

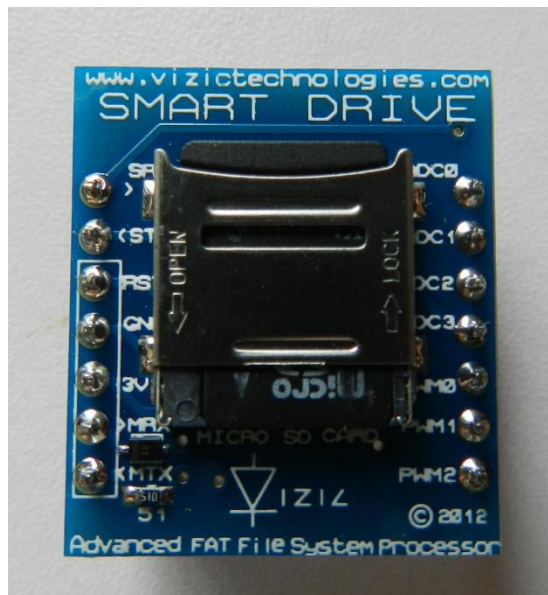


VIZIC  
TECHNOLOGIES

SMART  
DRIVE

Datasheet----Rev 1.0

# SMART DRIVE – Advanced FAT File System Processor Unit



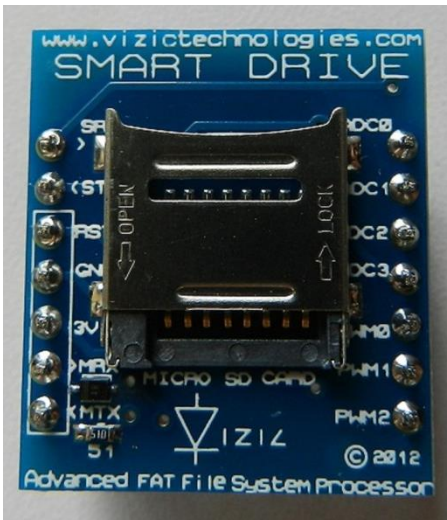
Smart DRIVE Bottom View



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## Introduction:



The Smart DRIVE is a powerful, high quality, easy to use professional FAT File System management processor with an easy to use serial UART interface. It's the perfect embedded tool to any data-logger application as it's the most complete and advanced FAT processor on the market + the unique that supports LFN(Long File Names). From a microSD card, the Smart DRIVE can Read, Write, Create, Rename, Move, Copy, set Date, set Time, Modify, list files and much more from Files and Directories/Folders.

The module offers a simple, yet effective serial UART interface to any host micro-controller(8051, PIC, ATMEL, FREESCALE, STMICRO, ARM, CORTEX, ARDUINO, FPGA, MBED, or PC(USB-UART SX)). All Data Management related functions can be called using simple commands via the serial interface.

The Smart DRIVE processor doesn't need any configuration or programming on itself, it's a slave device that only receives orders, reducing and facilitating dramatically the code size, complexity and processing load on your favorite main processor. The module has an on board microSDHC memory card socket with up to 32GB of data storage capacity with the integrated FAT/FAT12/FAT16 and FAT32 windows PC universal format.

In addition, the Smart DRIVE has an extra Serial Port(UART), 4 ADC(Analog to Digital Converters) channels to easy log analog values, 3 PWM channels to directly drive servos, control motors, fade LEDs or any other application that requires PWM.

The main goal of the Smart DRIVE it's to bring a very easy way to add high storage capabilities and universal FAT system to any application or project like "data loggers", without the user having experience in handling FAT file system management.

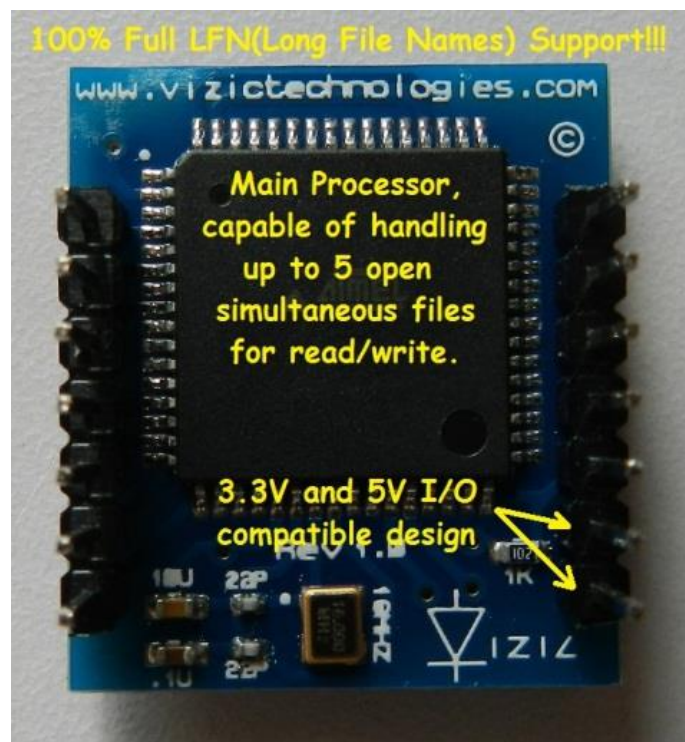
**Features:**

- Read, Write, Modify, Create, Erase, Copy, set Time, set Date, and many other functions on Files and Directories/Folders.
- Long File Names (LFN) up to 255 characters support.
- Up to 5 open files for read/write simultaneously.
- Easy 5 pin interface to any host device: **VCC, TX, RX, GND, RESET.**
- 9600 up to 2000000 Baud Rate speeds, 8 bits, no parity, 1 stop bit + an extra/auxiliary serial port (UART).
- On-board uSD/uSDHC memory card socket with FAT (windows PC), Support up to 32GB for storing thousands of files and directories. No need of special/rare file format.
- Full Directories and folder management support.
- 4 **ADC**(10 bit) Analog to Digital Converter channels for easy log analog data.
- 3 **PWM**(pulse width modulation) channels for direct servo, motor, LEDs or any other PWM control needs.
- Sleep mode.
- 5V and 3V3 I/O compatible, 3V3 power supply, ultra-low current consumption.

