

Bishamon

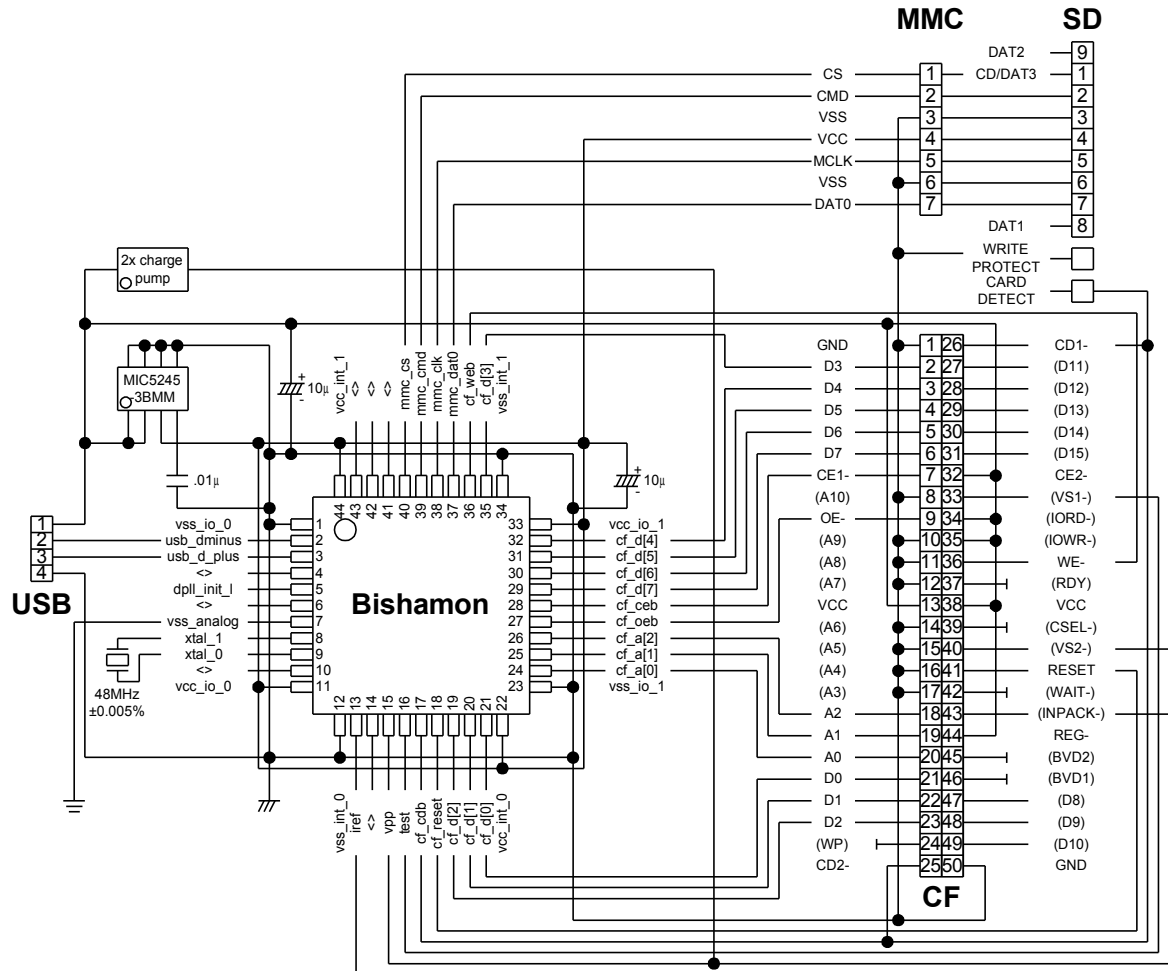
(**USB**-to-**CF/MMC/SD** Bridge LSI)

Advanced design approaches

- Total integration of SanDisk products (CF/MMC/SD).

