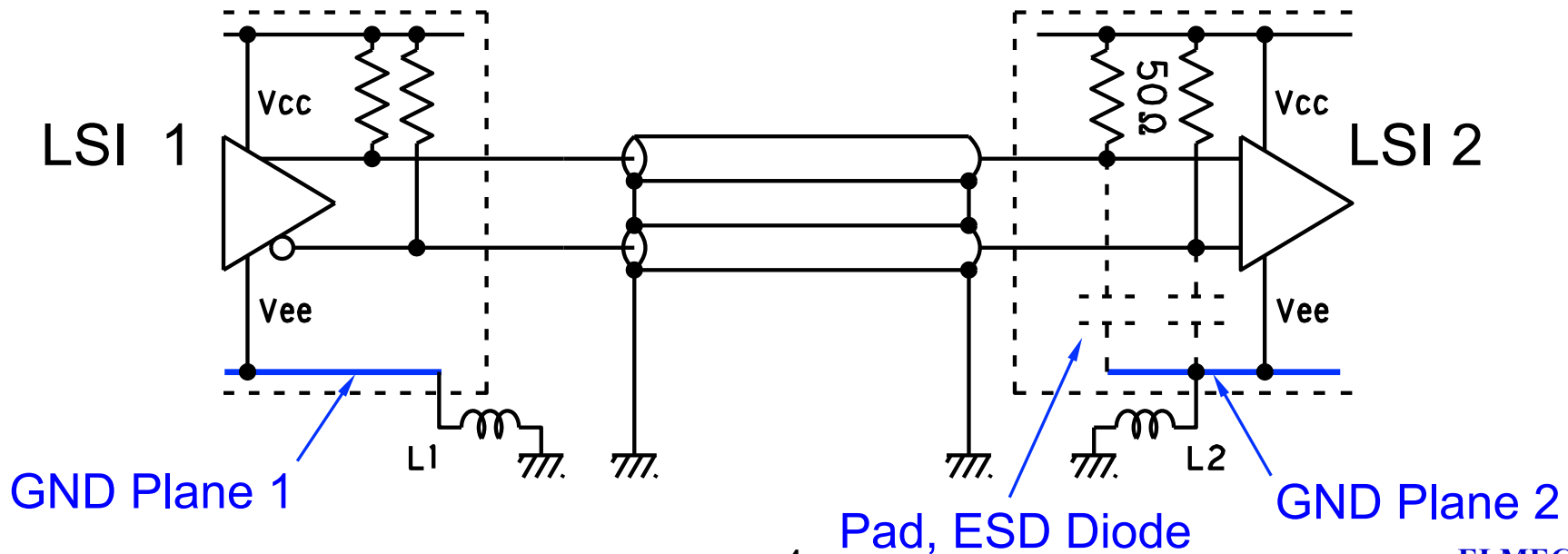**New Product
0.1 mm x 0.1 mm
～ 0.2 mm x 0.2 mm
Four Metal Layers**

**Built into Silicon Die
IP Core: ～ 3Q-2016**

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2. Application Example : Printed Circuit Board Transmission

LSI 1 GND Plane 1   GND Plane 2   LSI 2

GND Plane 3

PCB (PPE)

GND plane discontinuity (Inductive)

