



Direct file-system access from SATA-IP

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What is exFAT?

- **Industrial standard File System**
 - Compatible among Windows(XP/Vista/7/8),Mac,Linux...
- **Suitable for flash storage such as SDXC,USB memory.**
 - Also applicable to SSD/HDD
- **Maximum file size = 16 Ei-Byte (2^{60} byte)**
 - For FAT32, max file size is only 4GByte



exFAT file system is supported by popular OS.

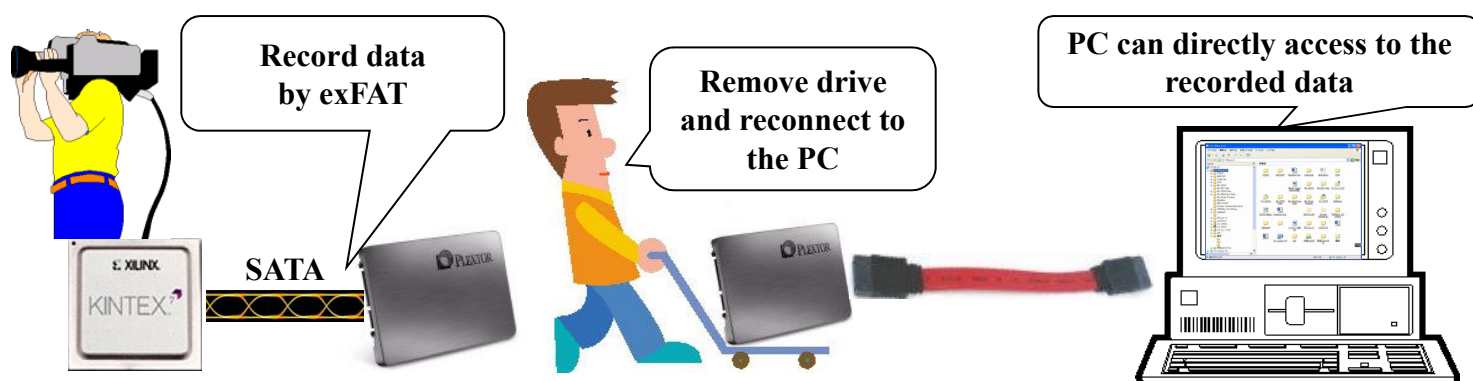
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Application merit of exFAT with SATA-IP 1

- **Direct access to the recorded data from the PC**
 - Record data as an exFAT file by this design application.
 - Remove drive and reconnect to SATA port of Host PC.
 - PC can detect drive and can access to the recorded file.



PC can directly access to the recorded data

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Application merit of exFAT with SATA-IP 2

- **Playback pattern data recorded by the PC**
 - Save pattern data to the drive as an exFAT file.
 - Remove drive and reconnect to the FPGA via SATA-IP.
 - FPGA can directly read data from the connected drive.



