HIPPI 6400 Links using PAROLI® Modules

Appnote 88

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OVERVIEW

The HIPPI 6400 standards family describe a point to point, full duplex link interface implementing the HIPPI 6400 PH protocol. The ANSI NCITS 323 document details a 16-bit link with 22 channels in each direction and 500 Mbit/s data transmission rates per channel. This is intended for a copper cable with a reach length of up to 40 m. Connections to a seperate longer-distance optical interface are also included.

The ANSI NCITS 338 document describes this media level, point-to-point, 12 channel (8-bit), full duplex, electrical/optical interface with each channel operating at 500 Mbit/s or 1 Gbit/s.

In this Application Note implementation of the 8-bit optical link using an AC PAROLI transmitter and receiver pair is described. Alternative optical link solutions for the copper interface are also presented. Two configurations are discussed, i.e., a single DC PAROLI transmitter&receiver pair, or, using two AC PAROLI transmitters&receivers. Fibre link solutions have the advantages of longer reach length and smaller cables compared to the copper link.

PAROLI DATA SHEETS

Detailed information regarding module operation parameters, assembly and start-up procedures is contained in the respective data sheets. These may be obtained from the Infineon Fiber Optics web site:

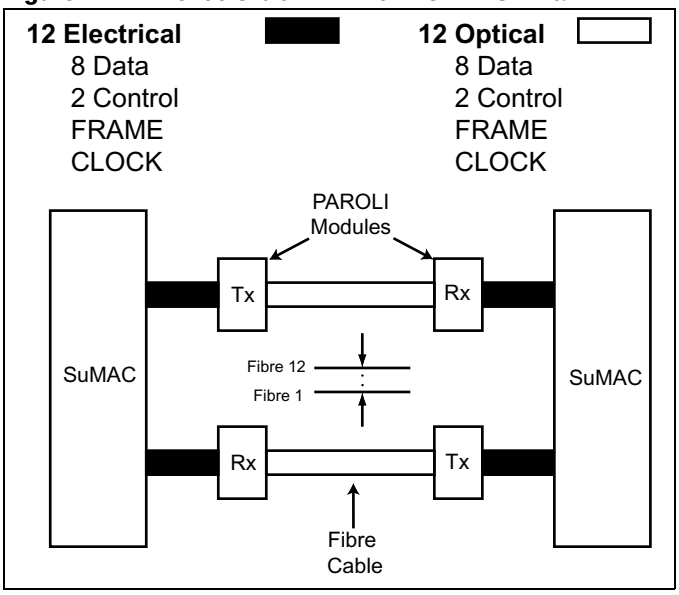
www.infineon.com/fiberoptics/

and selecting the topic “Parallel Optical Links (PAROLI)”

8-BIT OPERATION WITH AC PAROLI

The 1.6 Gbit/s AC PAROLI V23814-U1306-M130 transceiver and V23815-U1306-M130 receiver modules are recommended for the HIPPI 6400 8-bit link. A block diagram of this configuration is shown in Figure 1.

Figure 1. HIPPI 6400 8-bit Link with AC PAROLI Pair



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Electrical Interface

The following table details the input and output voltages of the SuMAC chip in APECL reduced swing mode (relevant to 8-bit and 16-bit operation) and all PAROLI modules.

Table 1. SuMAC and PAROLI Input and Output Voltages

	SuMAC Chip			PAROLI			Unit
	Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Common mode Voltage	1.05	1.35	1.55	-	1.20	-	V
Differential Input Voltage	0.50	-	2.70	0.10	-	1.00	
Output Common mode Voltage	-	1.25	-	-	1.20	-	
Differential Output Voltage	0.50	-	1.50	0.25	-	0.40	

As may be seen in Table 1, when operating in APECL reduced swing mode, the SuMAC output may be connected directly to the PAROLI input and the PAROLI output directly to the SuMAC input.

