LHCb Electronics Meeting

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CERN - 7 March 2005

Outline

• GOL start-up

- Start-up problem
- Why does it happens
- The CRT4T
- How to use the CRT4T
- GOL laser driver
 - Laser driver specifications
 - Interfacing a laser to the GOL
 - Check list

- The GOL might fail to start-up correctly:
 - A chip reset is not able to restore normal operation
- The problem occurs when the GOL is powered-up after other circuits in the system that provide input signals to the GOL
- The problem is due to partial powering of the ASIC through the I/O pins
 - The circuit affected is the PLL
 - The PLL was designed to be auto starting
 - Partial powering situation almost impossible to foresee
- The problem was detected very late in the design cycle:
 - Never in the lab tests
 - May users never experimented the problem
 - Only after the engineering run was done we received the first complaint

GOL Start-up



No signal present:

- To the phase detector is the same as having the VCO running slow
- It will increase the VCO control voltage
- Even if the reference clock it is not present it is possible that the PD will wake-up in the "charge state" (< 50% of the time)

- How to avoid the Start-up problem:
 - Power all the ICs interfacing with the GOL form the same power source:
 - Make sure that all the input signals are not active before power up
 - Don't forget "remote" signals like JTAG and I2C
 - Slow "starting" power supplies might still case problems so don't forget to check in conditions as similar as possible to the ones that will occur in the experiment (not lab conditions)
 - Use a CRT4T with each GOL

CRT4T

• What is the CRT4T:

- Radiation tolerant switch
- Specially designed to force the GOL power down
- The CRT4T contains:
 - 2 uncommitted NMOS
 - 2 uncommitted PMOS
 - Devices are capable of controlling currents up to 300 mA.
 - One inverter with high current driving capability is also provided.
 - Package:
 - 4 × 4 mm QFN16
 - 0.65 mm pitch.



Using the CRT4T

- The CRT4T ASIC can be used to implement a power switch
- Two PMOS devices are used in parallel in order to reduce the on resistance of the switch
- An NMOS device is additionally used to short the GOL power to ground when the power switch is open.
- Make sure the OFF/ON signal has fast rising and fall times
- If the above condition can not be fulfilled use the resistor (R) to limit the short circuit current



- Modulation current:
 - 10 mA
- Bias current:
 - I _{Id-bias} = 1 mA + Config3<6:0> × 0.4 mA
- Loading impedance:
 - 25 Ω (ideally)
 - Others can be used
- Minimum allowed output voltage:
 - 1V
- The driver can be used with:
 - Edge Emitting Laser Diodes
 - VCSELs

Connecting the GOL to a Laser/VCSEL

- GOL laser driver:
 - Designed to drive an edge-emitting laser diode;
 - Laser dynamic impedance (real-part) 10 to 16 Ω ;
 - Package: internal 25 Ω transmission line;
 - Ideally a 25 Ω impedance transmission line should be used:
 - Other impedances can be used
 - In any case a good matching should be achieved at the laser end
 - Use a small series resistor to adapt the impedance
 - The laser driver output must be kept above 1 V
 - Power and ground planes are mandatory
 - Good decoupling near the laser and GOL are mandatory











Laser / VCSEL

- Check that:
 - The modulation current is compatible with your laser/VCSEL
 - The laser threshold current can be provided by the GOL
 - The voltage drop across the laser is compatible with the power supply voltages being used
 - The dynamic impedance is compatible with the transmission line being used
- If you are concerned with radiation effect.
 Check that:
 - The laser threshold current remains within the GOL bias current range
 - The electrical/optical conversion coefficient is not degraded
 - The voltage drop across the laser remains acceptable