Equivalent Circuit with GND discontinuity

LSI 1   Vcc   50Ω   Vcc   LSI 2

Vee   Vee

GND Plane 1   L1   L2

Pad, ESD Diode   GND Plane 2
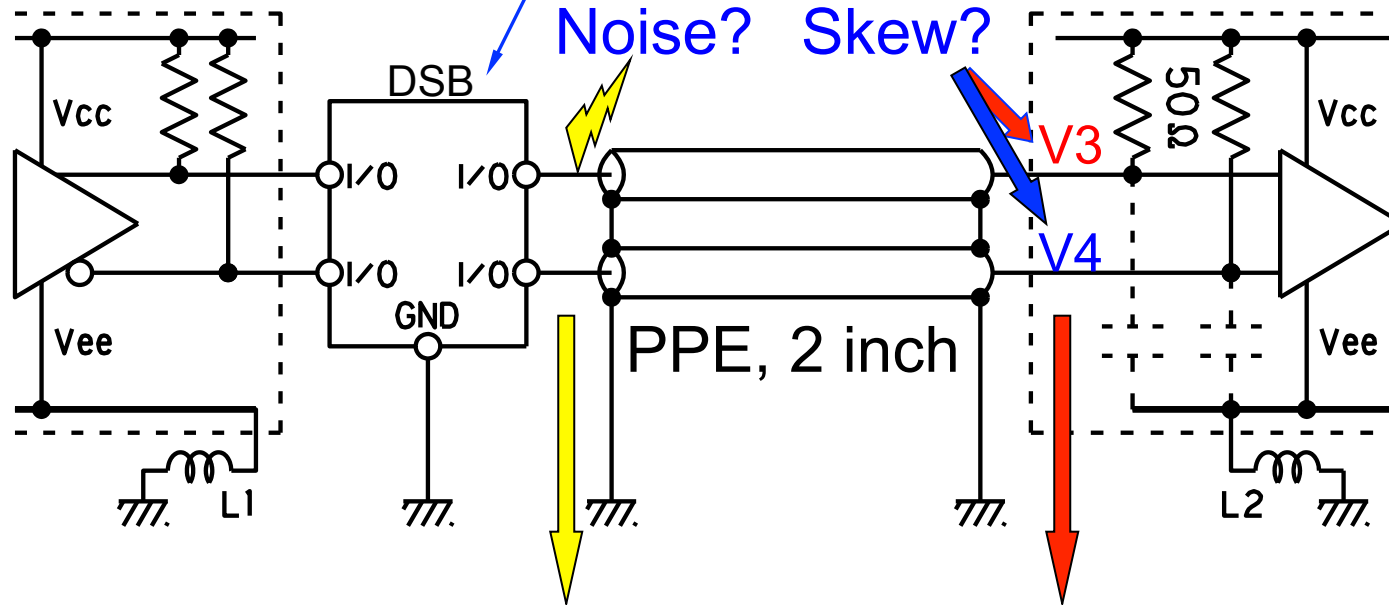
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2. Application Example : Printed Circuit Board Transmission

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

Noise **Skew**
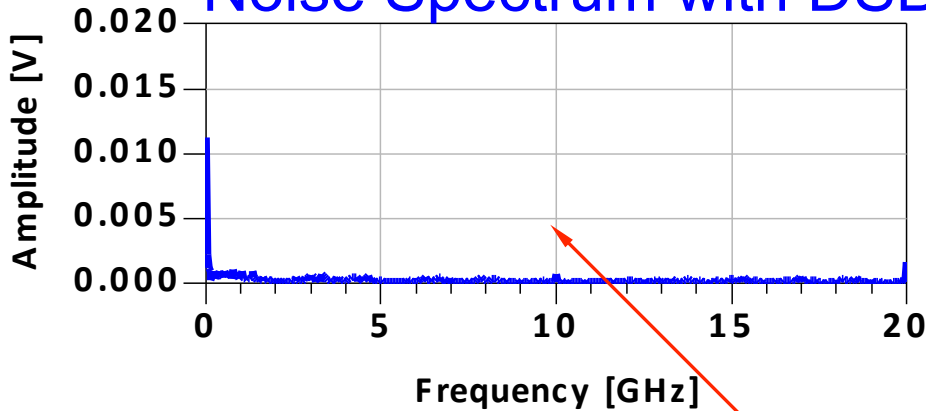
Vcc

50 Ω

Vcc

V3

V4

Vee

Vee

PPE, 2 inch

L1
200 pH

L2
200 pH

0.5 pF

Noise Spectrum

Amplitude [V] vs Frequency [GHz]

Strong Spike

Received Signal

V3&V4 [%] vs Time [ns]