Table 2 shows the pin-layout for the 8-bit link. Note that the SuMAC CLOCK2 signal is not transmitted as this function is not required for an optical connection. CLOCK is also sent as a data signal across fibre 1 of the tranmitter. It is advised to tie the SuMAC CLOCK2_in_p low and CLOCK_in_n high. The signal detect pins of the PAROLI module (SD1 and -SD12, pins 6 and 67, respectively) may be connected to the GP_IN Frame_Det of the SuMAC.

Table 2. Pin-Layout for AC PAROLI and SuMAC in 8-bit Mode

Transmit side						Receive side				
SuMAC		PAROLI				PAROLI			SuMAC	
Name	Pin	Name	Pin	Fibre	Channel	Fibre	Pin	Name	Pin	Name
CLOCK_Out_n	78	DI 01 N	13	1	1	12	13	DO 01 P	72	CLOCK_In_p
CLOCK_Out_p	79	DI 01 P	14				14	DO 01 N	73	CLOCK_In_n
D00_Out_n	98	DI 02 N	17	2	2	11	17	DO 02 P	52	D00_In_p
D00_Out_p	99	DI 02 P	18				18	DO 02 N	53	D00_In_n
D02_Out_n	94	DI 03 N	21	3	3	10	21	DO 03 P	56	D02_In_p
D02_Out_p	95	DI 03 P	22				22	DO 03 N	57	D02_In_n
D04_Out_n	90	DI 04 N	26	4	4	9	26	DO 04 P	60	D04_In_p
D04_Out_p	91	DI 04 P	27				27	DO 04 N	61	D04_In_n
D06_Out_n	86	DI 05 N	29	5	5	8	29	DO 05 P	64	D06_In_p
D06_Out_p	87	DI 05 P	30				30	DO 05 N	65	D06_In_n
D08_Out_n	47	DI 06 N	33	6	6	7	33	DO 06 P	3	D08_In_p
D08_Out_p	48	DI 06 P	34				34	DO 06 N	4	D08_In_n
D10_Out_n	43	DI 07 N	37	7	7	6	37	DO 07 P	7	D10_In_p
D10_Out_p	44	DI 07 P	38				38	DO 07 N	8	D10_In_n
D12_Out_n	39	DI 08 N	41	8	8	5	41	DO 08 P	11	D12_In_p
D12_Out_p	40	DI 08 P	42				42	DO 08 N	12	D12_In_n
D14_Out_n	35	DI 09 N	46	9	9	4	46	DO 09 P	15	D14_In_p
D14_Out_p	36	DI 09 P	47				47	DO 09 N	16	D14_In_n
C0_Out_n	82	DI 10 N	51	10	10	3	51	DO 10 P	68	C0_In_p
C0_Out_p	83	DI 10 P	52				52	DO 10 N	69	C0_In_n
C2_Out_n	31	DI 11 N	55	11	11	2	55	DO 11 P	19	C2_In_p
C2_Out_p	32	DI 11 P	56				56	DO 11 N	20	C2_In_n
FRAME_Out_n	27	DI 12 N	59	12	12	1	59	DO 12 P	23	FRAME_In_p
FRAME_Out_p	28	DI 12 P	60				60	DO 12 N	24	FRAME_In_n

16-BIT OPERATION WITH DC PAROLI

The first of the two options for a 16-bit link is presented in Figure 2. The DC/MUX-ENC PAROLI V23814-K1306-M230 transceiver and V23815-K1306-M230 receiver modules are used. With this configuration, the 16 data lines, the 4 control lines and the SuMAC frame are 2:1 multiplexed by the DC PAROLI module and transmitted across 11 fibres. The PAROLI transmits its own frame signal across fibre 1. The SuMAC CLOCK signal times the data sampling etc of the PAROLI module. This CLOCK is also transmitted across fibre 1 of the transmitter as a data signal.

The SuMAC FRAME is transmitted as a data signal across one of the fibre lines. The transmission length for this configuration is 75 m, limited by skew in the fibres making up the transmission cable. For longer transmission lengths in 16-bit mode see the next section.

