	Electrical schematics of the Cu/Polyimide barrel hybrid version 4		
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Project breakdown name

Electrical schematics of the Cu/Polyimide barrel hybrid version 4

abstract

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Distribution List

SCT

History of Changes

Rev. No.	*Date*	*Pages*	*Description of changes*
A	12/07/00	All	First version

1 Introduction

The Cu/Polyimide barrel hybrid version 3 was critically reviewed in the Barrel Hybrid Design Review held on 22nd June, 2000. The summary of review [1] has recommended several features to be implemented in the next round of fabrication for the module-0. In response, the schematics has been updated for the version 4.

2 Electrical schematics

The updated schematics is shown in the figures (2 pages), "Circuit Diagram of Barrel Cu/Polyimide Hybrid for ABCD3T chips".

3 Changes implemented

3.1 Connector pin assignment

The recommendation is

"keep the current 36-pin connector and minimize the number of changes to the current pin assignment. Remove unused pins, and

pin14 to AGND (to allow up to 4 AGND connections)

pin13 to VCC

pin7 to remain unallocated as a potential temperature return line".

Changes are made to

pin14 to AGND

pin13 to VCC

pin7 to tempret (see below).

3.2 Temperature sensing and DGND-sensing

Concerns are expressed in several paragraphs on the temperature sensing and DGND sensing. The arguments are a bit complicated:

1. The temperature reading and the DGND potential, when they are sensed at the mating connector, have uncertainty due to the voltage drops generated by the ASIC currents between the hybrid and the point of sensing. Both uncertainties are calculated to be acceptable, <0.5 K in the temperature reading and <40 mV in the DGND potential [2]. Although acceptably small, an introduction of a line can service for reducing both uncertainties.

2. There is an express of concern on the introduction of noise from the temperature sensing circuitry into DGND when the temperature return and the DGND are connected. A separate temperature return may evade the noise issue.

3. Introduction of lines must be minimized since it is an "real-estate" trade-off. The first and the second arguments are incompatible with the connection of the line to DGND.

Careful examination allows to introduce one line into the hybrid without compromising the real-estate. Thus, the change is

A separate line for "temperature return" of Temp1 and Temp2 sensors, connected to the pin7 (tempret), and an optional wire-bonding pad between the tempret line and DGND near the middle of the 12 chips hybrid.

If no-connection of the tempret and DGND minimizes the noise from the temperature circuitry, no wire-bonding at the "optional tempret-DGND" is made and the pin7 line should go to the temperature circuitry without connecting to DGND-sense in the dogleg and after. If there is no difference in the noise, there is a choice to sense the DGND at the middle of the hybrids or at the connector in the dogleg.

3.3 Option for connecting ID4 to either SELECT or VDD

ID4 has a pull-down resistor inside the ABCD chip and the module is served by primary fibre. In case the module is required to be served by an adjacent fibre, the ID4 is set by SELECT-high. An option is requested to set the ID4 high without SELECT-high connection.

Change is

A VDD wire-bonding pad is provided next to the SELECT line pad.

References

[1] M. Tyndel, et al., "Internal Design Review of the SCT Barrel Hybrids", reference id, 5 July, 2000

[2] Y. Unno, et al., "Temperature readout errors in thermistors due to voltage ambiguities", 29 June, 2000, http://atlas.kek.jp/~unno/si_hybrid/SMDparts/Temperrors.fm55.pdf

Silicon Microstrip Detector(front)

Backplane
strips
p   n

CON

1	+bias(HV)	2 1
2	+bias(HV)	
3	NC	4 3
4	NC	
5	-bias(ag)	6 5
6	-bias(ag)	
7	tempret	8 7
8	ag	
9	VCC	10 9
10	ag	
11	VCC	12 11
12	ag	
13	VCC	14 13
14	ag	
15	com1	16 15
16	com1B	
17	clk1	18 17
18	clk1B	
19	dg	20 19
20	dg	
21	VDD	22 21
22	VDD	
23	dg	24 23
24	dg	
25	reset	26 25
26	select	
27	com0	28 27
28	com0B	
29	clk0	30 29
30	clk0B	
31	led	32 31
32	ledB	
33	ledx	34 33
34	ledxB	
35	temp1	36 35
36	temp2	