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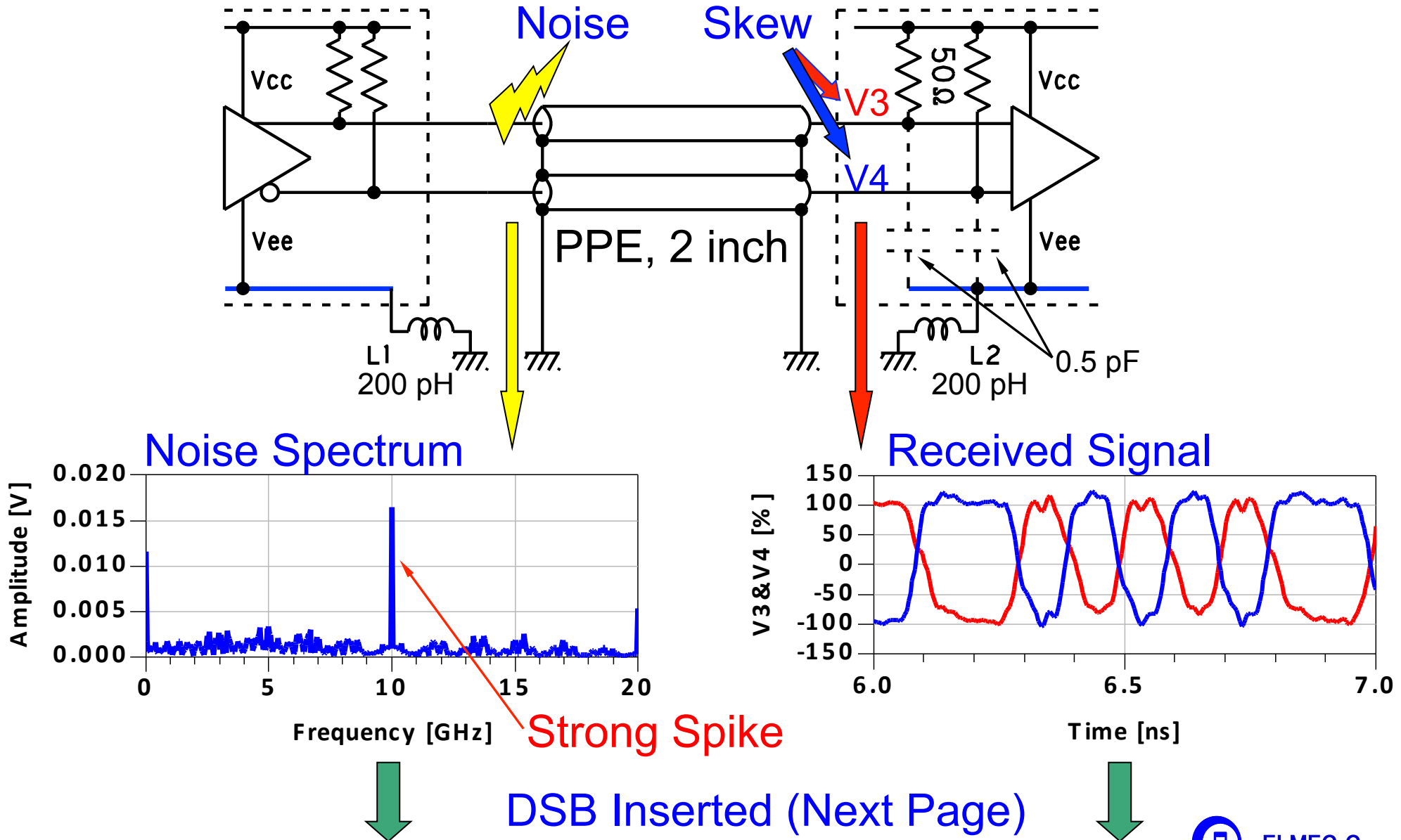
3. Application Example : Insert DSB before Transmission Line

CDLD30R Inserted

Noise? Skew?

DSB

Vcc

Vee

I✓0 I✓0
I✓0 I✓0

GND

L1

V3

V4

50Ω

Vcc

Vee

L2

PPE, 2 inch

Noise Spectrum with DSB

Amplitude [V]

0.020
0.015
0.010
0.005
0.000

0   5   10   15   20

Frequency [GHz]

Completely Removed

Received Signal with DSB
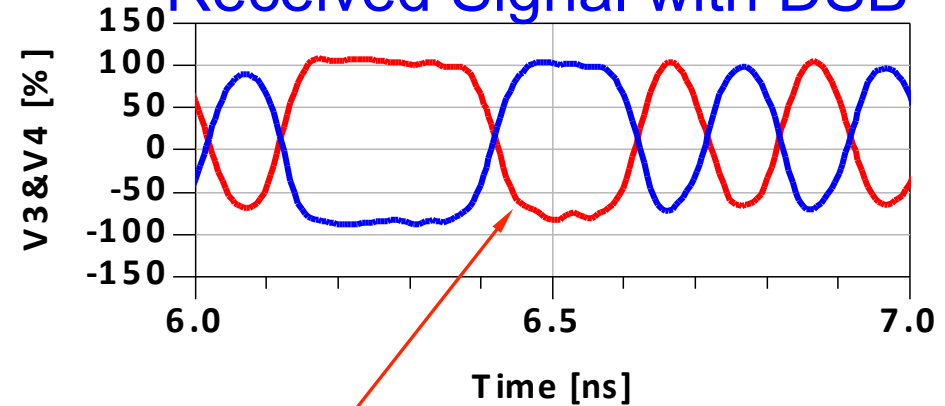
V3 & V4 [%]

150
100
50
0
-50
-100
-150

6.0   6.5   7.0

Time [ns]