Table 3. Pin-Layout for DC PAROLI and SuMAC in 16-bit Mode

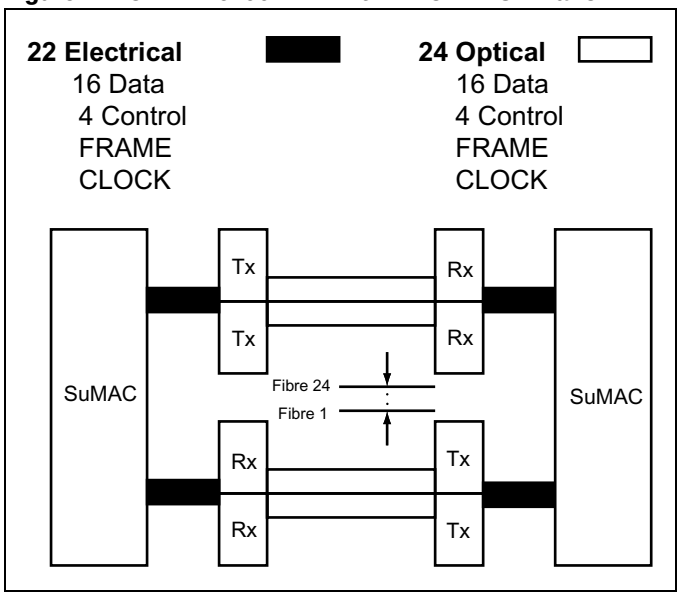
Transmit side						Receive side				
SuMAC		PAROLI				PAROLI			SuMAC	
Name	Pin	Name	Pin	Fibre	Channel	Fibre	Pin	Name	Pin	Name
CLOCK_Out_n	78	DI 01 N	13	2	1	12	13	DO 01 P	72	CLOCK_In_p
CLOCK_Out_p	79	DI 01 P	14				14	DO 01 N	73	CLOCK_In_n
D05_Out_n	88	DI 12 N	15		7		15	DO 12 P	62	D05_In_p
D05_Out_p	89	DI 12 P	16				16	DO 12 N	63	D05_In_n
D00_Out_n	98	DI 02 N	17	3	2	11	17	DO 02 P	52	D00_In_p
D00_Out_p	99	DI 02 P	18				18	DO 02 N	53	D00_In_n
D01_Out_n	96	DI 13 N	19		3		19	DO 13 P	54	D01_In_p
D01_Out_p	97	DI 13 P	20				20	DO 13 N	55	D01_In_n
D02_Out_n	94	DI 03 N	21	4	4	10	21	DO 03 P	56	D02_In_p
D02_Out_p	95	DI 03 P	22				22	DO 03 N	57	D02_In_n
D03_Out_n	92	DI 14 N	23		5		23	DO 14 P	58	D03_In_p
D03_Out_p	93	DI 14 P	24				24	DO 14 N	59	D03_In_n
D04_Out_n	90	DI 04 N	26	5	6	9	26	DO 04 P	60	D04_In_p
D04_Out_p	91	DI 04 P	27				27	DO 04 N	61	D04_In_n
D06_Out_n	86	DI 15 N	29		8		29	DO 15 P	64	D06_In_p
D06_Out_p	87	DI 15 P	30				30	DO 15 N	65	D06_In_n
D07_Out_n	84	DI 05 N	31	6	9	8	31	DO 05 P	66	D07_In_p
D07_Out_p	85	DI 05 P	32				32	DO 05 N	67	D07_In_n
D08_Out_n	47	DI 16 N	33		10		33	DO 16 P	3	D08_In_p
D08_Out_p	48	DI 16 P	34				34	DO 16 N	4	D08_In_n
D09_Out_n	45	DI 06 N	35	7	11	7	35	DO 06 P	5	D08_In_p
D09_Out_p	46	DI 06 P	36				36	DO 06 N	6	D08_In_n
D10_Out_n	43	DI 17 N	37		12		37	DO 17 P	7	D10_In_p
D10_Out_p	44	DI 17 P	38				38	DO 17 N	8	D10_In_n
D11_Out_n	41	DI 07 N	39	8	13	6	39	DO 07 P	9	D11_In_p
D11_Out_p	42	DI 07 P	40				40	DO 07 N	10	D11_In_n
D12_Out_n	39	DI 18 N	41		14		41	DO 18 P	11	D12_In_p
D12_Out_p	40	DI 18 P	42				42	DO 18 N	12	D12_In_n

