

SD-IDE40 Manual

microSD/TransFlash™ to ATA BUS Adapter

Manufactured by
TRI-M ENGINEERING
Engineered Solutions for Embedded Applications

Technical Manual

P/N: SD-IDE40-MAN
Revision: 2 October 2006

TRI-M ENGINEERING
1407 Kebet Way, Unit 100
Port Coquitlam, BC V3C 6L3
Canada
<http://www.Tri-M.com>
Tel 604.945.9565
North America 800.665.5600
Fax 604.945.9566

CHAPTER 1: INTRODUCTION	4
1.1 GENERAL DESCRIPTION	4
1.2 SPECIFICATIONS	5
1.2.1 IDE interface	5
1.2.2 SD Interface	5
1.2.3 Power input	5
1.2.4 microSD/TransFlash™	5
1.2.5 Mechanical/Environmental	5
CHAPTER 2: EMBEDDED FEATURES	6
2.1 PUSH/PUSH CONNECTOR WITH CARD DETECT	6
2.2 BICOLOR LED	6
2.3 HARDWARE TRANSLATION	6
2.4 MICROSD/TRANSFLASH™ TO SD ADAPTER	6
2.5 MECHANICAL CLEARANCE	6
2.6 SOFTWARE COMPATIBILITY	6
CHAPTER 3: INSTALLATION	7
3.1 LOCATING THE CONNECTORS AND LED	7
CHAPTER 4: LED	8
4.1 LED INDICATOR(LED1)	8
CHAPTER 5: CONNECTORS	9
5.1 INPUT POWER CONNECTOR(CN1)	9
5.2 ATA CONNECTOR (CN4)	9
5.3 MICROSD/TRANSFLASH™ CONNECTORS (CN5 AND CN6)	11
CHAPTER 6: INTERFACE	12
6.1 SUPPORTED ATA COMMAND	12
CHAPTER 7: MICROSD/TRANSFLASH™	13
7.1 DESCRIPTION	13
7.2 SD COMPATIBILITY	13
CHAPTER 8: LITERATURE REFERENCES	14
8.1 AT BUS DESIGN	14
8.2 PERSONAL COMPUTER BUS STANDARD P996	14
8.3 PC INTERRUPTS	14
8.4 PC/104 CONSORTIUM	14
8.5 SD IDE BRIDGE CONTROLLER DATASHEET	14
8.6 SANDISK SD CARD PRODUCT MANUAL	14

PREFACE

This manual is for integrators of applications of embedded systems. It contains information on hardware requirements and interconnection to other embedded electronics.

DISCLAIMER

Tri-M Engineering makes no representations or warranties with respect to the contents of this manual, and specifically disclaims any implied warranties of merchantability or fitness for any particular purpose. Tri-M Engineering shall under no circumstances be liable for incidental or consequential damages or related expenses resulting from the use of this product, even if it has been notified of the possibility of such damages. Tri-M Engineering reserves the right to revise this publication from time to time without obligation to notify any person of such revisions. If errors are found, please contact Tri-M Engineering at the address listed on the title page of this document.

COPYRIGHT © 2005-10-2 TRI-M ENGINEERING

No part of this document may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual, or otherwise, without the express written permission of Tri-M Engineering.

CHAPTER 1: INTRODUCTION

1.1 GENERAL DESCRIPTION

The SD-IDE40 is a compact board design to interface up to two microSD/TransFlash™ to a 40 pin header IDE connector. It has two microSD/TransFlash™ connectors with card detection allowing different combinations (Master, Slave, Master+Slave) without setting jumpers. The SD-IDE40 acts as a true hardware bridge, allowing the microSD/TransFlash™ to be seen as a hard-drive by the host computer without a software driver. It also allows the host computer to use a microSD/TransFlash™ as a bootable device. It has very low power consumption and supports PIO1 to PIO4 and UDMA 3 for fast data transfer.

1.2 SPECIFICATIONS

1.2.1 IDE interface

- Directly pluggable to an IDE 40 pin header.
- Hardware bridging between IDE and microSD/TransFlash™.
- OS installable to microSD/TransFlash™.
- Bootable from microSD/TransFlash™.
- Support PIO 0-4 and Ultra DMA 3 mode.

1.2.2 SD Interface

- Support up to two microSD/TransFlash™ (Master/Slave).
- Compliant with SD Host Controller Standard Specification Ver. 1.1.
- Support microSD/TransFlash™ up to 1G.
- Support microSD/TransFlash™ 1bit and 4bit modes.

1.2.3 Power input

- +5VDC using hard-drive power to SD-IDE40 adapter.
- Low power consumption.