**Applications:**

- Embedded Data Logger systems.
- Point of sale/terminals.
- Temperature logging, green houses.
- Battery powered audio systems, with FAT management.
- Automotive, parking, GPS navigation systems.
- Robotics, industrial control.
- Traffic facilities: Toll gates, parking lots.
- Home automation and domestic appliances.
- Elevator, Security, Access-Control, Warning devices.
- Toys, learning tools, electronic books, gaming.
- GPS type data storage.

## SMART DRIVE-EXPLAINED:



## 1.-Host Interface

The SMART DRIVE must be used as a slave peripheral device, providing a bidirectional serial interface to a host controller via its UART(Universal Asynchronous Receiver - Transmitter) by it's main MTX and MRX port.

Any microcontroller or processor (AVR, PIC, BASICstamp, ARDUINO, 8051, MBED, FPGA, ARM, STmicro, etc) or PC(by serial interface RS232) as host, can communicate to the device over this serial interface.

The SMART DRIVE doesn't need to be configured in any way; it's a plug-and-play device, could be used by students, up to industrial and professional applications, its compatible with any device and existing development board with a UART.

*The serial protocol is universal and very easy to implement.*

***Serial Data Format: 8 Bits, No Parity, 1 Stop Bit.***

***BaudRate: 9600 bps (can be selected, up to 2000000bps).***

***Serial data is true and not inverted.***

### 1.1 Command Protocol: Flow Control

The SMART DRIVE Advanced FAT File System Processor Unit is a slave device and all communication and events must be initiated first by the host. Commands consist of a sequence of data bytes beginning with the command/function byte.

When a command is sent from host to the device, this process the command and when the operation is completed, it will always return a response\*. The device will send back a single acknowledge byte called the ACK (4Fhex, 'O' ascii), in the case of success, or NAK (46hex, 'F' ascii), in the case of failure or not recognized command.

\* Commands having specific responses may send back varying numbers of bytes, depending upon the command and response. It will take the device a certain amount of time to respond, depending on the command type and the operation that has to be performed.

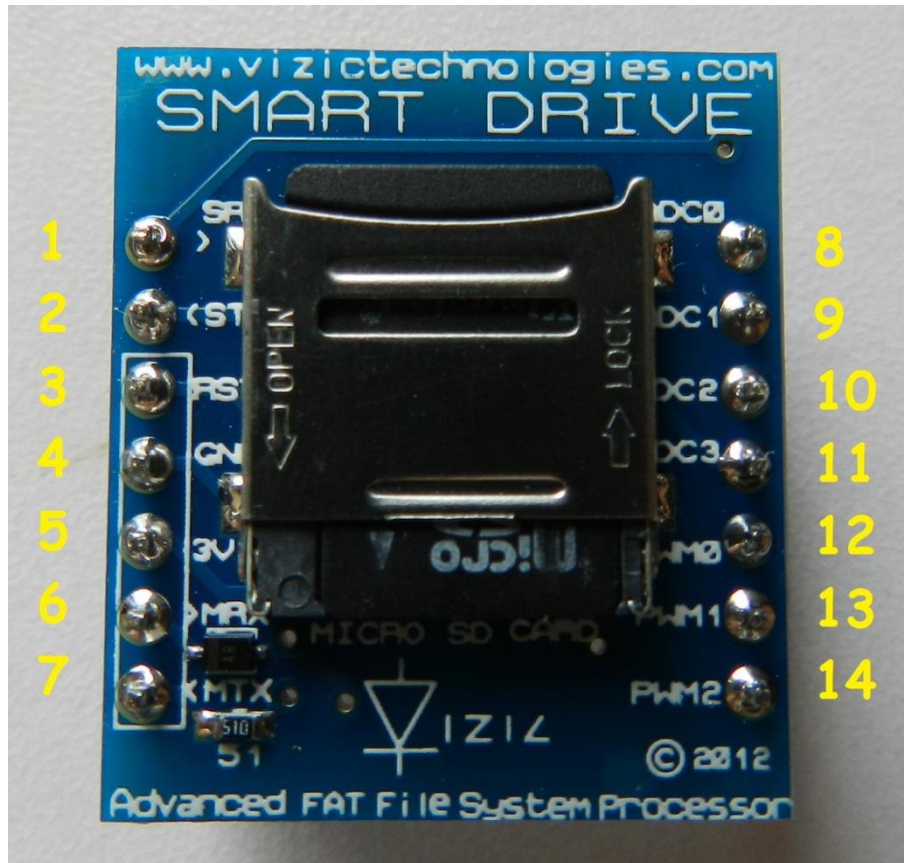
### 1.2 Power-up, Reset and Serial Set-up

When the SMART DRIVE device comes out of a power up or external reset, a 200ms delay before sending any command must be met, do not attempt to communicate with the module before this period. Any command could be sent after this point.

The SMART DRIVE is configured to always initialize at a standard **baud rate of 9600 bps**. Any other baudrate speed can be set after this initialization.