D13_Out_n	37	DI 08 N	43	9	15	5	43	DO 08 P	13	D13_In_p
D13_Out_p	38	DI 08 P	44				44	DO 08 N	14	D13_In_n
D14_Out_n	35	DI 19 N	46		16		46	DO 19 P	15	D14_In_p
D14_Out_p	36	DI 19 P	47				47	DO 19 N	16	D14_In_n
D15_Out_n	33	DI 09 N	49	10	17	4	49	DO 09 P	17	D15_In_p
D15_Out_p	34	DI 09 P	50				50	DO 09 N	18	D15_In_n
C0_Out_n	82	DI 20 N	51		18		51	DO 20 P	68	C0_In_p
C0_Out_p	83	DI 20 P	52				52	DO 20 N	69	C0_In_n
C1_Out_n	80	DI 10 N	53	11	19	3	53	DO 10 P	70	C1_In_p
C1_Out_p	81	DI 10 P	54				54	DO 10 N	71	C1_In_n
C2_Out_n	31	DI 21 N	55		20		55	DO 21 P	19	C2_In_p
C2_Out_p	32	DI 21 P	56				56	DO 21 N	20	C2_In_n
C3_Out_n	29	DI 11 N	57	12	21	2	57	DO 11 P	21	C3_In_p
C3_Out_p	30	DI 11 P	58				58	DO 11 N	22	C3_In_n
FRAME_Out_n	27	DI 22 N	59		22		59	DO 22 P	23	FRAME_In_p
FRAME_Out_p	28	DI 22 P	60				60	DO 22 N	24	FRAME_In_n
CLOCK_Out_n	78	CI N	11	-	-	-	-	-	-	-
CLOCK_Out_p	79	CI P	12				-	-	-	-

16-BIT OPERATION WITH AC PAROLI

The 16 Gbit/s AC PAROLI V23814-U1306-M130 transceiver and V23815-U1306-M130 receiver modules may be used for the HIPPI 6400 16-bit link. With this configuration using AC components, two transmitters, two receivers and two fibre cables are required to form the link. The 16 data lines, four control lines, frame and clock are transmitted across individual fibres. The advantage of this configuration is that transmission lengths in excess of 700 m may be achieved. A block diagram of such a link is shown in Figure 2.

Figure 2. DC HIPPI 6400 Link with 2 AC PAROLI Pairs



The SuMAC outputs 22 electrical signals and the two AC PAROLI Tx/Rx pairs have 24 optical connections. Therefore, the outer fibres of the link are not used, i.e., fibres 1 and 24 of the fibre cable. In Table 4, the double line separates the transmitter and receiver pairs.