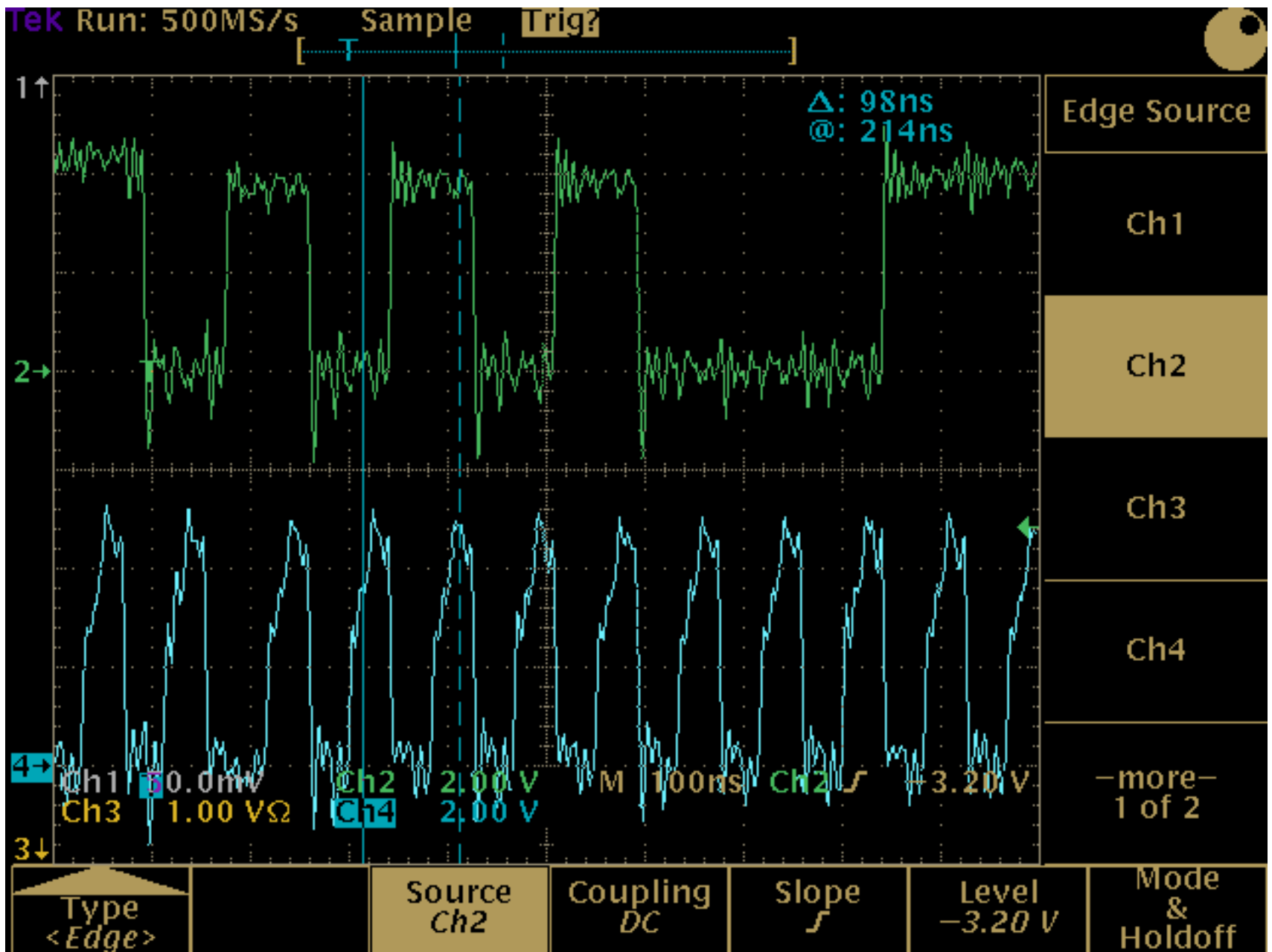
Bishamon (USB to CF/MMC/SD bridge LSI)

(A) System configuration (Board design example)



Advanced design approaches

- Total integration of SanDisk products (CF/MMC/SD).
- Stable 4x over-sampling DPLL (Digital Phase-Locked Loop).



