HDP User Group International, Inc.
Optical Component FPC Assembly and Reliability

February 26, 2014

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Problem Statement

Data products are increasingly requiring the use of optical transceivers in order to handle speed and throughput required by our member companies' customers. System design density is also increasing so board edge space is at a premium. As a result the size of transceiver is shrinking to accommodate these requirements.

Manufacturing yields of optical assembly of Flexible Printed Circuit (FPC) to device have been deeply impacted by miniaturization and higher density requirements of the optical devices.

The FPC manufacture has finer traces, spacing is tighter, and vias are getting smaller. Typical pitch today is 0.8mm and new requirements are cutting this to 0.4mm and even in some cases 0.2mm. All of these changes are occurring simultaneously driving the need for more accurate equipment and higher level of engineering support in order to have a stable process.

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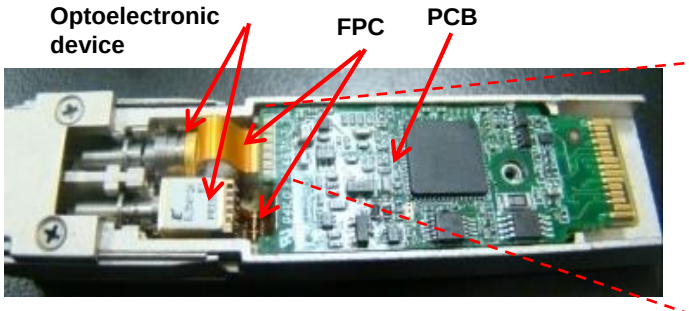
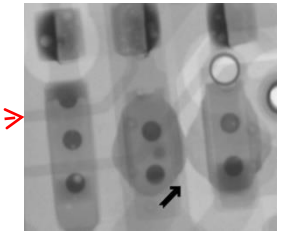
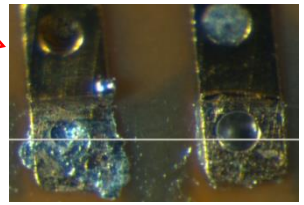
FPC Assembly Problem Examples

Optical component suppliers have different footprints and FPC designs. They include multi row I/O on a single FPC, multiple FPCs, and finer pitch which make the assembly very difficult and results in defects such as opens, insufficient solder, and bridging.





Defect: bridge



Defect: insufficient

- **0.8mm pitch, pad width 0.4mm**
- **stencil aperture is 40% area of pad**
- **PCB-OSP finish, FPC-ENIG finish**

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Goal of Project

The Objective of this project is to explore and provide a holistic solution for Optical component FPC assembly with 0.3mm/0.4mm pitch design.

1. **Explore better assembly process to improve the yield for finer pitch FPC device**
2. **Establish a simple, acceptable test method to evaluate the reliability of different FPC designs, including different FPC materials, solder pad pitch, geometry structure, assembly process.**

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Project Objectives

1. Explore and evaluate soldering and assembly process methods (such as hot bar, laser, manual) which could meet the 99% assembly yield target
2. Define test processes and methodologies to evaluate the Reliability of these FPC designs.
3. Publish guidelines that can be adopted as a general qualification standard for FPC+PCB assemblies

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Project approach

- Design a test vehicle that can be used for both process characterization on reliability testing
- Take a phased approach to evaluation
  - Phase 1 Hot Bar and ACF
  - Phase 2 Laser soldering
  - Phase 3 Microwave Assembly

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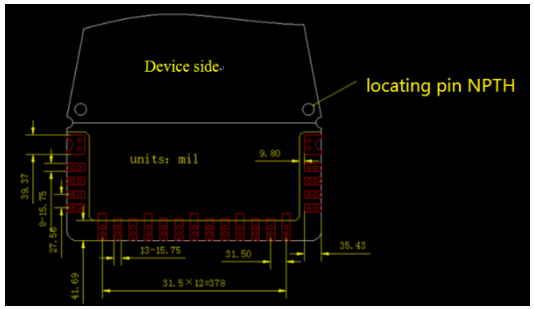
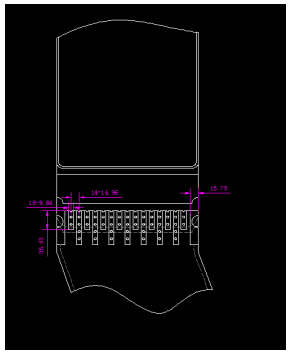
Test Vehicle Materials

