Status of Opto-Board Production/Postmortem

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Outline

● Status of opto-board production
● Results of opto-board postmortem
● Summary
Introduction

- 3 opto-board flavors
  - nSQP D opto-board (disk, L1, L2): 7 TTC + 14 data links
  - nSQP B opto-board (B-layer): 7 TTC + 14 data links
  - IBL opto-board: 8 TTC + 16 data links
Opto-Pack Enforcement

- Several opto-packs detached at various stages of production
  - detailed investigations + discussion with epoxy vendor
  - no obvious causes of failure found
  - two improvements:
    - scoring of PCB surface to improve adhesion
    - add aluminum brace to greatly increase epoxy contact area
  - cannot remove opto-pack without destroying opto-pack
Wire Bonding

- Bond pads on ASICs are not designed for double bonds
  - previous opto-boards used double bonds
  - double bonding was difficult with K&S 1470 but doable
- Use K&S 8060 for new opto-boards
  - double bonding is very challenging and
    needs significant more programming development
  ⇨ use single bonds
Second PCB Vendor

- Exception (UK) is the second PCB vendor
  - 25 PCB delivered
  - 2 PCB delaminated
  - 1 PCB delaminated during solder paste reflow
  - Use PCBs from Cirexx (US) which delivered high-quality PCB
Production Status

- 22 D opto-boards have passed QA
  - 7 boards with optical epoxy on PIN arrays and no opto-pack re-enforcement
  - 9 boards without opto-pack re-enforcement
  - 6 boards with final configuration
- 2 opto-boards failed QA due to bad duty cycle
  - duty cycle will be checked before QA in order to stack a second layer of ASIC
    ⇒ board will be classified as 2nd class
- B opto-boards with mounted passive components will be delivered next Wednesday
- IBL opto-boards will be fabricated after B boards
Opto-Board Optical Power

- Excellent optical power!!!
Reception Test System

- Reception test system is now operational at SR1
  - use to retest delivered IBL, D and B boards
  - also use in the old opto-board postmortem
  - 16 D boards passed reception test
What to Expect on Old Opto-boards

- 54 failed modules are attributed to opto-link problems based on a calculation
  - including three totally failed opto-boards
Verification of Extraction Procedure

- Extraction procedure tested on service panel A12
  - visual inspection revealed that all opto-boards were well secured
    ⇒ no sign of loose connection in causing an opto-link to fail
- 36 opto-boards on A12:
  - all boards extracted and tested
  - 1 out of ~252 channels non functional (DORIC) as expected
    ⇒ extraction procedure does not induce additional damage
    ⇒ will only test problematic boards for other service panels
Failure Classification

- 7 opto-boards have a broken DORIC reset line on chip 2
  - reset line is routed from chip 1 to 2 but it carries little current
  - unclear why failure occurs on chip 2 only
  - 3-4 modules are connected to chip 2
  - some modules can still be operated if DORIC can lock in
    ⇔ ~10 modules are operational at one time
- 16 VCSELs and 6 PINs are non operational
  - include 1 dead VCSEL
  - one module connected to both disconnected VCSEL/PIN
  - 15 VCSELs are connected to modules
  - caused by cold solder joints
    ⇔ 20 modules non operational
- 54 module failures were predicted to be caused by opto failures
- probably no wire bond failures since there were no random failures
Summary

- opto-pack re-enforced to increase adhesion
- will use single wire bonds
- PCB from second vendor not acceptable
- opto-board production has started with 7% produced
- opto-board postmortem reveals:
  - no dead opto-boards
  - probably no random (wire bond) failures
  - failure on chip 2 reset line not understood
    - cause ~10 modules non operational at a given time
  - 20 modules connected to disconnected/dead VCSEL or PIN