Well Balanced

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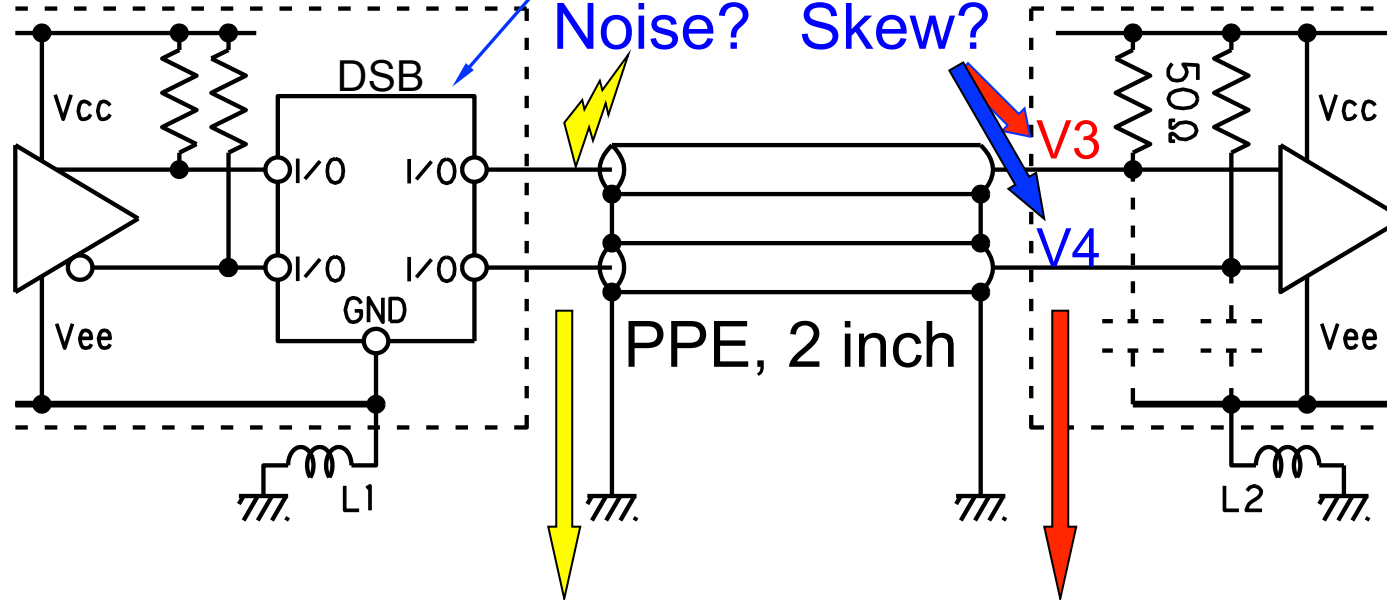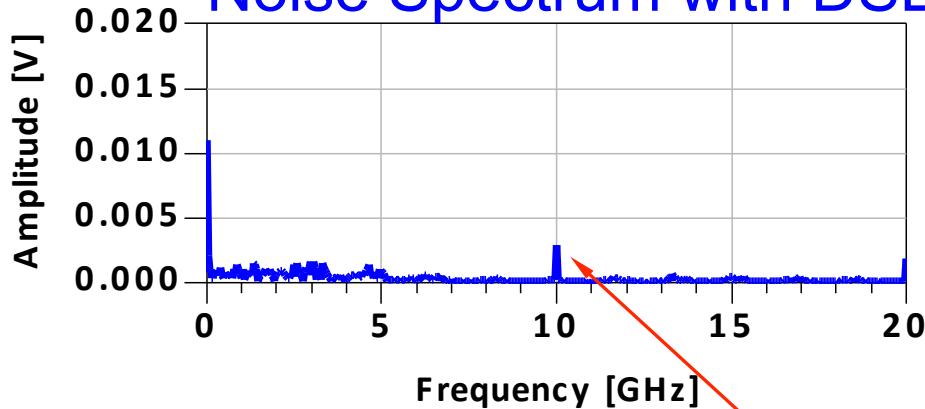
3. Application Example : Insert DSB before Transmission Line

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

Noise?   Skew?