Advanced design approaches

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- Compact USB SIE (Serial Interface Engine).

USB SIE (Serial Interface Engine)

USB receiver functions

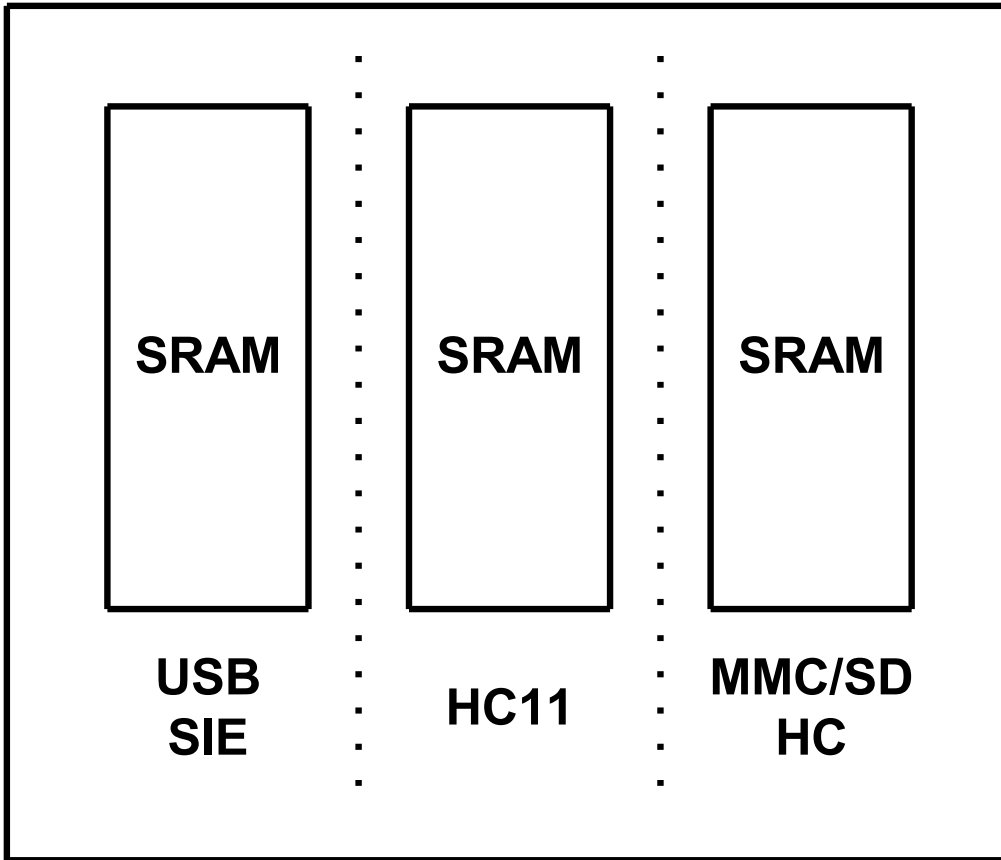
- Receiving differential D+ & D-.
- NRZI decoding & stuffed bit stripping.
- Unpacking packet ID, address, endpoint, CRC5, data, & CRC16.
- Decoding packet IDs, reset, EOP, and suspend.
- Real time CRC16 and CRC5 generation and check.
- Sequence control of DATA0 & DATA1.