### 1.3 Pin configuration

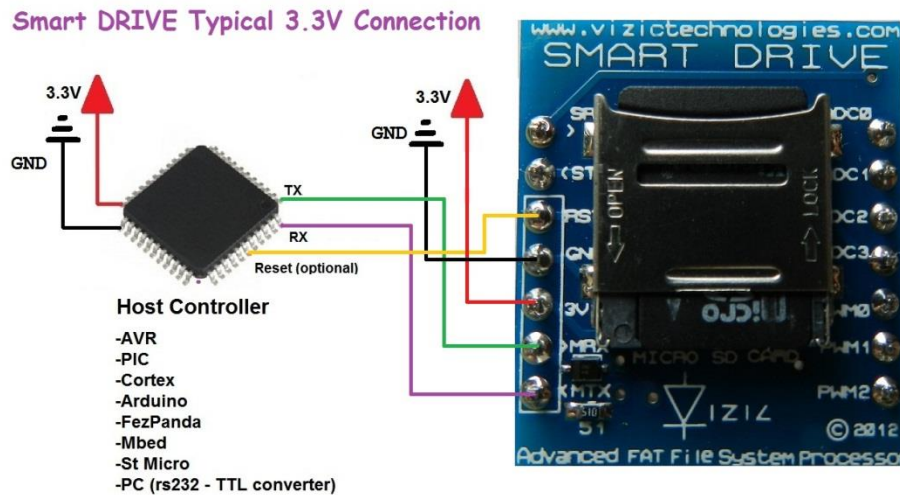


Pin	Symbol	I/O	Description
1	Auxiliary Receiver In 3.3V	In	Asynchronous Auxiliary serial receiver Input Pin for 3.3V logic only. (Always place a series 500ohm-1Kohm resistor to protect pin).
2	Auxiliary Transmitter Out 3.3V/5V	Out	Asynchronous Auxiliary serial transmit Output Pin for 3.3V logic, 5V compatible. (Always place a series 500ohm-1Kohm resistor to protect pin).
3	Reset	In	Master reset signal, Internally pulled-up to 3.3V via a 20K resistor. An active low pulse greater than 100ns will reset the module. 5V-9V tolerant input.
4	Ground	In	Supply Ground.

<b>5</b>	<b>VCC 3.3V</b>	<b>In</b>	Main voltage supply, 2.7v-3.6v.
<b>6</b>	<b>Master Receiver In 3.3V/5V</b>	<b>In</b>	Asynchronous Master serial receiver Input pin for 3.3V logic, 5V tolerant input.
<b>7</b>	<b>Master Transmitter Out 3.3V/5V</b>	<b>Out</b>	Asynchronous Master serial transmit Output pin, for 3.3V logic, 5V compatible.
<b>8</b>	<b>ADC Channel 0</b>	<b>In</b>	Analog Input pin, 10-bit high precision ADC, internally referenced to VCC and GND.
<b>9</b>	<b>ADC Channel 1</b>	<b>In</b>	Analog Input pin, 10-bit high precision ADC, internally referenced to VCC and GND.
<b>10</b>	<b>ADC Channel 2</b>	<b>In</b>	Analog Input pin, 10-bit high precision ADC, internally referenced to VCC and GND.
<b>11</b>	<b>ADC Channel 3</b>	<b>In</b>	Analog Input pin, 10-bit high precision ADC, internally referenced to VCC and GND.
<b>12</b>	<b>PWM Channel 0</b>	<b>Out</b>	Digital Out pin, 30Hz-2000000Hz frequency PWM, full and independent duty cycle selector. (Always place a series 500ohm-1Kohm resistor to protect pin).
<b>13</b>	<b>PWM Channel 1</b>	<b>Out</b>	Digital Out pin, 30Hz-2000000Hz frequency PWM, full and independent duty cycle selector. (Always place a series 500ohm-1Kohm resistor to protect pin).
<b>14</b>	<b>PWM Channel 2</b>	<b>Out</b>	Digital Out pin, 30Hz-2000000Hz frequency PWM, full and independent duty cycle selector. (Always place a series 500ohm-1Kohm resistor to protect pin).

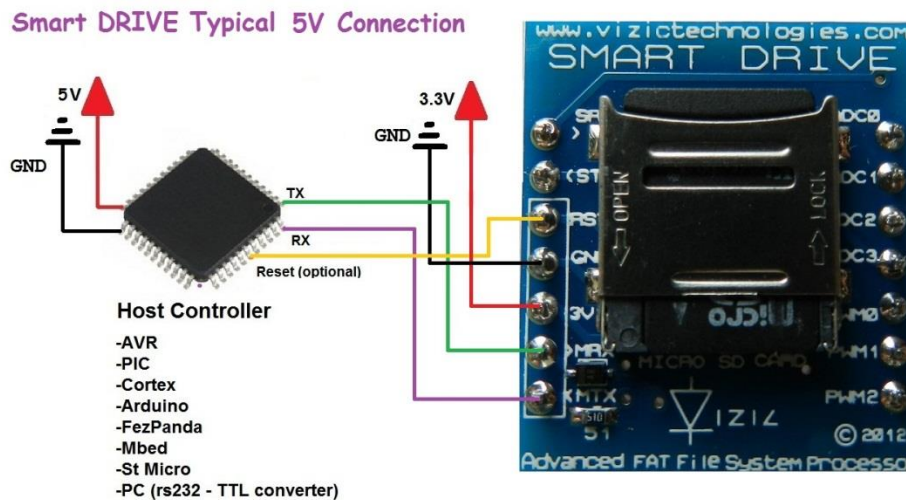
## 1.4 TYPICAL CONNECTION: for Single 3.3V

\*The SMART DRIVE must always be powered with 2.7V-3.6V (Reset and RX pin are 5V tolerant). Could be easily powered with 2AA size (1.5V) batteries.