DSB

Vcc

I∕O   I∕O

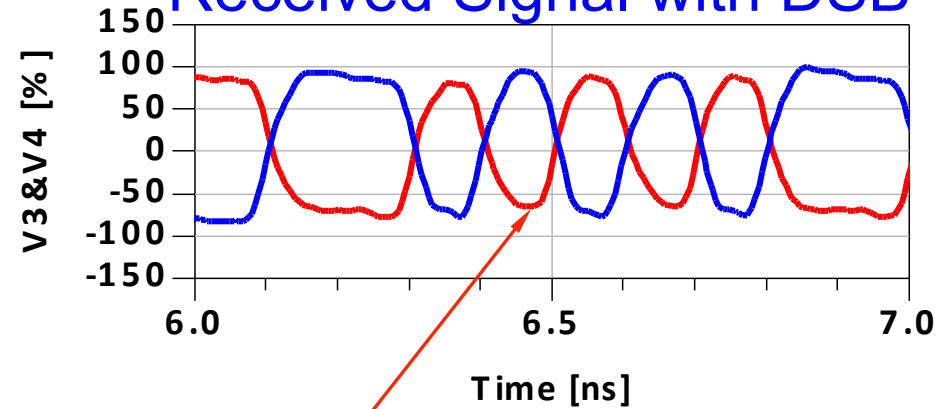V3

50Ω

Vcc

I∕O   I∕O

GND

V4

Vee

PPE, 2 inch

Vee

L1

L2

Noise Spectrum with DSB
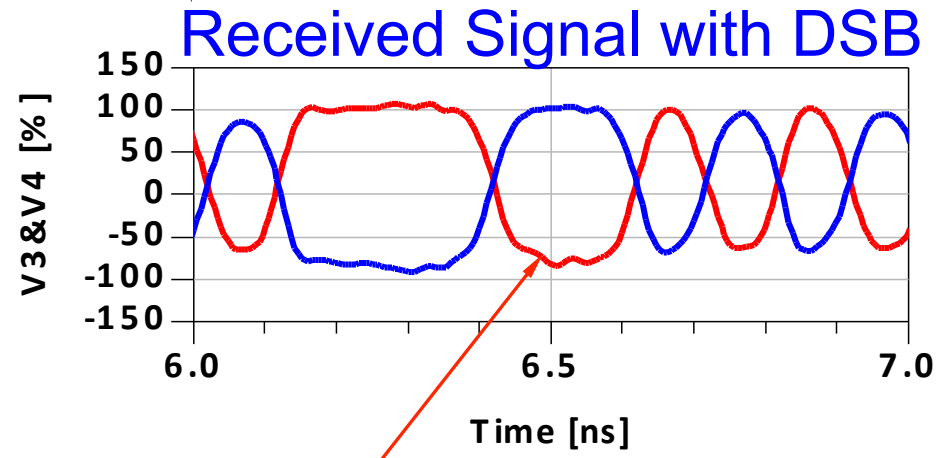
Amplitude [V]

0.020
0.015
0.010
0.005
0.000

0   5   10   15   20

Frequency [GHz]

Enough Removed

Received Signal with DSB

V3&V4 [%]

150
100
50
0
-50
-100
-150

6.0   6.5   7.0

Time [ns]