1.2.4 microSD/TransFlash™

- 64MB, 128MB, 256MB, 512MB, 1GB and 2GB models available.
- Low power consumption automatic power down and wake up.
- On card error correction and wear leveling.
- Extremely small 11x15x1(mm).
- SD card adapter available
- low cost.

1.2.5 Mechanical/Environmental

- Dimension: 2.14" x .595" x .430" (54.4mm x 15.1mm x 10.9mm)
- Operating temperature -40° to 185°F (-40° to 85°C)
- Storage temperature: -67° to 185°F (-55° to 150°C)
- Weight: 0.017 LB. (7.8G)

CHAPTER 2: EMBEDDED FEATURES

2.1 *Push/push connector with card detect*

- Push the microSD/TransFlash™ in to lock the card.
- Push the locked microSD/TransFlash™ to eject the card.
- A built-in switch into the connector allows the controller to detect card when inserted.

2.2 *Bicolor LED*

- Display power applied to the board.
- Display when the microSD/TransFlash™ are accessed.

2.3 *Hardware translation*

- The embedded controller handles the ATA protocol to SD protocol translation.
- No additional software required.

2.4 *microSD/TransFlash™ to SD adapter*

- An SD adapter allows the use of microSD/TransFlash™ in any SD slot.

2.5 *Mechanical clearance*

- The width of the board is less than an IDE cable connector.
- The high of the board is matching the PC/104 specs allowing stacking when used on edge connectors.

2.6 *Software Compatibility*

- All Operating Systems and BIOS supporting IDE hard-drive.