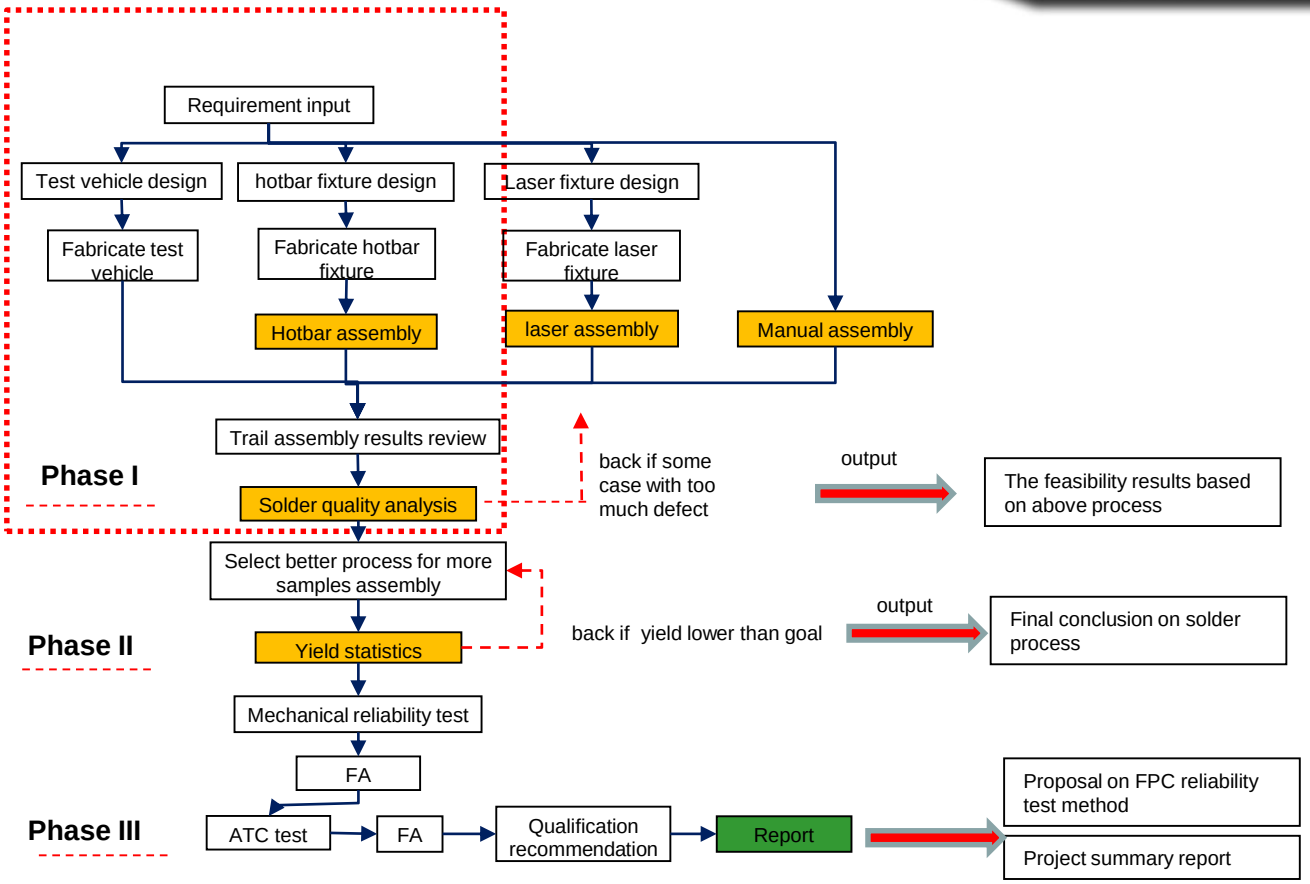
Scopes	Descriptions
PCB Material:	FPC- PI (Polyimide), TK (Teflon/Kapton), PCB- FR4
Soldering Material:	Lead free solder paste, ACF
Soldering Process:	Hot bar, Laser, Microwave, ACF
FPC design geometry :	U-shape FPC design and 0.38mm pitch FPC design to accommodate the hotbed soldering process. Visual descriptions as in attached pictures.





FPC design
etry input from Hu

Project Flow proposal



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Project Execution Plan

#	Items	Date	FPC ACF	PCB ACF	FPC SP	PCB SP
1	Design File released	1/6/14d	yes	yes	yes	yes
2	Design approved by project members for fabrication	3/1/14				
3	Complete Pilot Run design and build verification	3/31/14	10	10	10	10
4	Quantity fabricated and completed by TTM	4/15/14e	100	100	100	100
5	Quantity to send to and arrive Huawei	4/22/14e	25	25	25	25
6	Quantity to send to Miyachi for assembly	4/22/14e	75	75	75	75
7	1st lot for assembly and inspection by Miyachi	5/15/14e		10		10
8	2nd lot for assembly and inspection by Miyachi	6/15/14e		10		10
9	3rd lot for final assembly and send for testing by Miyachi	7/3/14e		55		55

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Proprietary

Reliability Testing Proposal

- Mfg based dimensional stability test to be performed instead of modulus– TTM
- Tests to be performed – TTM incoming

  Flex Material testing
  Tensile Strength
  Fracture Elongation
  Fracture Ductility
  Copper foil peel strength

  Completed Part Test – Huawei/Miyachi/IST
  Cross section & visual inspection – prior to testing
  Pull Test
  Bend Radius Test
  Bend Radius Life Test
  Heat and Humidity
  Thermal Shock

Compare the characteristic bending test life among 3 test vehicle with different soldering process.
Then take the life data at first failure from best one to be the criteria of " test to pass" of bending radius test.
Failure mode expected should be on interconnect rather than on FPC.

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Implementation Team Members

Roles & Responsibilities	Name – Company
Project Leader	**Laye Fenglei– Huawei**
Facilitator/s	**L. Marcanti / Jack Tan– HDP**
FPC and PCB fabrication	**TTM – Timo Jokela**
Assembly Equipment Supplier	**Miyachi – John Van Der Linden**
Tooling and Fixtures	**Huawei / Miyachi**
Reliability Testing	**Huawei / IST**

Other Companies Subscribed to Project Mailing

TUC
IBM
Nvidia
Celestica
Finetech
Panasonic

Ciena
Curtis Wright
Sumitomo
Boeing
Dupont

Emerson
Flextronics
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