Almost Balanced

4. Application Example : Insert DSB after Transmission Line

Effective to remove unbalance in PCB
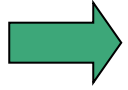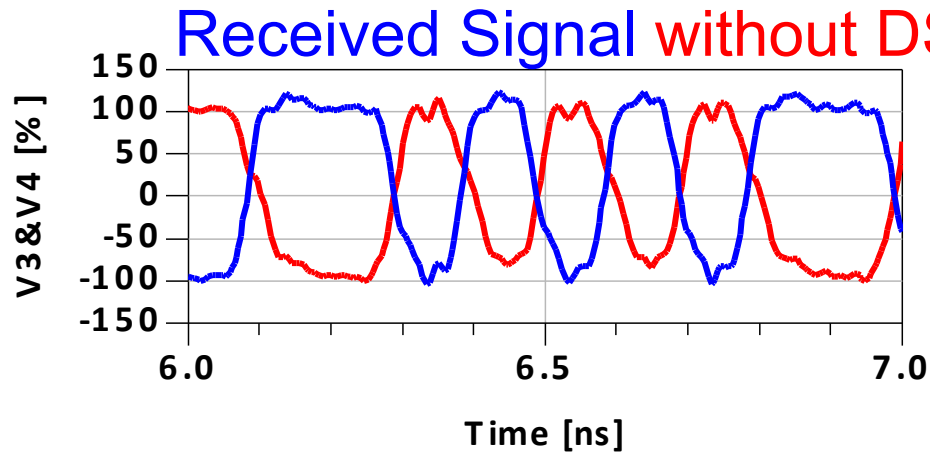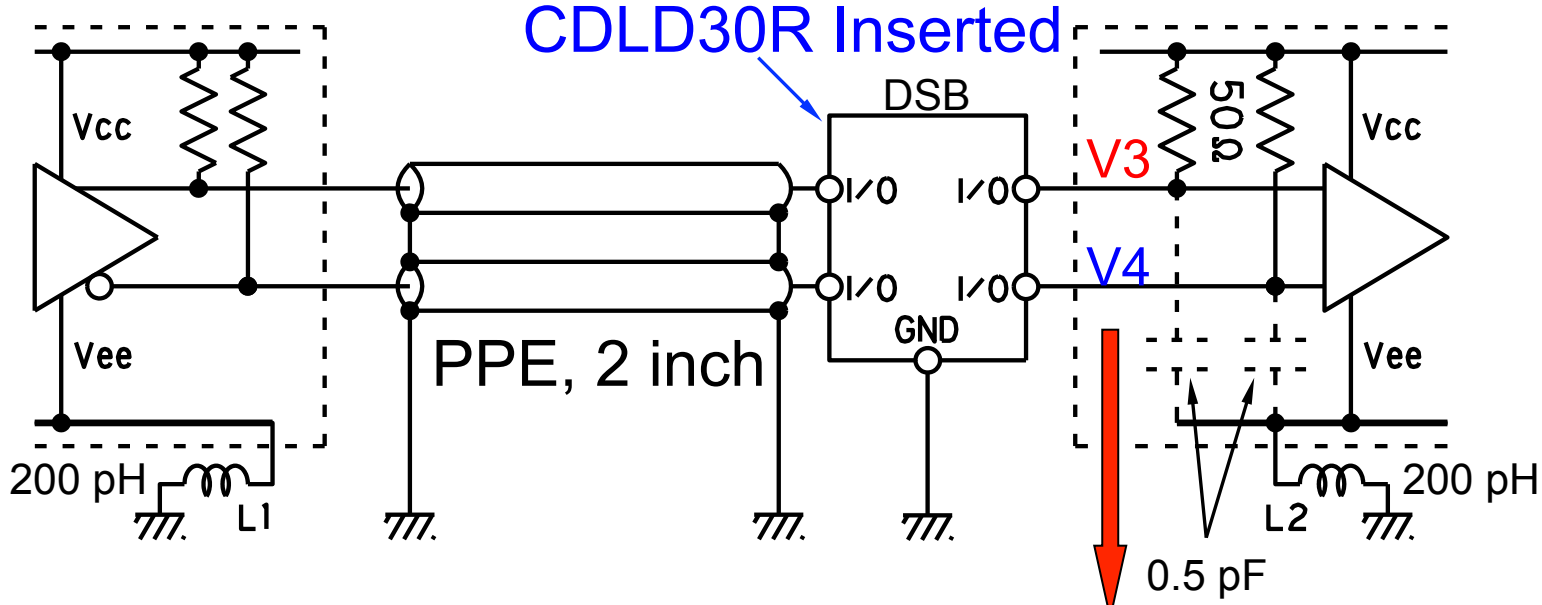
CDLD30R Inserted