CHAPTER 3: INSTALLATION

3.1 Locating the Connectors and LED

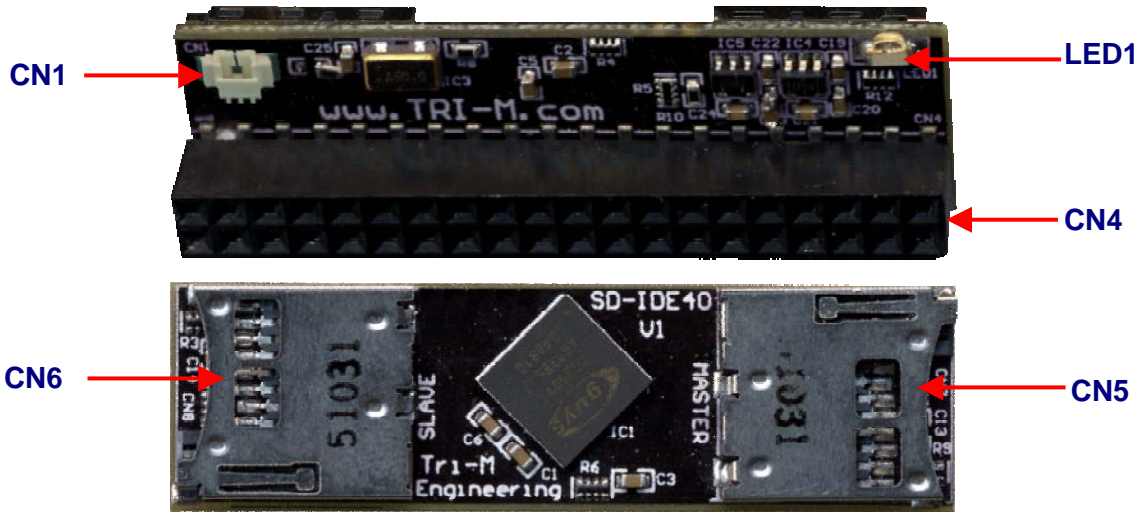


Figure 1: Connector Location

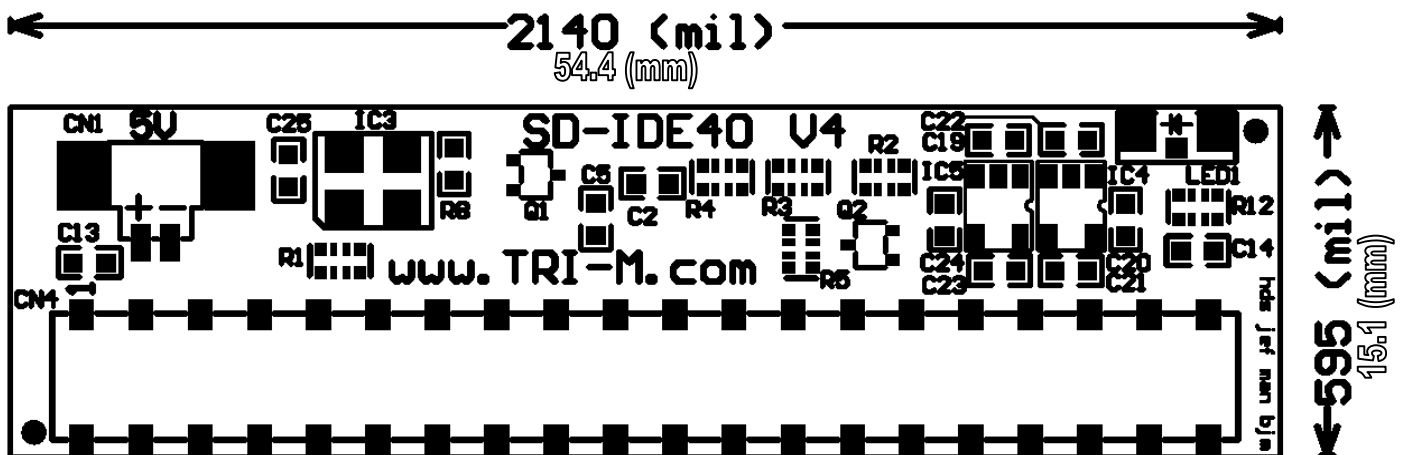


Figure 2: Board dimensions

CHAPTER 4: LED

A bi-color LED is provided on the SD-IDE40 to indicate the board status.

4.1 LED indicator(LED1)

The LED (LED1) of the SD-IDE40 indicate when the host computer is accessing one of the microSD/TransFlash™. Any access to one of the microSD/TransFlash™ in read or write mode will turn the LED red. The LED will also display when the 3.3V is regulated.

Mode	LED1
unpowered	OFF
Powered but no access	GREEN
Read from MASTER device	GREEN + RED
Write to MASTER device	GREEN + RED
Read from SLAVE device	GREEN + RED
Write to SLAVE device	GREEN + RED

Table 2: LED display

CHAPTER 5: CONNECTORS

Connectors on the SD-IDE40 are provided to power the board, transfer data through the ATA BUS and insert microSD/TransFlash™ devices.

SD-IDE40 Connector List	
Connector Label	Function
CN1	Input Power
CN4	ATA BUS
CN5	microSD/TransFlash™ MASTER slot
CN6	microSD/TransFlash™ SLAVE slot

Table 3: SD-IDE40 Connector List

5.1 Input Power connector(CN1)

The SD-IDE40 needs a +5VDC input voltage to operate. There is no power available on an IDE connector 40 pins, therefore an external power source need the be used. The SD-IDE40 uses power cable adapter able to connect on a hard-drive power cable. The power cable adapter part number is CBL-SD-IDE40.

Input Power connector (CN1)			
Pin #	Marking	Type	Description
1	+	Power	+5VDC
2	-	Power	Power Ground

Table 4: Input power connector

5.2 ATA connector (CN4)

The SD-IDE40 is controlled by the host using the ATA BUS through an IDE 40 pins connector.

ATA connector (CN4)			
Pin #	Signal	Type	Description
1	HDRESET-	In	Reset signal from host
2	GND	Power	Power Ground

ATA connector (CN4)			
Pin #	Signal	Type	Description
3	HDD07	I/O	Data bit 7
4	HDD08	I/O	Data bit 8
5	HDD06	I/O	Data bit 6
6	HDD09	I/O	Data bit 9
7	HDD05	I/O	Data bit 5
8	HDD10	I/O	Data bit 10
9	HDD04	I/O	Data bit 4
10	HDD11	I/O	Data bit 11
11	HDD03	I/O	Data bit 3
12	HDD12	I/O	Data bit 12
13	HDD02	I/O	Data bit 2
14	HDD13	I/O	Data bit 13
15	HDD01	I/O	Data bit 1
16	HDD14	I/O	Data bit 14
17	HDD00	I/O	Data bit 0
18	HDD15	I/O	Data bit 15
19	GND	Power	Power Ground
20	KEY	N/C	Keyed pin
21	IDEPDREQ	IN	DMA 0 Request
22	GND	Power	Power Ground
23	HDIOW-	IN	Write strobe
24	GND	Power	Power Ground
25	HDIOR-	IN	Read strobe
26	GND	Power	Power Ground
27	HDRDY	OUT	I/O Channel Ready
28	GND	Power	Power Ground
29	IDEPDACK	OUT	DMA 0 Acknowledge
30	GND	Power	Power Ground
31	IRQ14	OUT	Drive interrupt request
32	IOCS16-	OUT	I/O Chip Select 16
33	HDA1	IN	IDE Address 1
34	RSVD	N/C	Reserved
35	HDA0	IN	IDE Address 1
36	HDA2	IN	IDE Address 2
37	HDCS0-	IN	IDE Chip Select 0
38	HDCS1-	IN	IDE Chip Select 1
39	HDDLED-	OUT OD	Drive access indicator
40	GND	Power	Power Ground