Data playback from FPGA saved by the PC

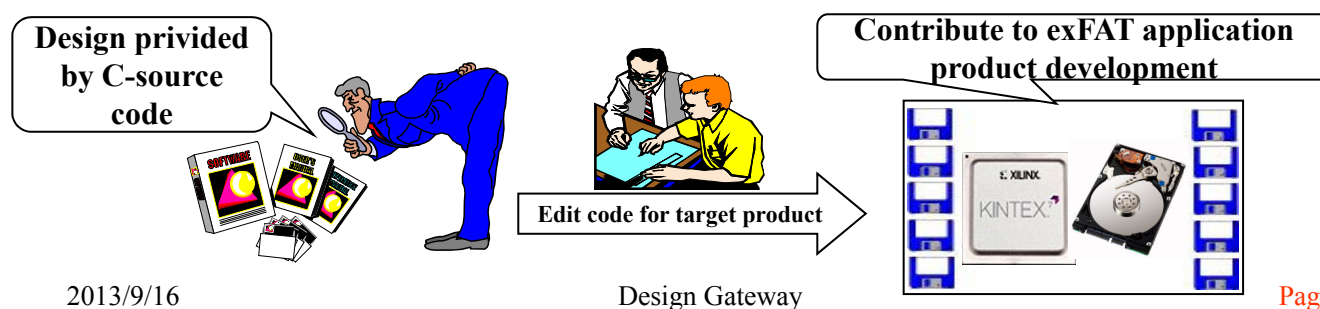
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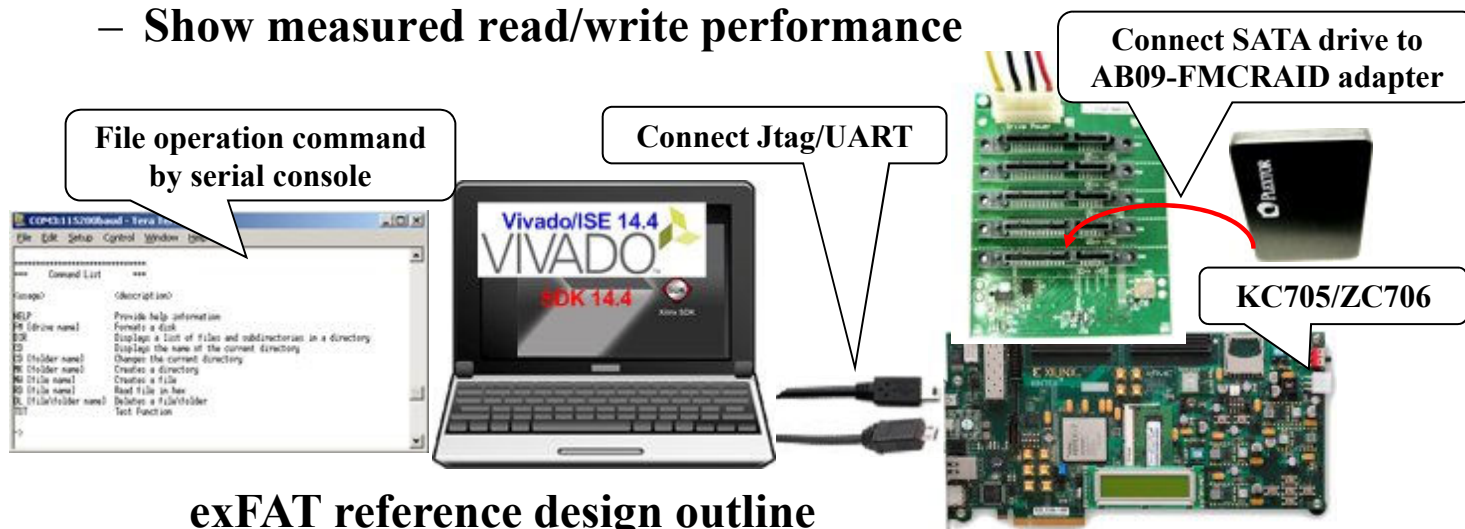
exFAT reference design summary 1

- **Reference design for Kintex-7/Zynq-7000**
 - Operation on KC705/ZC706+AB09-FMCRAID environment
 - Optional product for exFAT application development
- **Real read/write access to connected drive by exFAT**
 - PC can directly access to the drive when reconnected
 - Design provided by MicroBlaze firmware C-source code
 - User can apply C-source code to the final application product



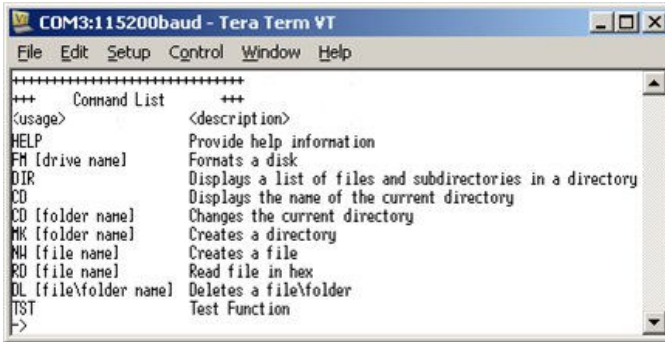
exFAT reference design summary 2

- **Same hardware as KC705/ZC706 reference design**
 - MicroBlaze firmware is modified for exFAT support
- **Serial console user interface for control**
 - Show measured read/write performance



exFAT reference design summary 3

- Cover basic command for exFAT operation
 - Read/write for file/dir (directory) operation
 - Help user to understand exFAT operation for target design
 - Can check exFAT compatibility by drive reconnection to PC