USB transmitter functions

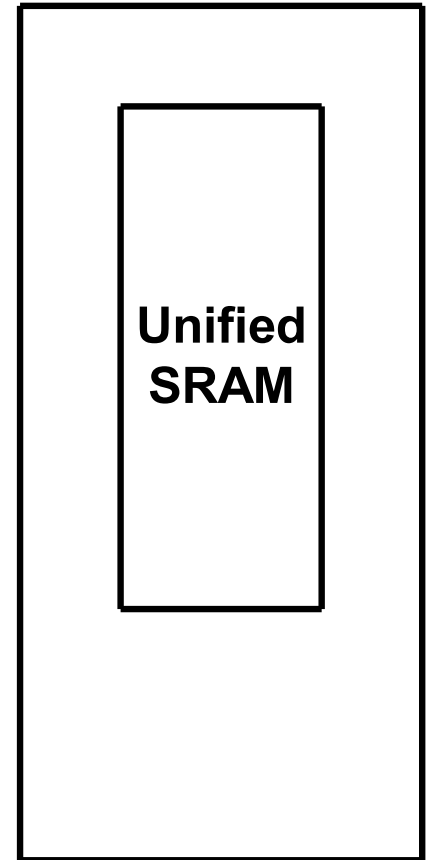
- NRZI encoding & stuffed bit insertion.
- Real time CRC16 generation.
- Packing packet ID, data, CRC16, & EOP.
- Transmitting differential D+ & D-.

Advanced design approaches

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- Unified SRAM architecture.



Conventional design approach



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Speed performance comparison

	IM CF	IM MMC	Bishamon CF/MMC/SD
CF Read	303msec 634kB/sec	N.A.	293msec 655kB/sec
CF Write	103msec 437kB/sec	N.A.	103msec 437kB/sec
MMC Read	N.A.	454msec 423kB/sec	329msec 583kB/sec
MMC Write	N.A.	316msec 142kB/sec	325msec 139kB/sec
SD Read	N.A.	N.A.	239msec 512kB/sec
SD Write	N.A.	N.A.	155msec* 406kB/sec

- Tool : USB Chief (USB bus analyzer).
- Hardware : IBM PC (Pentium III 550MHz).
- Environment : Windows 98.
- USB driver : SanDisk driver for Image Mate.
- read time : "OUT" for "READ(10)" to "ACK" for "CSW" of last data.
- write time : "OUT" for "WRITE(10)" to "ACK" for "CSW" of last data.
- Flash card : 20MB SanDisk CF, 8MB SanDisk MMC, & 64MB Panasonic SD.