R33 R34 R35 R36
C71 C72
C51 VCC
C52 VDD

C1 U1 C2 U2 C3 U3 C4 U4 C5 U5 C6 U6
C15 C16 C17 C18 C19 C20 C21
C7 C53 C73 C54

tokenout1B
tokenin1
dataout1B
datain1

Flexible part

resetB
select
com0
com0B
com1
com1B
ID4

ID4
clk1
clk1B
clk0
clk0B

This bonding connects ID4 to SELECT or VDD

TEMP
TM1

Legend:
- Analog ground
- Digital ground
- VCC
- VDD
- Capacitor
- Resistor
- Bonding pad (connected)
- Bonding pad (isolated)
- Bonding wire

These bonding wires are to connect Anaglog ground and Digital ground. Multiple bonds, e.g., 5 bonds per location are recommended.

Optional bonding for connecting TEMPRET to Digital ground.

1997.9.5 T. Kondo (KEK)
1997.9.6 V1
1997.10.10 V2
1998.1.25 V3
1998.4.10 V4
1998.4.12 V5
1998.5.8 V6 <-- Melbourune
1998.5.19 V7 <--Unno
1999.6.29 V8
1999.7.28 V8a
1999.12.1 V8b
1999.12.28 V8c
2000.1.15.V8d
2000.2.4 V8e
2000.2.9 V8f (5 -> 5.1 kohm)
2000.3.18 Helvetica font
2000.5.11 mistakes corrected
2000.7.12 new version for ABCD3T

Circuit Diagram of Barrel Cu/Polyimide Hybrid for ABCD3T chips
(ATLAS/K4ABCD3/2K09)

Silicon Microstrip Detector(back)

backplane

p n

strips

C74

C75

C8

C55

U7

C9

U8

C10

U9

C11

U10

C12

U11

C13

U12

C14

C57

C56

C22

C23

C24

C25

C26

C27

C28

C58

R27   100 Ohm
R28   100 Ohm
R29   100 Ohm
R30   100 Ohm

TEMP

TM2

resetB
select
com0
com0B
com1
com1B
ID4

ID4
clk1
clk1B
clk0
clk0B

sensor p-side

sensor n-side

+bias(HV)

There are four places to connect
+bias(HV) and AGND to the
sensor backplane and bias-ring
respectively. Two places for +bias
(HV) and four AGND are to be
bonded.

HV capacitor

AGND   AGND

Flexible part

---Parts list--
part notation	total number	dimensions (mm)	specifications and part No.
U1 ~ U12	12	6.55 x 8.40	ABCD3T chip (version 1.1)
C1 ~ C28	22	1.6 x 0.8	100 nF, 25 V, Ceramic capacitor, Murata GRM39-X7R-104-K-25
C51 ~ C58	8	3.2 x 1.6	330 nF, 25 V, Ceramic capacitor, Murata GRM42-X7R-334-K-25
C71 ~ C75	5	3.2 x 1.6	10 nF, 630 V, Ceramic capacitor, Murata GHM1530-B-103-K-630
R27 ~ R30	4	1.6 x 0.8	100 ohm (termination of com and clock lines)
R33, R34	2	1.6 x 0.8	5.1 k ohm, resistor
R35	1	1.6 x 0.8	1 k ohm, resistor
R36	1	1.6 x 0.8	jumpering wire
TM1, TM101	2	1.6 x 0.8	10k thermistors, Semitec 103KT1608-1P
CON	1	1.27mm pitch	2 row x 18 pins connector, Samtec SFMC-140-L3-S-D