Command	Summary
HELP	Show command help
FM	Format a disk
DIR	Show file list in current directory
CD	Change current directory
MK	Create new directory
NW	Create new file
RD	Read file from disk
DL	Delete file/directory
TST	Test function

Basic command provided by this reference design

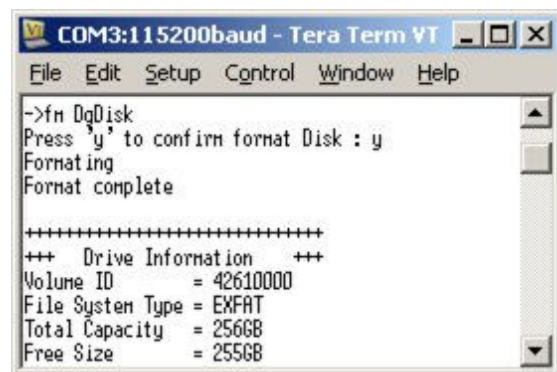
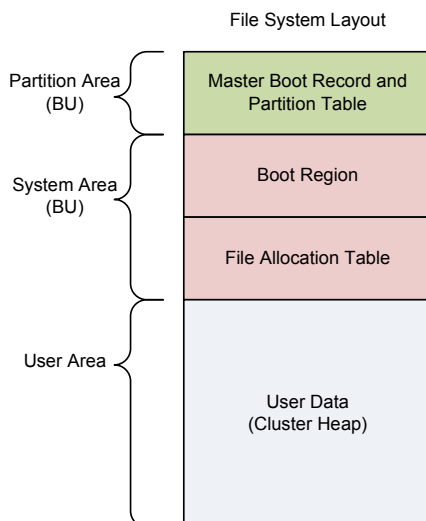
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Command detail 1: Format

- Format whole drive by exFAT
 - Show drive information after format completion



Example of format command

exFAT format image

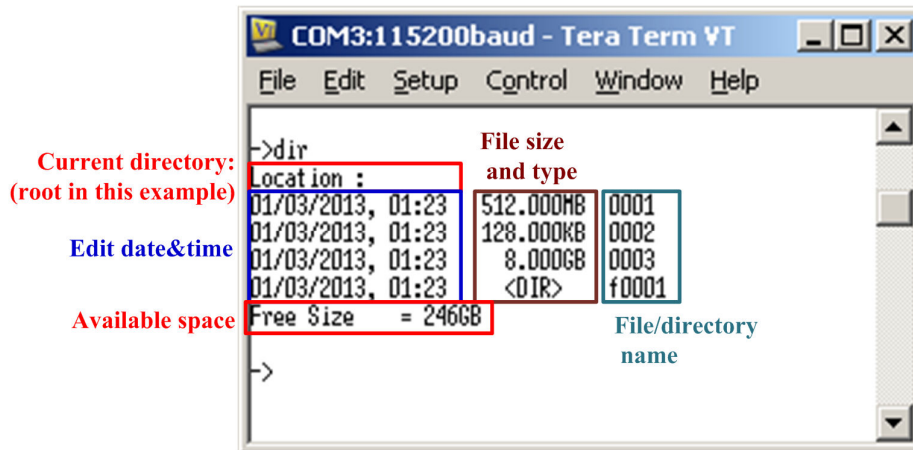
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Command detail 2: Display directory

