## SID 2013 Exhibitor Forum High Data Rate Transmission Line Technology Comparison

### Small Gauge Coaxial (SGC) transmission medium

using VESA<sup>®</sup> 16:9 Notebook Panel Standard connector

I-PEX Cabline-VS (0.5mm centers pitch)



VS.

**Double Sided Shielded Flat Flexible Cable transmission medium** using Cabline-VS Pad Layout compatible I-PEX EVAFLEX5-VS Shielded Connector (0.5mm centers Pitch)





- **1. Construction and Operation Comparison**
- 2. Features and Function and Cost Comparison
- 3. Performance Testing @ 6Gbps Comparison Test Setup Impedance (Time Domain) Eye Pattern (Time Domain) Insertion Loss/Return Loss (Frequency Domain) Far End / Near End Crosstalk (Frequency Domain) Electro-Magnetic Interference





### EVAFLEX5-VS 0.5mm Pitch I-PEX Connector P/N: 20535-030E-02 20p, **30p**, 40p Sumitomo "SUMI-CARD" Top side signal contacts

Bottom side shield/Ground contacts



# SUMITOMO SUMI-CARD Flat Flexible Cable (FFC)

Double Sided Shield Tape, UL5442 (80°C, 60V) , UL File E41105 100  $\Omega$  Differential Impedance, 0.5mm Centers Pitch





#### Symmetric Contact Design Concept with I-PEX standard FFC/FPC





### One action auto lock Notch (1) FFC Complete FFC Initial Status Mating Process mating To push the whole of top shell $(\mathbf{1})$ Complete FFC Locking Release lock & FFC un-mating un-mating Two action FFC un-mating





# **Cabline-VS/SGC Construction**







 $50\Omega$  Single Ended Impedance,  $100 \Omega$  Differential

Jacket : Outer Wrap Tape 0.35mm Nominal O.D. Shield 2: Cu Coated Polyester Tape Shield 1: Tinned Cu Alloy Wire 0.03mm/Spiral Inner Insulation: PFA, 0.21mm Nominal O.D. Conductor: 7strands/0.03 0.09mm Nominal O.D.







# EvaFlex5-VS/FFC vs.Cabline-VS/SGCFeatureFunctionCost

#### Dbl. Sided Shield FFC Cable Bending Radius and Strain Relief:



Do Not Twist

Do Not distort the edge of the supporting tape Hold the support tape and insert at a straight direction

During the design allow for some horizontal distance (space) for inserting the FFC into the connector. Typically minimum bending radius of r20mm for Dbl. Sided Shielded FFC and extend the bending point as far as possible from the edge of the supporting tape. The number of bending cycles is limited.



Provide a strain relief by attaching the cable to the frame of the assembly



# EvaFlex5-VS/FFC vs.Cabline-VS/SGCFeatureFunctionCost

The insulation tape on the locking bar is necessary to protect against shorting to the Receptacle solder tail contacts.



Insert Straight. SGC wire twists and bends naturally.

Very Little horizontal distance is needed but a height clearance of ~5-6mm is necessary to flip the bar to lock.

Full engagement before the Locking-Pulling Bar will move down into the fully locked position. The Bar will not fit over the corner of the receptacle into the locked position if the connector is not fully engaged.



No strain relief of the wire is required

## EvaFlex5-VS/FFC vs. Cabline-VS/SGC Pin Assignment:

#### Cabline-VS/SGC:

Signal position assignments of the SGC wire is versatile and can vary from the connector on one end of the cable to the connector on the other end of the cable.

#### EvaFlex5-VS/FFC:

Position assignments are fixed from one end of the cable to the other end of the cable and all positions must be connected.