DSB

V3
V4

50Ω

Vcc
Vee

200 pH

L2

0.5 pF

Vcc
Vee
200 pH
L1

PPE, 2 inch

GND

Received Signal without DSB

Received Signal with DSB

Balanced

4. Application Example : Insert DSB after Transmission Line

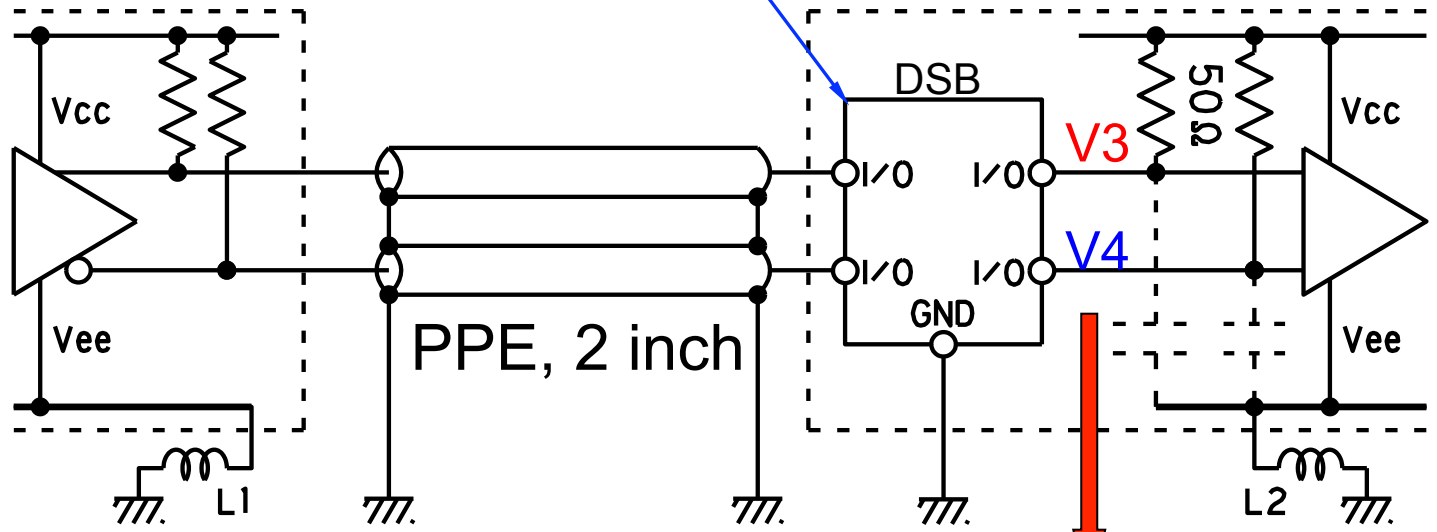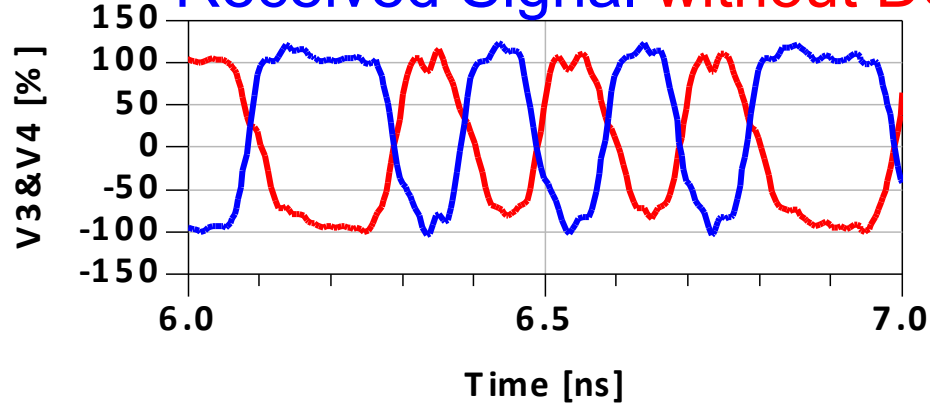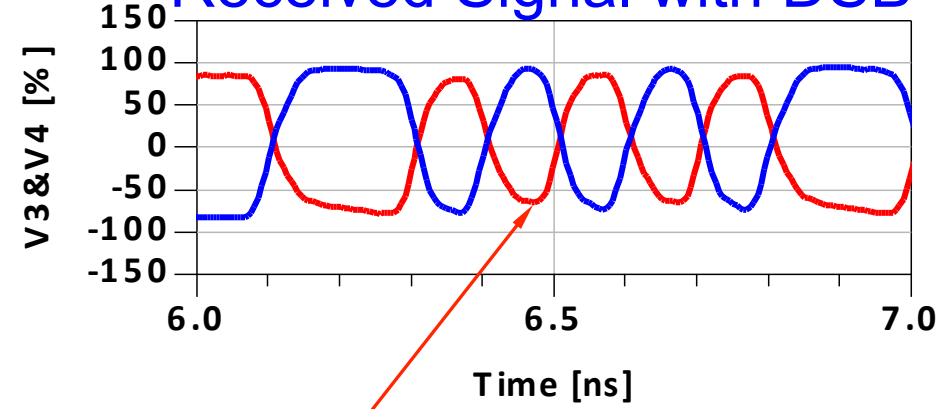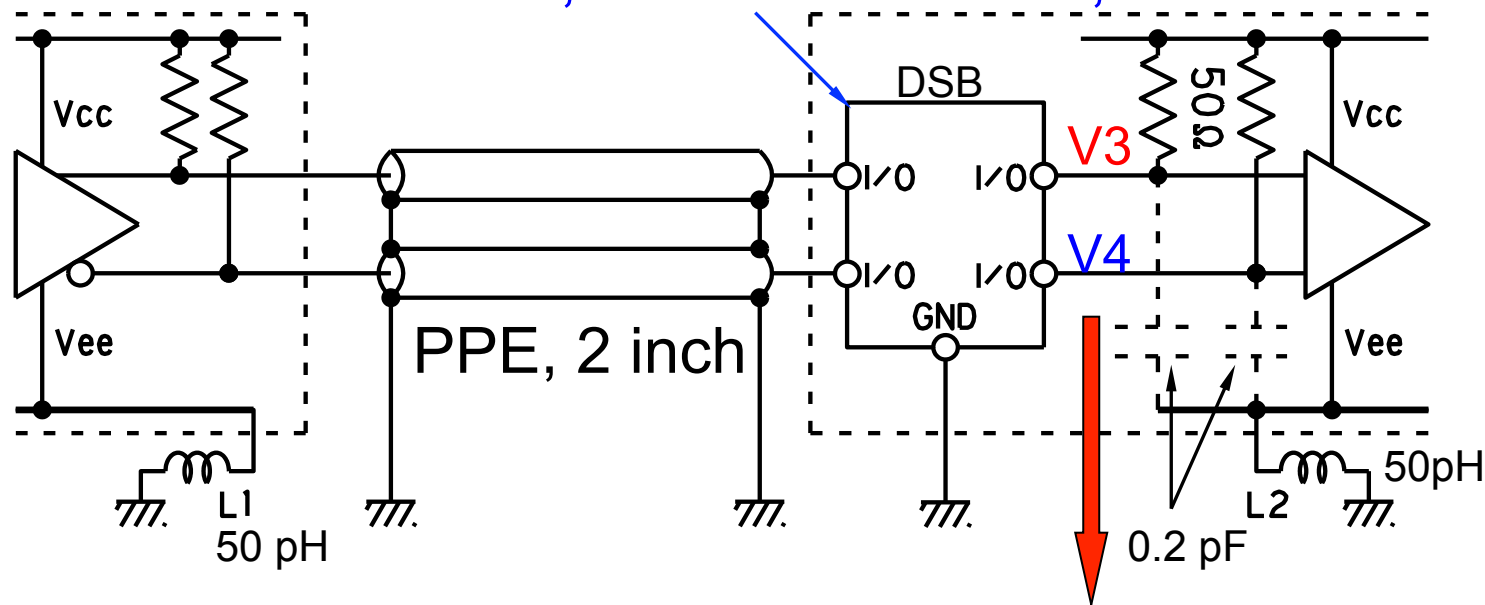IP Core, 0.1 mm x 0.1 mm, Built into Die