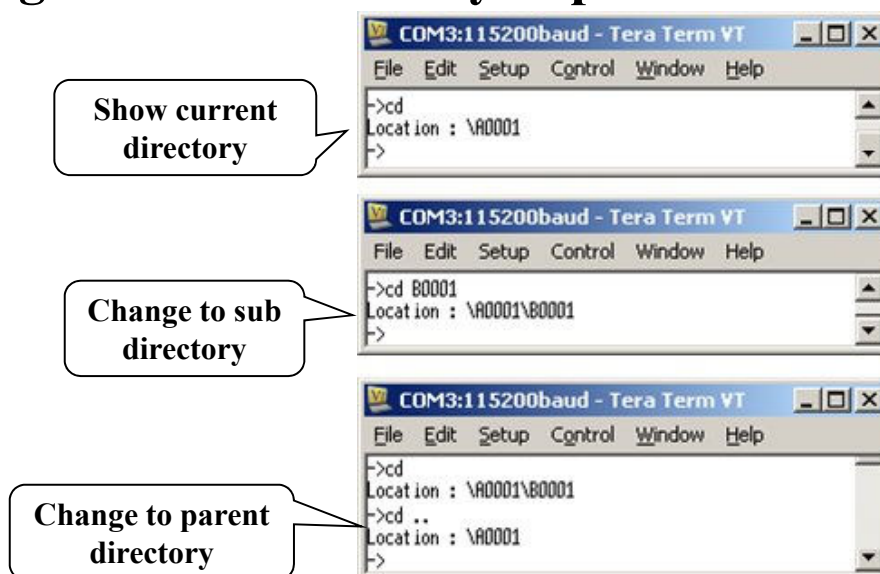
- Display file and sub dir information in current dir
 - Show file size, update date&time, type in a list
 - Show available free space in the drive



Example of display directory command

Command detail 3: Change current directory

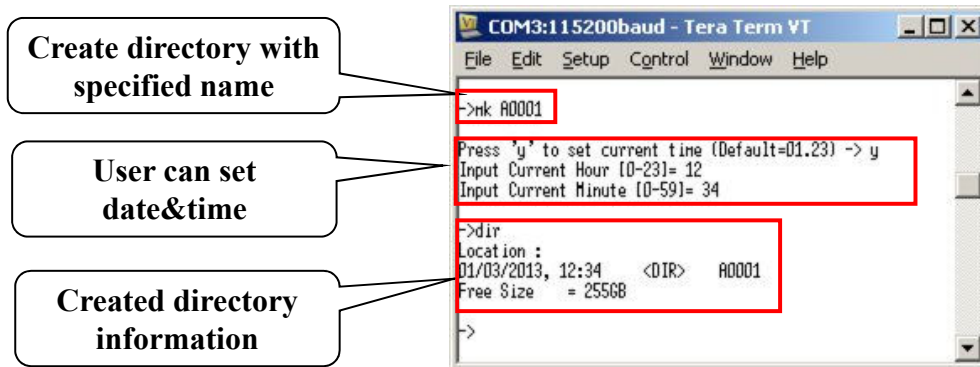
- Change current directory to parent dir or sub dir



