LightABLE Production Status

CERN, Mini opto-workshop 21/3/14
Changes Since Design Review

• Essential:
  – Make it easier for Infineon SMC connector to connect to LTx in USA15
  – Improve thermal management

• Highly desirable: Allow option of decreasing optical power from LTx in case of saturation for DORIC4A.

• Mechanical reliability, consider use of under-fill for LightABLE BGA.
Mechanical Changes

- Make mate/demate with Infineon SMC easier.
  - Shortened length of MT guide pins.
  - Added groove near end that was cut to help with gluing. End sticking out is the uncut end.
  - Use long guide pins in jig during reflow. Ensures that guide pins will be in the correct location and pointing the correct way.
Underfill

• Decided against use of underfill for BGA
  – Mismatch in CTE.
  – Very little insertion force required.
  – 100 mate/demate cycles with monitoring of power every 10 cycles ➔ no changes
  – Thermal cycling: no change in power.
Cooling

- Thermal path from LightABLE to front panel via Thermal Gap Filler (3 Wm/K)
- OSA analysis $\Delta T$ from junction to ambient $= 20^\circ C$ (next slide).
OSA Analysis

- Measure Peak wavelength $\lambda_p$
- Scan Mark: Space Ratio (MSR) and measure $\lambda_p$
- Plot $\lambda_p$ versus MSR
- Fit slope and extrapolate to 50%.
- Use calibration $d\lambda_p/dT \rightarrow \Delta T$
- Fit Results variable in quality but reasonable consistency
We can use a microprocessor to drive the LightABLE Engine’s I2C inputs, and the SPI lines currently used for the MDACs can be used to drive the µProc

But the MDACS we must still give the right output current for the interface circuit

• This could be done using the µProc’s SPI lines
• It could be carried out when the µProc is initialised
• The MDAC_CLR command (one of the BOC_SPI signals) could be used to force a uProc initialisation

This is what it would look like:
Production Status

• 328 LightABLEs delivered.
  – Delivery should be completed by end March.

• Two flavours of PCB produced and components mounted (except LightABLE).

• 123 LTx assembled.
  – 10 burn-in complete, now @ Cambridge for QA
  – 16 in oven for burn-in.
  – Rest either at RAL waiting for wire bonding or at Oxford waiting for burn-in.

• Production rate between 20 to 40/ week.
<Optical Power> LTx
@ 50% duty cycle, after burn-in

Change with burn-in (72 hours @70C)
LTx in SR1

- LTx optical power.
- No T correction
- Initial decrease ~1%.
  - No burn-in preformed for this array ➔ probably ok but should run longer
AvgVolt by Day : No Correction

Steve McMahon

Optical Power (mV)

Time (days)
Summary

- Improvements following design review have been implemented.
- Production well underway.
- Populate one crate in USA-15 in May
- Need to continue long-term optical power monitoring in SR1 and USA-15.
OSA Thermal Studies

• New metalwork for front panel of BOC
  – Takes heat through thermal pad → metalwork → outside crate
• OSA measured for 12 channels from first LTx with micro on board.
• OSA spectra taken at MSR settings of 0, 10, 20 and 24 (maximum value which gave clean waveform).
• Very crude peak finding
  – Found $\lambda_{\text{max}}$ corresponding to maximum power
  – Found $\lambda_1$ and $\lambda_2$ corresponding to peak power -3dB
  – Best estimate $\lambda_{\text{peak}} = (\lambda_1 + \lambda_2)/2$
  – Used difference between $\lambda_{\text{peak}}$ and $\lambda_{\text{max}}$ as estimate of error.
  – Error on MSR set to 1% (guess)
  – Fit $\lambda_{\text{peak}}$ vs MSR → next slides
Fit Results variable in quality but reasonable consistency

00

01

02

03

Mini Opto-Workshop
21/03/2014

Tony Weidberg
Check this point (see next slide)
Check Channel 8 MSR=20

- Spectra looks ok
- Programme found reasonable results
- 3 sigma effect → doesn’t change conclusions

From programme:
Max power @
Summary

- Fits to each channel for slope
- Use Carlos’s analysis for temperature sensitivity
  - $d\lambda/dT=0.0673 \text{ nm/K}$
- Extrapolate to 50% duty cycle
- $\Delta T = 20 \pm 4 \text{ C}$
- Improved thermal performance compared to previous study $\Delta T = 29 \text{ to } 43 \text{ C}$.
  - Improved metalwork takes heat through thermal pad to outside of crate.

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