Table 4. Pin-Layout for DC PAROLI and SuMAC in 16-bit Mode

Transmit side						Receive side				
SuMAC		PAROLI				PAROLI			SuMAC	
Name	Pin	Name	Pin	Fibre	Channel	Fibre	Pin	Name	Pin	Name
CLOCK_Out_n	78	DI 02 N	17	2	1	11	17	DO 02 P	72	CLOCK_In_p
CLOCK_Out_p	79	DI 02 P	18				18	DO 02 N	73	CLOCK_In_n
D05_Out_n	88	DI 03 N	21	3	7	10	21	DO 03 P	62	D05_In_p
D05_Out_p	89	DI 03 P	22				22	DO 03 N	63	D05_In_n
D00_Out_n	98	DI 04 N	26	4	2	9	26	DO 04 P	52	D00_In_p
D00_Out_p	99	DI 04 P	27				27	DO 04 N	53	D00_In_n
D01_Out_n	96	DI 05 N	29	5	3	8	29	DO 05 P	54	D01_In_p
D01_Out_p	97	DI 05 P	30				30	DO 05 N	55	D01_In_n
D02_Out_n	94	DI 06 N	33	6	4	7	33	DO 06 P	56	D02_In_p
D02_Out_p	95	DI 06 P	34				34	DO 06 N	57	D02_In_n
D03_Out_n	92	DI 07 N	37	7	5	6	37	DO 07 P	58	D03_In_p
D03_Out_p	93	DI 07 P	38				38	DO 07 N	59	D03_In_n
D04_Out_n	90	DI 08 N	41	8	6	5	41	DO 08 P	60	D04_In_p
D04_Out_p	91	DI 08 P	42				42	DO 08 N	61	D04_In_n

D06_Out_n	86	DI 09 N	46	9	8	4	46	DO 09 P	64	D06_In_p
D06_Out_p	87	DI 09 P	47				47	DO 09 N	65	D06_In_n
D07_Out_n	84	DI 10 N	51	10	9	3	51	DO 10 P	66	D07_In_p
D07_Out_p	85	DI 10 P	52				52	DO 10 N	67	D07_In_n
D08_Out_n	47	DI 11 N	55	11	10	2	55	DO 11 P	3	D08_In_p
D08_Out_p	48	DI 11 P	56				56	DO 11 N	4	D08_In_n
D09_Out_n	45	DI 12 N	59	12	11	1	59	DO 12 P	5	D08_In_p
D09_Out_p	46	DI 12 P	60				60	DO 12 N	6	D08_In_n
D10_Out_n	43	DI 01 N	13	1	12	12	13	DO 01 P	7	D10_In_p
D10_Out_p	44	DI 01 P	14				14	DO 01 N	8	D10_In_n
D11_Out_n	41	DI 02 N	17	2	13	11	17	DO 02 P	9	D11_In_p
D11_Out_p	42	DI 02 P	18				18	DO 02 N	10	D11_In_n
D12_Out_n	39	DI 03 N	21	3	14	10	21	DO 03 P	11	D12_In_p
D12_Out_p	40	DI 03 P	22				22	DO 03 N	12	D12_In_n
D13_Out_n	37	DI 04 N	26	4	15	9	26	DO 04 P	13	D13_In_p
D13_Out_p	38	DI 04 P	27				27	DO 04 N	14	D13_In_n
D14_Out_n	35	DI 05 N	29	5	16	8	29	DO 05 P	15	D14_In_p
D14_Out_p	36	DI 05 P	30				30	DO 05 N	16	D14_In_n
D15_Out_n	33	DI 06 N	33	6	17	7	33	DO 06 P	17	D15_In_p
D15_Out_p	34	DI 06 P	34				34	DO 06 N	18	D15_In_n
C0_Out_n	82	DI 07 N	37	7	18	6	37	DO 07 P	68	C0_In_p
C0_Out_p	83	DI 07 P	38				38	DO 07 N	69	C0_In_n
C1_Out_n	80	DI 08 N	41	9	19	5	41	DO 08 P	70	C1_In_p
C1_Out_p	81	DI 08 P	42				42	DO 08 N	71	C1_In_n
C2_Out_n	31	DI 09 N	46	9	20	4	46	DO 09 P	19	C2_In_p
C2_Out_p	32	DI 09 P	47				47	DO 09 N	20	C2_In_n
C3_Out_n	29	DI 10 N	51	10	21	3	51	DO 10 P	21	C3_In_p
C3_Out_p	30	DI 10 P	52				52	DO 10 N	22	C3_In_n
FRAME_Out_n	27	DI 11 N	55	11	22	2	55	DO 11 P	23	FRAME_In_p
FRAME_Out_p	28	DI 11 P	56				56	DO 11 N	24	FRAME_In_n

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