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Estimated Typical Cost:
Cabline-VS/SGC:
4 Connectors : ~ $2 – $2.50, SGC Wire and Preparation ~$10 - $12
EvaFlex5-VS/FFC:
2 Connectors : ~ $1.00 - $1.25, Double Sided Shielded FFC $5.00
Extruded
Typical Application
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# Performance Testing @ 6Gbps



#### I-PEX Empirical One Differential Pair Testing Setup and Probes



### TECHNICAL REPORT

## No. IER-001-05477

# <u>CABLINE-VS SGC Cable</u> <u>.vs.</u> <u>EVAFLEX5-VS FFC</u> 6Gbps Performance Comparison

### **Transmission Lines Tested**



	Connector A	Connector B	Cable	Cable Length
Transmisson Line	CABLINE-VS Plug P/N 20453-030T-01	CABLINE-VS Plug P/N 20453-030T-01 SGC AWG#40		100mm
Micro coaxial	CABLINE-VS Receptacle P/N 20453-030T-01	CABLINE-VS Receptacle P/N 20453-030T-01	50Ω	TOOMIN
Transmisson Line	EVAFLEX5-VS P/N 20526-030E	EVAFLEX5-VS P/N 20526-030E	Sumitomo Shield FFC	100mm
FFC	—		(Double) 100 $\Omega$ Differential	TOOIIIII



# Performance Testing @ 6Gbps

#### Test Item

- 3-1. Characteristic Impedance
- 3-2. Eye Pattern
- 3-3. Insertion Loss & Return Loss
- 3-4. Cross Talk
- 3-5. EMI

Measurement equipmen	t	
Oscilloscope :		Textronix TDS8000B
Pulse generator :		Textronix AWG7102
Network Analyzer	:	Agilent technologies N5230A
Spectrum Analyzer :		Agilent technologies E4404B
Magnetic field probe	:	NEC CP-2S

#### Test Method

4-1. Characteristic Impedance (Differential)

Measure Zdiff impedance of Connectors as Fig-1.

Rise time : 50ps (10%-90%), 130ps(20-80%)

Measured points : pos.15,16



#### 5. Test Result

#### 5-1. Characteristic Impedance



N=1 Unit :  $\Omega$ 

	CABLINE-VS Connector Cable			EVAFLEX5-VS				
8.5	Connector		Cable		Connector		FFC	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
50ps(10-90%)	100.62	94.04	102.73	100.27	103.60	92.97	107.14	97.61
130ps(20-80%)	98.34	97.04	102.61	99.97	100.33	97.70	102.16	97.77

There was no difference in result between CABLINE-VS and EVAFLEX5-VS.



Eye Pattern (Differential) Measure Eye Pattern of Connectors as Fig-2. Bit rate : 6Gbps, 5.4Gbps PRBS 2^7 Rise time : 60ps (10-90%) Input Voltage : 0.5Vp-p(6Gbps), 1.2V(5.4Gbps) Pre-emphasis Level : 0dB, 3.5dB (6Gbps only) Measured points : pos.15,16



Eye Pattern







			CABLINE-VS	ě.	EVAFLEX5-VS			
		Eye Height (mV)	Eye Width (ps)	Jitter (ps)	Eye Height (mV)	Eye Width (ps)	Jitter (ps)	
6Gbps	0dB	164.98	136.48	23.00	169.27	136.59	24.00	
	3.5dB	260.65	153.22	12.00	262.46	152.79	13.00	
5.4Gbps	-	425.55	156.20	22.00	474.30	159.79	21.00	

There was not much difference between Cabline-VS and Eva5-VS



Insertion Loss & Return Loss (Differential) Measure Insertion Loss & Return Loss of Connectors as Fig-3. Measured Frequency : 10MHz~20GHz Measured points : pos.15,16







5-3. Insertion Loss & Return Loss

There was no difference in result between CABLINE-VS and EVAFLEX5-VS.



FEXT & NEXT

Measure Crosstalk of Connectors as Fig-4,5.

Measured Frequency : 10MHz~20GHz Measured points : pos.15,16-pos.18,19





There was no difference in result between CABLINE-VS and EVAFLEX5-VS.



EMI (Differential) Measure EMI of Connectors as Fig-6. Bit rate : 6Gbps, 5.4Gbps Rise time : 60ps (10-90%) Input Voltage : 0.5V(6Gbps), 1,2V(5.4Gbps) Measured Frequency : 30MHz~3GHz / RBW : 3MHz Measured points : pos.15,16



Fig-6. EMI



5-5 EMI



In EMI, leak was not confirmed.



**Conclusion:** 

SGC wire has better bending properties. r3mm vs. r20mm SGC has a 100,000+ cycles of bending without failure SGC wire has no strain relief requirements SGC wire has more position assignment flexibility

**Dbl. Sided Shielded FFC is good for specific applications.** 

Performance Testing Results show that the cables tested had equivalent performance for each parameter.

