Accelerated Lifetime Test Of Opto-Boards

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Summary of Failed Boards

- 28 out of the 421 opto-boards failed to pass the QA

Failed Opto-Boards

- 8 Bad VDC
- 2 Bad DORIC (duty cycle)
- 8 Low IVDD
- 4 Mechanical
- 5 Leaky PIN array
- 5 Others
Failure Analysis

● Several of the 421 boards have problems after burn-in/thermal cycles:
  ✤ 1 VDC: cannot adjust drive current
  ✤ 8 VCSEL arrays have low power
    ■ 3 failed for thermal cycle outside Finisar spec: -25 C
      ⇨ thermal cycle: 0-50 C
    ■ 5 arrays not properly glued to BeO substrate
  ✤ 4 leaky PIN arrays
Accelerated Lifetime Test

- Industry standard: opto-boards should survive for 1,000 hours at 85°C/85% relative humidity
  - operate each VCSEL channel with 10 mA (pk-pk)
  - perform weekly measurements
    - VCSEL optical power
    - PIN dark current
    - supply current
    - operate with no error in all channels

After 1,500 hours at 85°C/85% RH
Accelerated Lifetime Test - Phase I

- Started the test with two IBL boards on Feb. 2014
  - All VCSEL channels survived
  - Both PIN arrays became leaky before 1,000 hours
    - PIN biased at 10 V
    - ULM photonics: recommend operate at 5 V even though spec. sheet lists bias as up to 10 V

Spike in dark currents
Accelerated Lifetime Test-Phase I

- VCSEL optical power OK up to 1,008 hours in 85°C/85% RH

Dirty VCSEL
Accelerated Lifetime Test-Phase II

- June/July: started four D opto-boards in 85°C/85% RH
  - 2 boards fabricated in 6/2013: optical power OK after 1,740 hours
  - 2 boards fabricated in 12/2013: optical power OK after 1,560 hours
  - PIN arrays biased at 10 V in ~4 days of burn-in/thermal cycle
    - No leaky PIN arrays for 5 V bias after ~1,650 hours!!
Accelerated Lifetime Test-Phase II

- VCSEL optical power OK up to 1,740 hours in 85°C/85% RH

Wirebond broken during cleaning

Board dropped

K.K. Gan

Pixel Week
Accelerated Lifetime Test-Phase II

- VCSEL optical power OK up to 1,560 hours in 85°C/85% RH
Summary

● production opto-boards passed accelerated lifetime test
  ◆ 10 V bias degrades PIN array lifetime!
● planning to begin long term 50°C/50% RH study next