## 1.5 TYPICAL CONNECTION: for 5V and 3.3V

\*The SMART DRIVE must always be powered with 2.7V-3.6V (Reset and RX pin are 5V tolerant). Could be easily powered with 2AA size (1.5V) batteries.



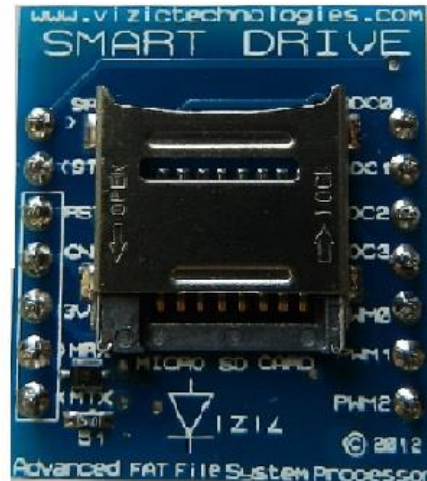
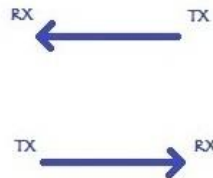
## 2. SMART DRIVE Command Set - Software Interface Specification

As mentioned before the command interface between the SMART DRIVE and the host is via the serial interface UART.

A list of very easy to learn commands provide complete access to all the available functions. Commands and responses can be a single byte or a byte package. All commands always return a response, either a single ACK, or data followed by an ACK.

*Remember all commands start with a uppercase letter (ascii).*

- 8051
- PIC
- ATMEL
- FREESCALE
- STMICRO
- FPGA
- ARDUINO
- ARM
- BASIC STAMP



Main Processor:

- main application processing.
- math processing
- I/O processing

VS

SMART DRIVE Processor:

- FAT System Management
- File/Folder sync
- Low level SD communication
- PWM output processing
- ADC processing
- FAT System Tasks
- And more...

## 2.1 Command summary

For detailed information on those commands, be sure to check the Smart DRIVE **COMMAND SET sheet**. Available to download on the web site.

### General Commands:

- Initialize –Mount/Unmounts SmartDRIVE – **55hex ‘U’**
- Get bytes from Secondary USART – **42hex ‘B’**
- Transmit bytes to Secondary USART – **4Bhex ‘K’**
- ADC or PWM action – **41hex ‘A’**
- Sleep Mode – **5Ahex ‘Z’**
- Set Master/Secondary USART BaudRate – **58hex ‘X’**

### Fat Management – General Functions:

- Get Drive Used/Free Space – **46hex ‘F’**
- List/Count of Files/Folders – **4Chex ‘L’**
- Get Name of File/Folder # – **47hex ‘G’**
- Get Current Directory Path – **48hex ‘H’**

### Fat Management – File Functions:

- Open File – **4Fhex ‘O’**
- New File – **4Ehex ‘N’**
- Close File – **43hex ‘C’**
- Read Data from File – **52hex ‘R’**
- Write Data to File – **57hex ‘W’**
- Sync File – **53hex ‘S’**
- Set/Get File Pointer Pos – **50hex ‘P’**
- Truncate File Size – **56hex ‘V’**
- Get File Attribute/Size – **49hex ‘I’**
- Erase/Delete File – **45hex ‘E’**
- Set/Get File Time-Date – **54hex ‘T’**
- Re-Name/Move File – **4Dhex ‘M’**
- Copy File – **59hex ‘Y’**
- Test End Of File/Error – **51hex ‘Q’**

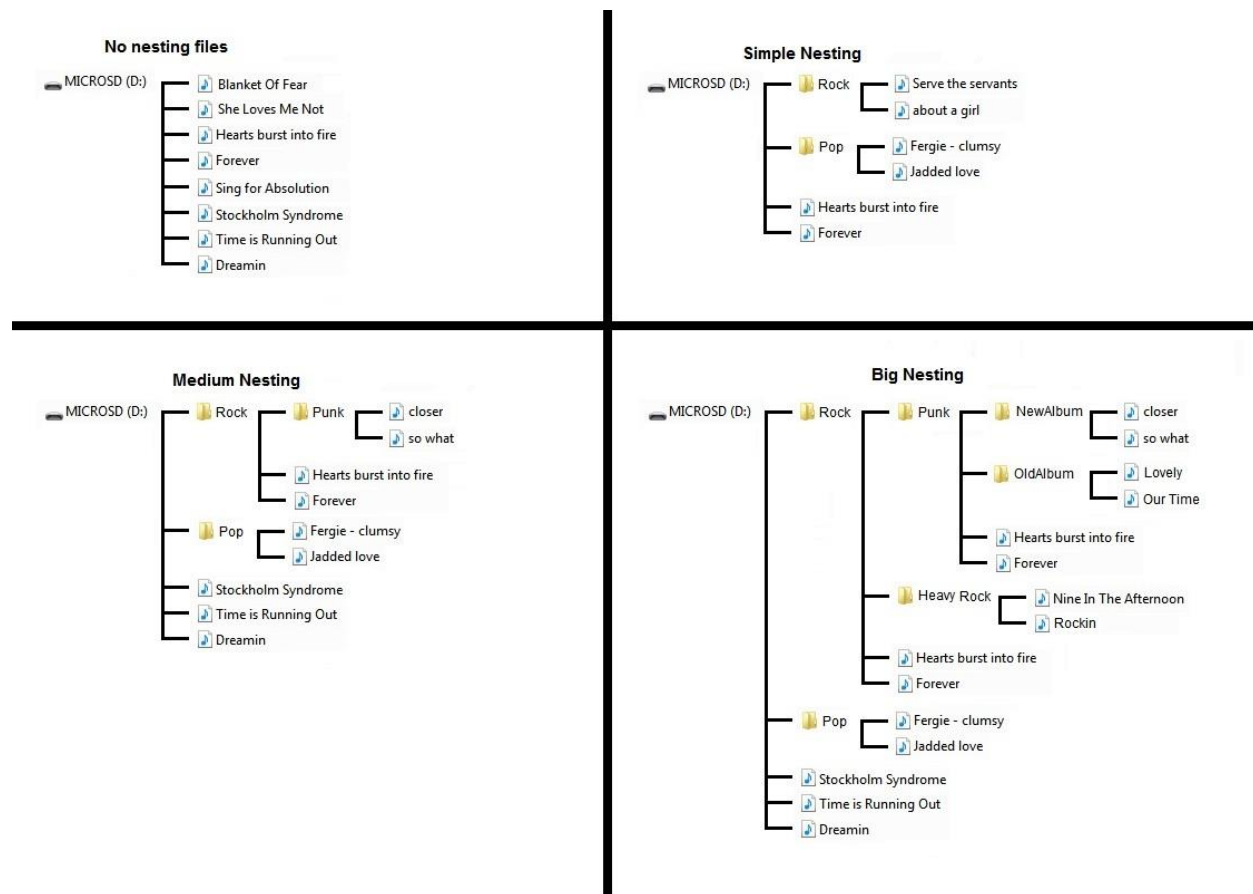
### Fat Management – Folder/Dir Functions:

- Open/Enter Folder/Dir – **44hex ‘D’**
- New Folder/Dir – **4Ehex ‘N’**
- Erase/Delete Folder/Dir – **45hex ‘E’**
- Re-Name Folder/Dir – **4Dhex ‘M’**

### 3 Micro SD File/Folder organizations

The Smart DRIVE is capable of managing files and folders, so a complete FAT File System organization can be achieved inside the micro SD card. Also the Smart DRIVE could access nested folders for example: "0:/rock/punk/oldies/song.wav".

The next image gives some examples of files/folders organization/nesting that can be achieved and accessed with the Smart DRIVE processor; up to X folder nesting is allowed, as long as path name + file name <255 characters:



## 4 Micro SD card file management

As mentioned before, the SMART DRIVE is capable of managing files directly in FAT/FAT12/FAT16 or FAT32 file systems without any special program/interface or micro SD rare formats.

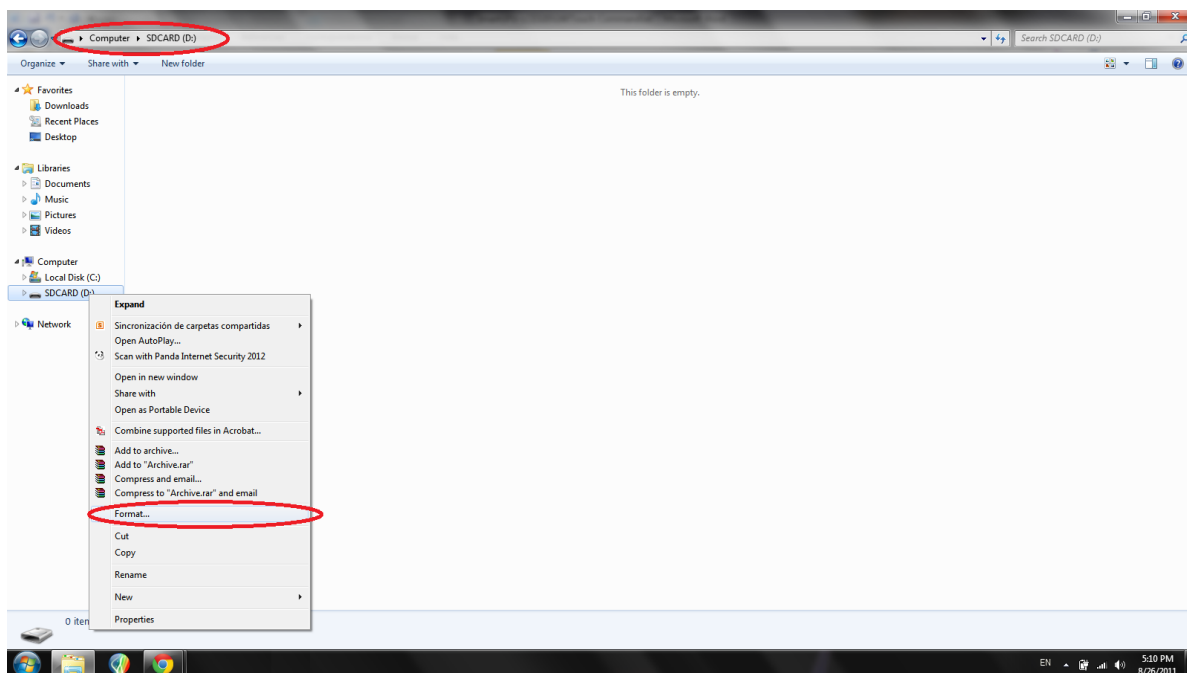
A maximum of 32GBs micro SD memory card is supported, allowing storing thousands of files and folders.

The files are fully format compatible with any PC, LFN file names can be used without any restriction, when **calling/opening** files with the Smart DRIVE, the module is not case sensitive, so it doesn't distinguish between upper case and lower case.