Example of change directory command

Command detail 4: Create new directory

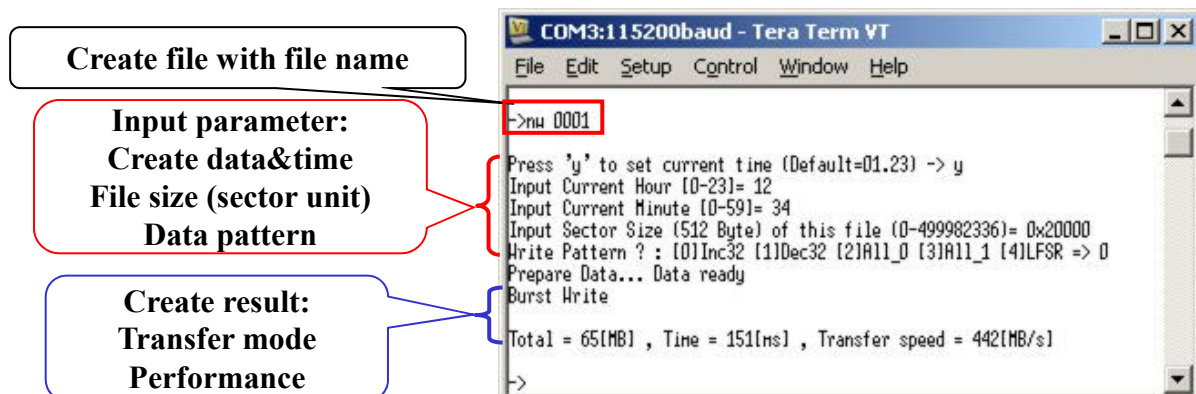
- Create sub directory under current directory
 - Directory name can be set up to 255 characters
 - User can set create date&time (user also can omit it)



Example of create directory command

Command detail 5: Create new file

- Create file in the current directory
 - User can specify data pattern in the file
 - User can specify file size by sector (512Byte) unit
 - Display create time (write performance) result



Example of create file command

Command detail 5: Create new file (cont'd)

- Switch write mode according to space distribution
 - Burst write mode if available space is continuous
 - Single write mode if available space is not continuous
 - Performance is much different by fragment distribution

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
->nu 0001
Press 'y' to set current time (Default=01.23) -> y
Input Current Hour [0-23]= 12
Input Current Minute [0-59]= 34
Input Sector Size (512 Byte) of this file (0-499982336)= 0x20000
Write Pattern ? : [0]Inc32 [1]Dec32 [2]A11_0 [3]A11_1 [4]LFSR => 0
Prepare Data... Data ready
Burst Write
Total = 65[MB], Time = 151[ms], Transfer speed = 442[MB/s]
->
  
```

Space is continuous (Burst mode)

```

COM3:115200baud
File Edit Setup Con
->nu 0010
Press 'y' to set current time (Default=01.23) -> y
Input Current Hour [0-23]= 23
Input Current Minute [0-59]= 59
Input Sector Size (512 Byte) of this file (1-463809024)= 0x20000
Write Pattern ? : [0]Inc32 [1]Dec32 [2]A11_0 [3]A11_1 [4]LFSR => 0
Prepare Data... Data ready
Available Size is not continuous
Single Write
Total = 65[MB], Time = 682[ms], Transfer speed = 98[MB/s]
->
  
```

Space is not continuous (Single mode)

Command detail 6: Read file

- Execute specified file read operation
 - Display file read time (read performance) result
 - Data verify is possible if file size is within 64MBytes