Advanced design approaches

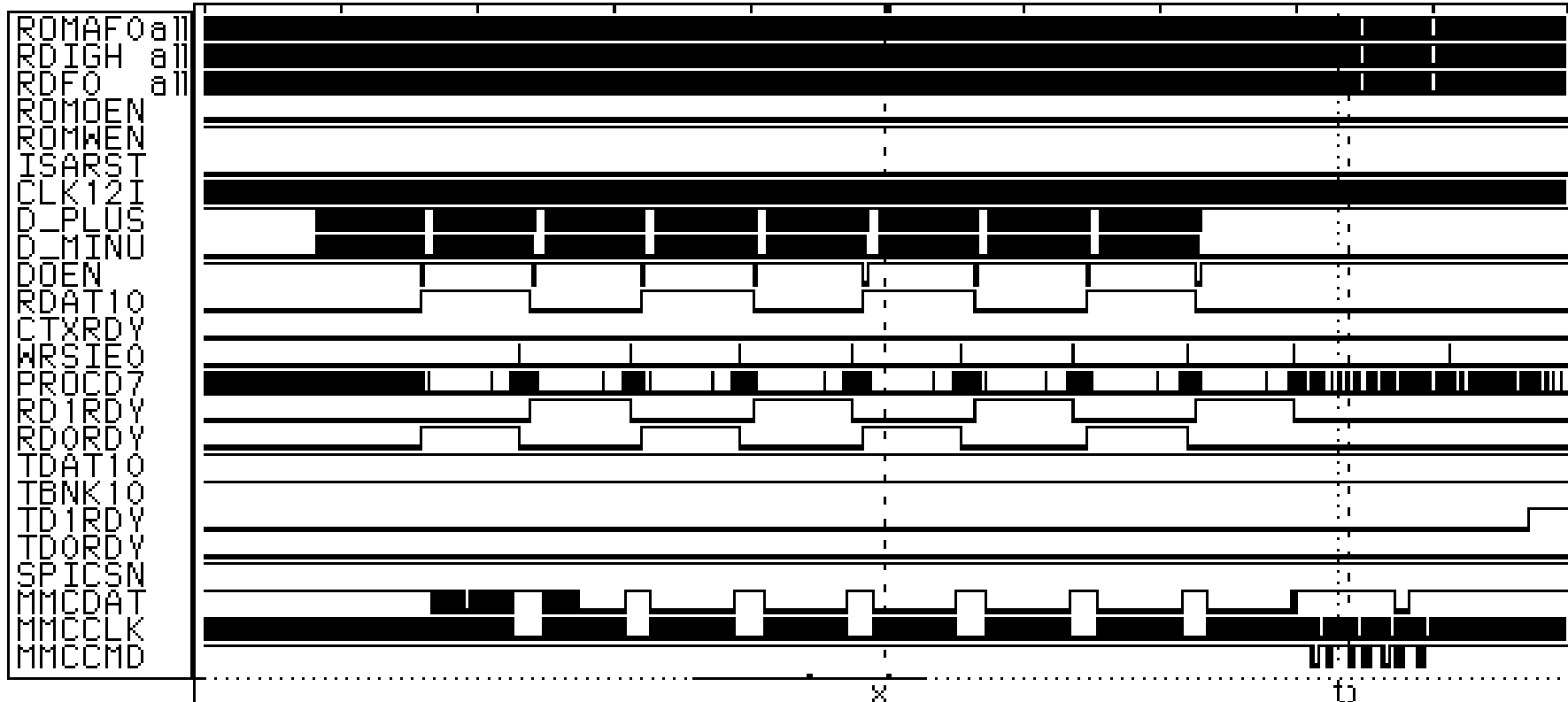
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- Utilizing block move instruction (DMA) and hold functions.

Analyzer Waveform MACHINE 1 Acq. Control Cancel Run

Accumulate On ROMAFO X → 000A Center Screen

Hex 0 → 1305

sec/Div 70.0 us Delay -232.0 us Markers Time X to 0 237.3 us Trig to X -232.5 us Trig to 0 4.790 us



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- Small die size.