### 4.1 Formatting the micro SD card for first use

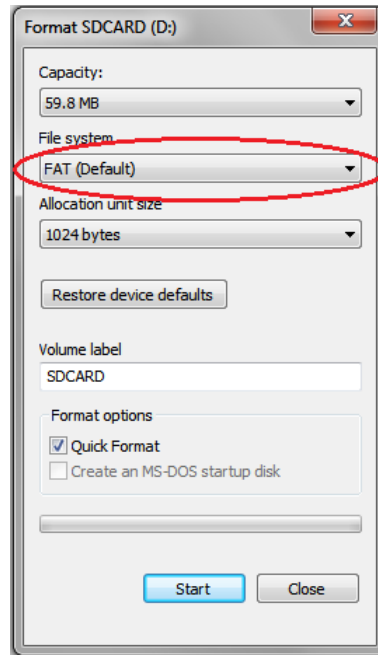
It is recommended but not necessarily to format the micro SD card for first use, in this section a format to new micro SD card to FAT format is explained.

**1.- Open a new windows explorer right click on the microSD card and a menu appears, select the “FORMAT...” and click on it. (Note that formatting a micro SD card will erase all the contents of it).**

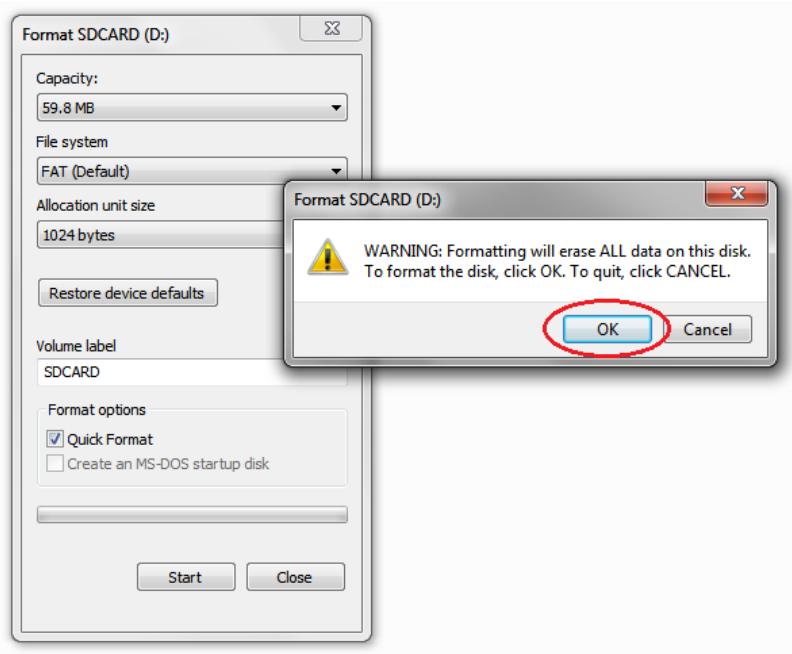




2.- A new window will pop-up, chose **FAT(default)** on the File System menu, and click start.

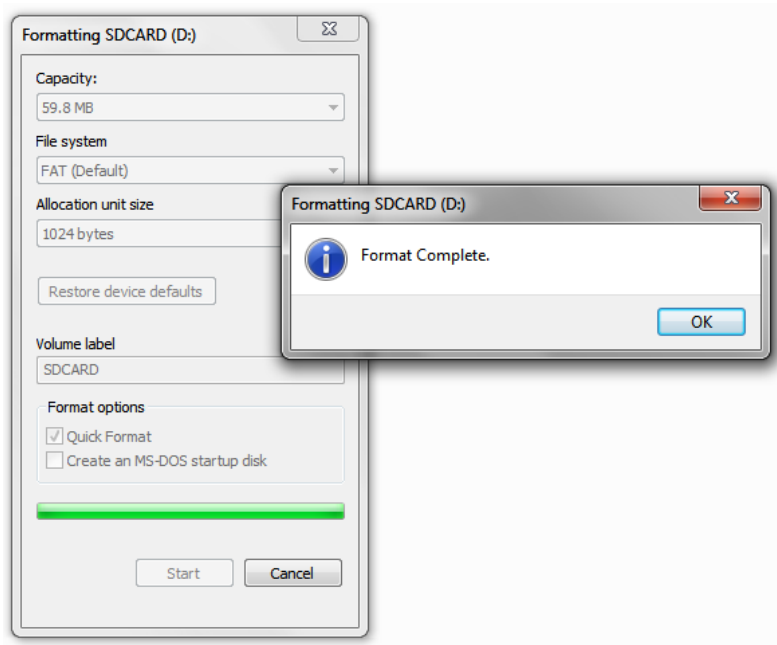


3.- Click OK on the new window and wait to the PC to perform the format.