```

COM3:115200baud - Tera Term VT
File Edit Setup Control Window Help
->rd 0001
Select [1]-Read data [2]-Dump data : 1
Burst Read
Total = 65[MB], Time = 121[ms], Transfer speed = 552[MB/s]
Verify Pattern ? : [0]Inc32 [1]Dec32 [2]A11_0 [3]A11_1 [4]LFSR => 0
Verify Data ...Start check
Success
->
  
```

Read file with file name

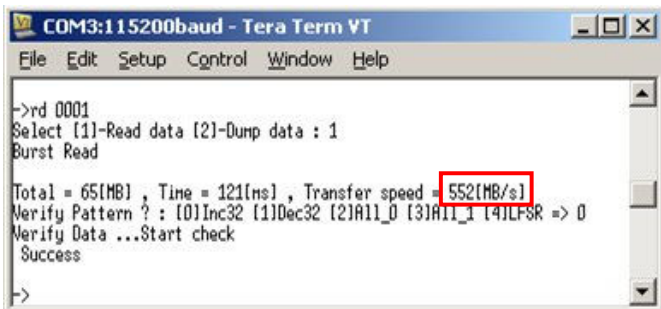
[1]-Read data=Check performance
[2]-Dump data=Dump file data

Display read performance
Data verify when file size is within 64MBytes

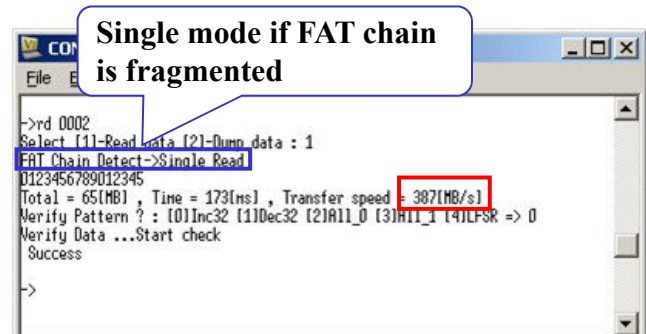
Example of read file command

Command detail 6: Read file (cont'd)

- Switch read mode according to FAT chain situation
 - Burst read mode if chain is continuous
 - Single read mode if chain is not continuous
 - Performance is much different by FAT chain fragmentation



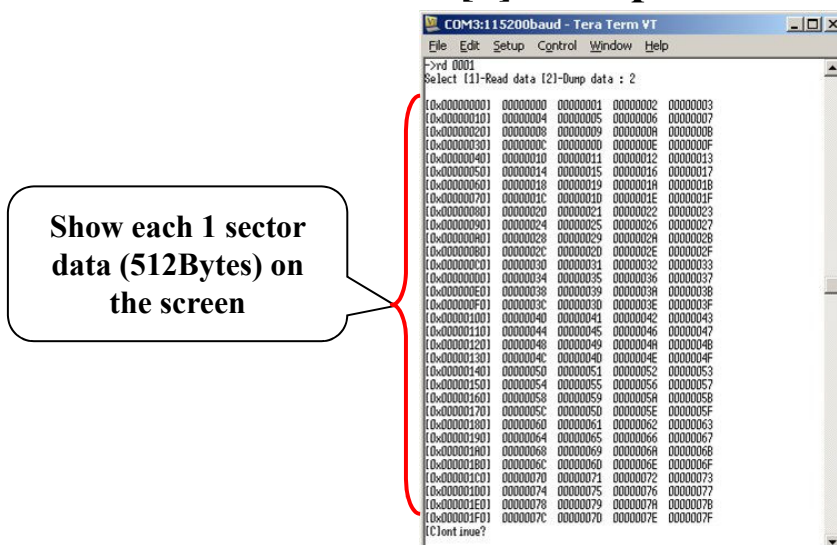
FAT chain is continuous (Burst mode)



FAT chain is not continuous (Single mode)

Command detail 6: Read file (cont'd 2)

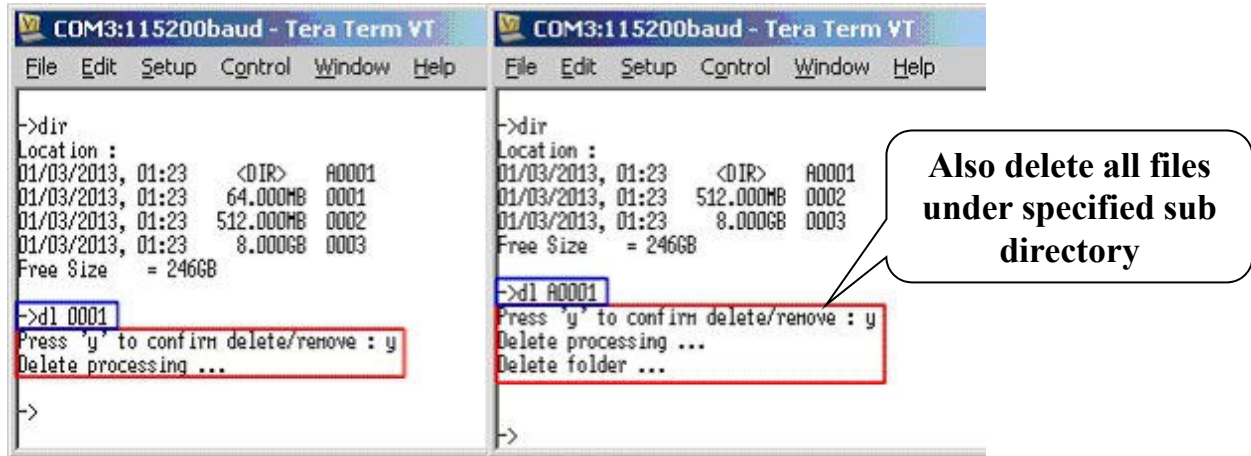
- Dump data to display data in the file
 - Show data when [2]-Dump data is selected



Example of dump data

Command detail 7: Delete file/directory

- Delete specified file/directory from current directory
 - Also delete all files under sub directory if exist

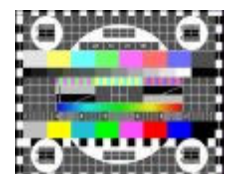


Delete file

Delete directory

Application Example

- High speed camera recorder
 - High-Vision image recording to SSD (More than 400MB/s)
 - Use exFAT format for recording operation
 - Reconnect SSD to PC and playback immediately
- High speed data pattern generator
 - Build data pattern by PC and save to SSD as exFAT file
 - Reconnect SSD to the FPGA
 - High speed read (500MB/s) and generate pattern



Sales and support condition

- **Sales condition of this reference design**
 - One project license (valid only for one project)
 - Required NDA contract before purchase
 - Supported SATA-IP core:
 - SATA-IP005 (for Kintex-7)
 - SATA-IP006 (for Zynq-7000)
- **Support condition of this reference design**
 - Support period is limited to 90 days after purchase