Random gate count

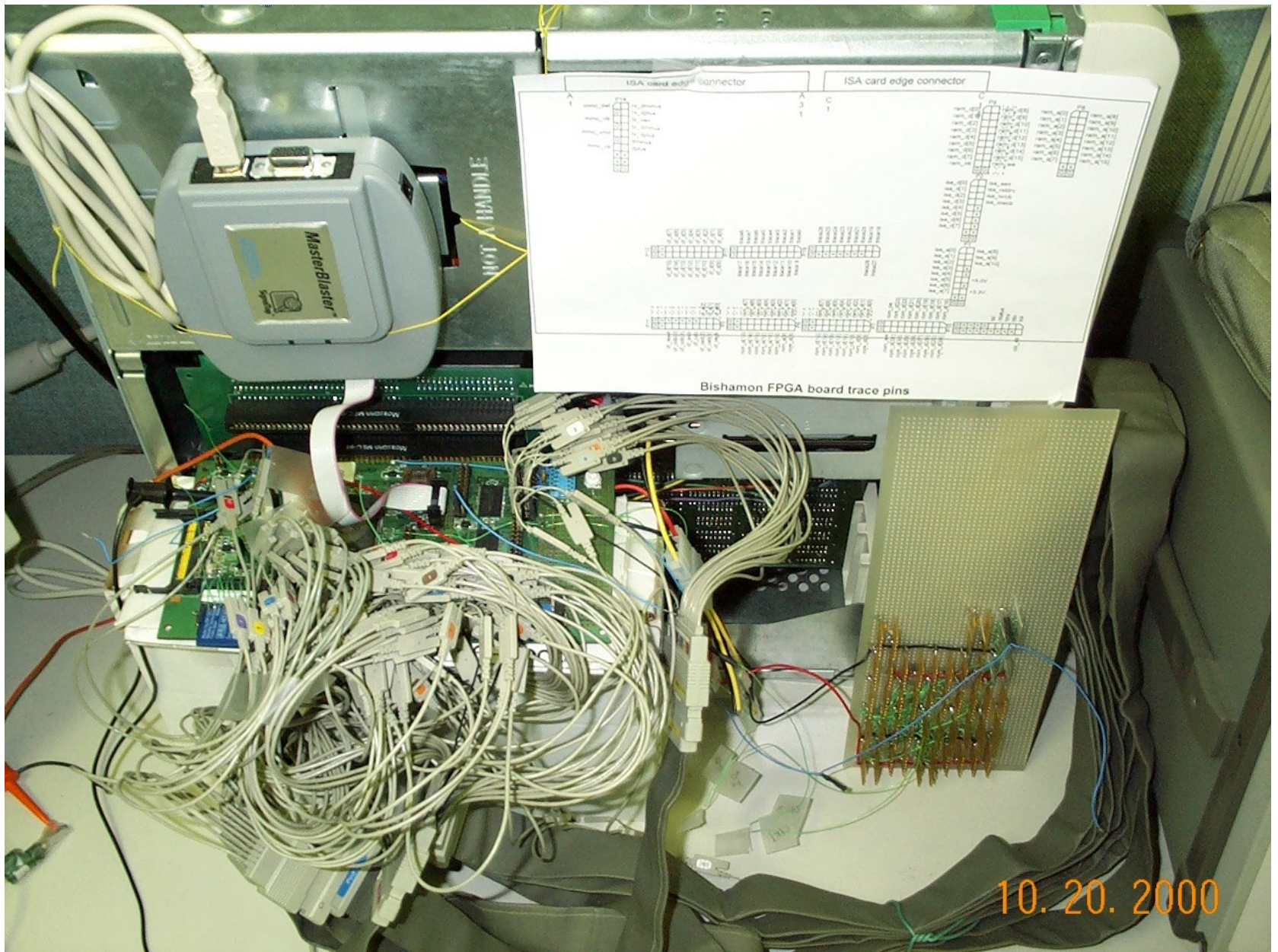
USB SIE	3.5k
HC11 core	6.0k
MMC/SD host controller	3.5k
CF interface	0.2k
SRAM BIST	1.0k
Debug	0.4k
Flash ROM controller	1.0k
Total	15.6k

SRAM size : 1024x8 (256x8 original.)
Flash ROM size : 32kx8 (8kx8 is sufficient.)

Tape-out : Nov/2000

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- Overall functional verification on actual system by FPGA.



10/25/2000

Bishamon

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nitron

The screenshot shows a Windows XP desktop environment with several applications open:

- Acrobat Exchange - [test.pdf]**: A PDF viewer showing a diagram with a central circle labeled "Follow QHD.Horz" and various text annotations like "Vert.T = 1", "Ocontext = 1 and (TD.VF_Flag = 0 or TD.Link.T = 1)", and "Qcontext = 1 and TD.VF_Flag = 1 and TD.Link.T = 0 and TD.Link.Q = 0".
- VISIO - [Test.vsd:Page-2]**: A diagram showing a circuit for "MMC mode" with components like "Bishamon" and "MMC card".
- My Computer**: Shows the "E:\" drive with a list of folders: Jpeg, Mp3, Pdf, Test, and Visio.
- test.bat - Notepad**: A text editor window containing a list of file paths, such as "block#00block#00block#00block#00block#00".
- Playlist Editor**: A window showing a list of songs, including "Carpenters_2.mp3" and "Eilon_Joke_1.mp3".
- Preferences Menu**: A small dialog box with options like "Shuffle", "Repeat", and "Blend | Dissolve".

10.20.2000

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- **F-to-F (Floppy disk drive to Flash card slot) Evolution.**



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