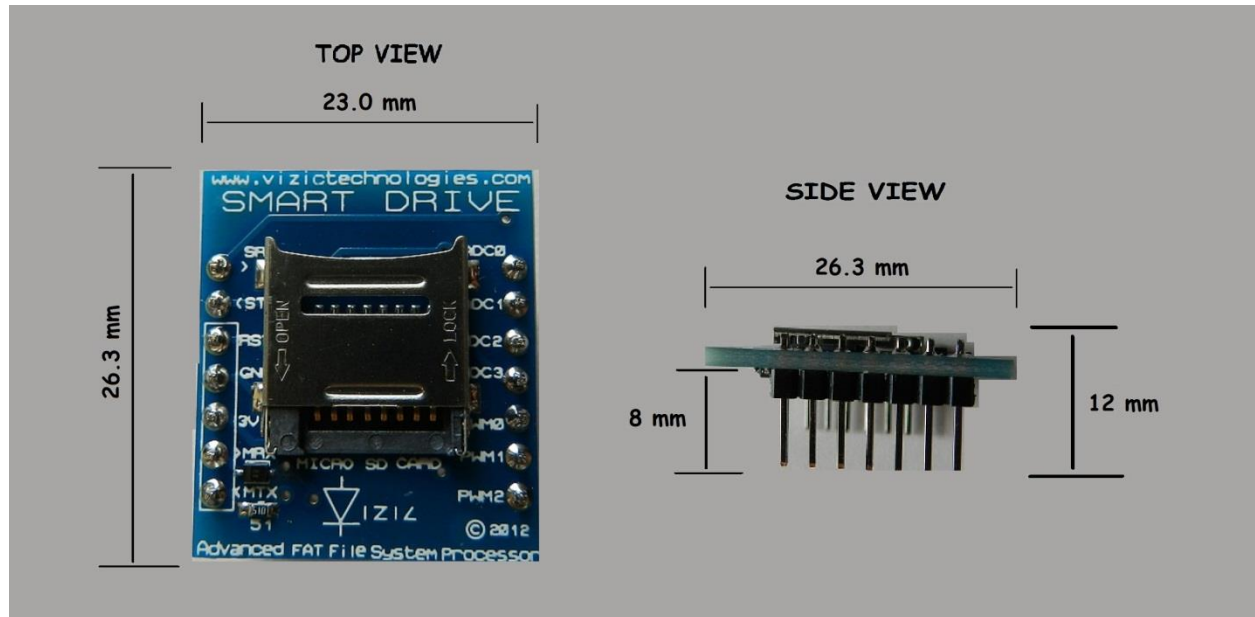




#### 4.- Now the microSD card is ready to load Folders and Files!



## 5 Mechanical dimensions



*All units are in mm.*

## 6 Specifications and ratings:

### Absolute Maximum Ratings\*

Operating Temperature.....	-55°C to +125°C
Storage Temperature .....	-65°C to +150°C
Voltage on any Pin except $\overline{\text{RESET}}$ and Master Rx Pin with respect to Ground .....	-0.5V to $V_{CC}+0.5V$
Voltage on $\overline{\text{RESET}}$ and Master Rx Pin .....	-0.5V to +10.0V
Maximum Operating Voltage .....	3.6V
DC Current per I/O Pin .....	40.0 mA
DC Current $V_{CC}$ and GND Pins.....	200.0 - 400.0mA

\*NOTICE: Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### DC Characteristics.

Symbol	Parameter	Condition	Min	Typ <sup>(1)</sup>	Max	Units
$V_{IL}$	Input Low-voltage	ALL pins	-0.5		$0.2V_{CC}^{(3)}$	V
		$\overline{\text{RESET}}$ pin	-0.5		$0.2V_{CC}^{(3)}$	V
$V_{IH}$	Input High-voltage	ALL pins	$0.7V_{CC}^{(2)}$		$V_{CC}+0.5$	V
		$\overline{\text{RESET}}$ pin	$0.9V_{CC}^{(2)}$		$V_{CC}+0.5$	V
$V_{OL}$	Output Low Voltage (Except Reset pin)	$I_{OL} = 5 \text{ mA}$ , $V_{CC} = 3V$			0.5	$\frac{V}{V}$
$V_{OH}$	Output High-voltage (Except Reset pin)	$I_{OH} = -5 \text{ mA}$ , $V_{CC} = 3V$	2.5			$\frac{V}{V}$
$I_{IL}$	Input Leakage Current I/O Pin	$V_{CC} = 3V$ , pin low (absolute value)		< 0.05	1	$\mu A$
$I_{IH}$	Input Leakage Current I/O Pin	$V_{CC} = 3V$ , pin high (absolute value)		< 0.05	1	$\mu A$
$R_{RST}$	Reset Pull-up Resistor		30		60	$k\Omega$
$R_{PU}$	I/O Pin Pull-up Resistor		20		50	$k\Omega$
$I_{CC}$	Power Supply Current	$V_{CC} = 3V$		10	15	mA
	Sleep mode	$V_{CC} = 3V$		4	10	$\mu A$

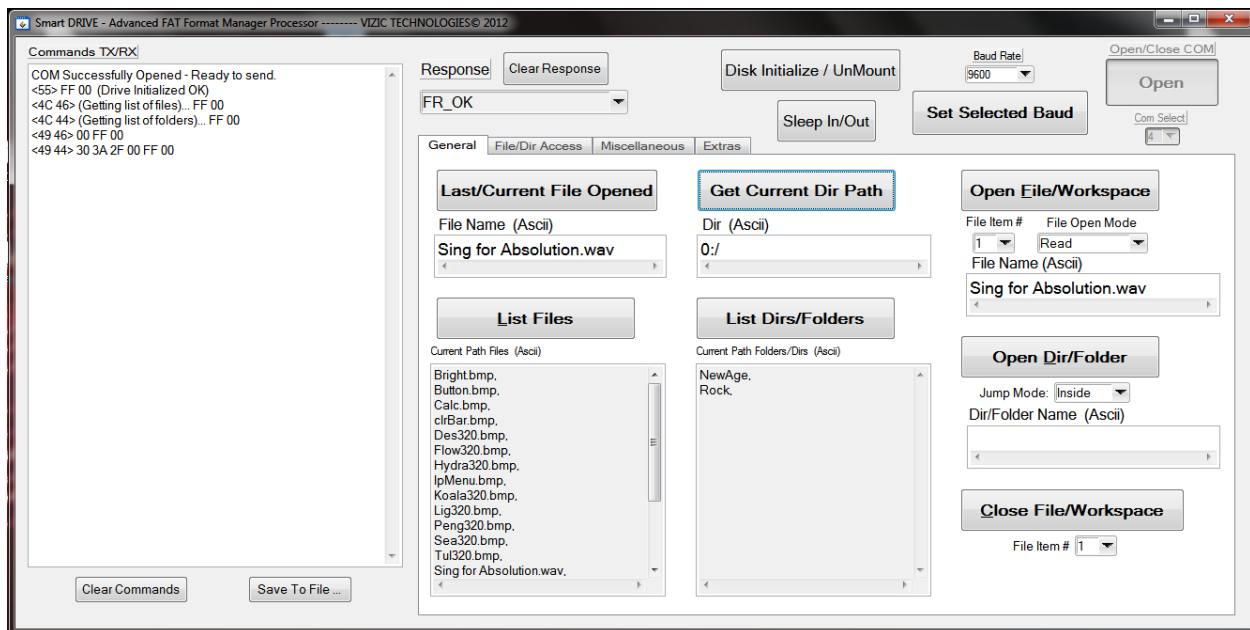
Notes: 1. Typical values at +25°C.  
 2. “Min” means the lowest value where the pin is guaranteed to be read as high.  
 3. “Max” means the highest value where the pin is guaranteed to be read as low.