 - Supports only KC705/ZC706 + AB09-FMCRAID environment
 - Supports original design only (No support if any modification)
 - Needs problem reproduce procedure for support request

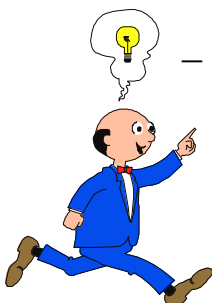
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For more detail

- **Detailed documents available on the web site.**
 - http://www.dgway.com/SATA-IP_X_E.html
- **Contact**
 - Design Gateway Co., Ltd.
 - E-mail : sales@design-gateway.com
 - FAX : +66-2-261-2290



The Expert of IP Core & Embedded

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SATA-IP core Support Spartan-6 & Virtex-6

SerialATA(SATA) IPCore compliant with the Serial ATA specification revision 2.6 and work on Xilinx Virtex-6 and Spartan-6 device. This IPcore provide link layer. Design Gateway provide transport layer and 20bit 150MHz RocketIO GTP physical layer design for 3.0Gbps SATA-II interface as reference design. It can connect with SATA-II HDD without PHY chip.

Design Gateway also provides SATA-IP for Altera [Go to SATA-IP <for Altera>](#)

Features

- Compliant with the Serial ATA specification revision 2.6
- Support both of SATA Host and SATA Device (Applicable to SATA Peripheral development)
- Simple transaction interface with Host processor or DMA Engine
- 32-bit internal data path
- 4KB FIFO implemented by BlockRAM in transmit and receive paths
- Support SATA-II (SATA-I support is also possible by PHY parameter settings change)
- Low frequency operation
 - IP Core clock 75.0MHz and PHY clock 150MHz for SATA-II
 - IP Core clock 37.5MHz and PHY clock 75MHz for SATA-I
- CONT primitive support for continue primitive suppression to reduce EMI
- Support 20bit width PHY implemented by VirtexS GTP

USB 3.0 IP Core

IP Core 開発 評価 基板 AB シリーズ

YouTube

8-bit IP Core

FPGA Configuration

SD LINK

FPGA Security

IP Lock

Alliance Partner

Xilinx

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Revision History

Rev.	Date	History
1.0	01-May-2013	English version initial release
1.1E	2013/9/13	Added Zynq-7000(ZC706) support