Received Signal without DSB

Received Signal with DSB

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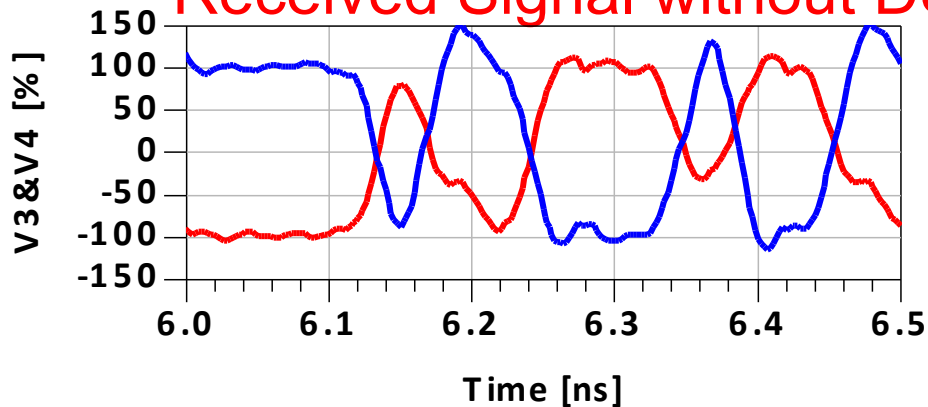
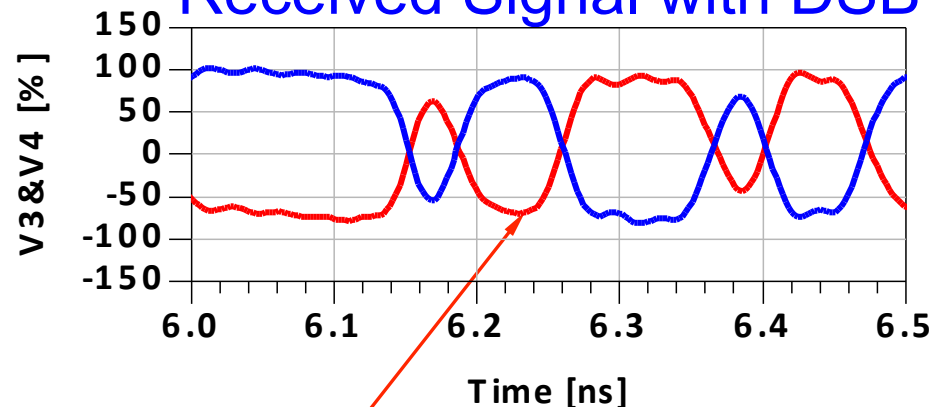# 4. Application Example : Insert DSB after Transmission Line

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

Received Signal without DSB

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)

Development of Production Machine (@ Matsue ELMEC Corp. 1992-1998)

Research of Traditional Delay Line (@ ELMEC Corp.1988-1992)

Research of Semiconductor Laser (@ Mitsubishi Electric corp. 1985-1988)

Education : Tokyo Institute of Technology (Master degree)

【Office】

Head Office (Kawasaki Japan)
ELMEC Corporation

Factory (Shimane Japan)
Matsue ELMEC Corporation

USA
ELMEC Technology of America, Inc.

ELMEC Corp.