## 7 Development software tools

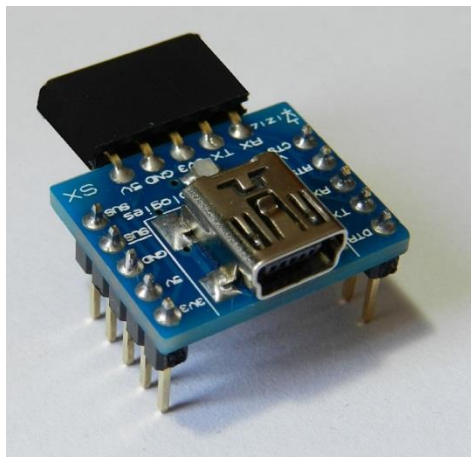
In order to make easier the learning about how to communicate with the SMART DRIVE it's highly recommended to download the free "SmartDRIVE PC Interface" software and use it in any PC. This software simulates in real time all of the functions of the SMART DRIVE. This is achieved by connecting the **USB-UART SX** Bridge to the SMART DRIVE enabling real FAT management and processing.

This software greatly reduces the time of learning the commands, and helps the user to understand how commands are created.

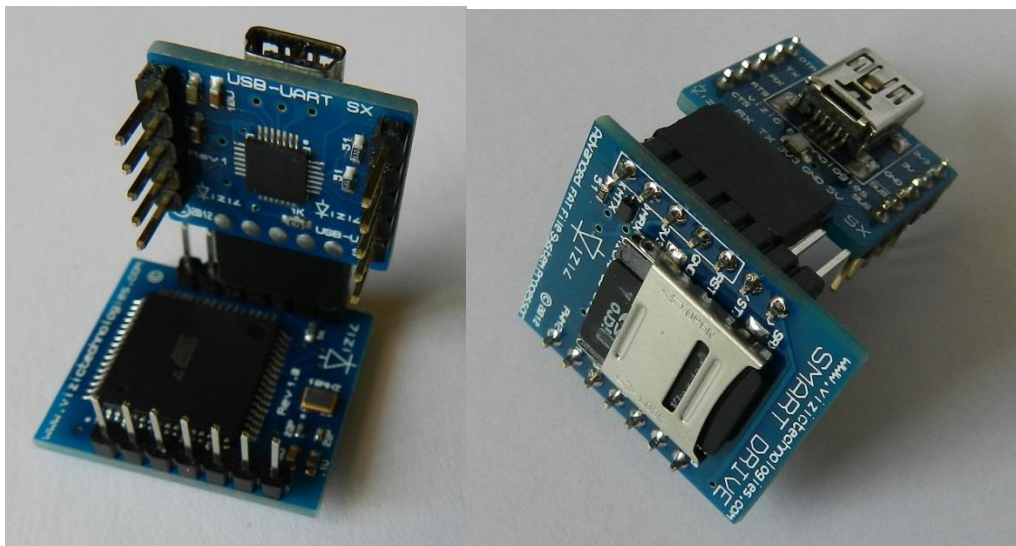
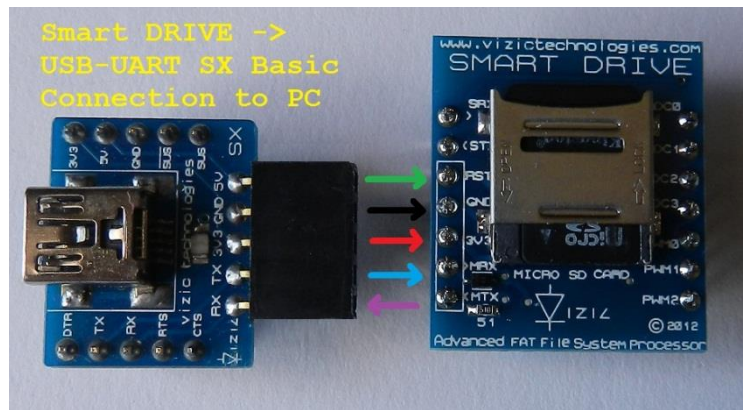
Smart DRIVE PC Interface:



The USB-UART SX:



### Smart DRIVE connection to the USB-UART SX



For detailed information about this software and how to use it, please refer to the “SMARTDRIVE-PCsimulation.pdf” sheet that could be downloaded in the web site.

For detailed information about the USB-UART SX bridge, please visit our web site.

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