Table 5: ATA connector

5.3 *microSD/TransFlash™ connectors (CN5 and CN6)*

These connectors are used to insert the microSD/TransFlash™. They are push-push style allowing insertion and ejection with one push. When a microSD/TransFlash™ is installed into CN5 it will be reported as MASTER hard-drive. When installed into CN6 it will be reported as Slave hard-drive.

microSD/TransFlash™ connector (CN5 and CN6)			
Pin #	signal	Type	Description
1	DATA2	I/O	Data line 2
2	DATA3	Power	Data line 3
3	CMD	I/O	Command/Response line
4	VDD	Power	+3.3 Volt supply
5	CLK	OUT	Clock
6	GND	Power	Power Ground
7	DATA0	I/O	Data line 0
8	DATA1	I/O	Data line 1

Table 6: microSD/TransFlash™ connectors

CHAPTER 6: INTERFACE

The SD-IDE40 controller is compliant with ATA/ATAPI-6 specification. It supports PIO mode 0 to 4 and ULTRA DMA mode 2 and 3. I/O Channel Ready is supported for PIO mode 3 and 4.

6.1 Supported ATA command

The SD-IDE40 controller supports the ATA Mandatory commands and the Power Management feature set. The controller will return error status for any other command which is not supported.

Supported ATA Command		
Name	Code	Note
CHECK POWER MODE	E5 _H	Dummy
EXECUTE DEVICE DIAGNOSTIC	90 _H	Dummy
FLUSH CACHE	E7 _H	Dummy
IDENTIFY PACKET	EC _H	
IDLE	E3 _H	Dummy
IDLE IMMEDIATE	E1 _H	Dummy
RECALIBRATE	10 _H	Dummy
INITIALIZE DEVICE PARAMETERS	91 _H	
READ DMA	C8 _H	
READ DMA WITH RETRY	C9 _H	Same as READ DMA
READ MULTIPLE	C4 _H	
READ SECTOR(S)	20 _H , 21 _H	
READ VERIFY SECTOR(S)	40 _H , 41 _H	
SEEK	70 _H	Dummy
SET FEATURES	EF _H	Supports Set Transfer Mode only.
SET MULTIPLE MODE	C6 _H	Only one sector is available.
SLEEP	E6 _H	Dummy
STANDBY	E2 _H	Dummy
STANDBY IMMEDIATE	E0 _H	Dummy
WRITE DMA	CA _H	
WRITE DMA WITH RETRY	CB _H	Same as WRITE DMA.
WRITE MULTIPLE	C5 _H	
WRITE SECTOR(S)	30 _H , 31 _H	

Table 7: Supported ATA command

Note: Dummy commands return normal status but doesn't do any processing.

CHAPTER 7: microSD/TransFlash™

7.1 Description

microSD/TransFlash™ are ultra-small (15 mm x 11 mm x 1 mm) removable flash memory card, it is currently the smallest memory card format commercially available. They are commonly available in capacities of 128 MB, 256 MB, 512 MB, 1 GB and 2 GB. TransFlash™ and microSD cards are basically exactly the same, and each can be used in devices made for the other type. There is one exception, which is that unlike TransFlash™, microSD devices have the capability to support NFC (Near Field Communication).



Figure 2: TransFlash™ (scale 1:1)

7.2 SD compatibility

All devices which support SD cards can support microSD/TransFlash™ with the SD card adapter which is often included in the packages.



Figure 3: SD adapter (scale 1:1)

CHAPTER 8: LITERATURE REFERENCES

The following references are for information about the PC/104 architecture, the PC DOS, and the PC BIOS.

8.1 AT Bus Design

Edward Solari
Anabooks
12145 Alta Carmel Ct., Suite 250
San Diego, CA 92128
ISBN 0-929392-08-6

8.2 Personal Computer Bus Standard P996

Institute of Electrical and Electronic Engineers, Inc.
445 Hoes Lane
Piscataway, NJ 08854

8.3 PC Interrupts

PC Interrupts, Ralf Brown, Addison/Wesley.

8.4 PC/104 Consortium

809 B-175 Cuesta Drive,
Mountain View, CA 94040
Phone: 415 903-8304
FAX: 415 967-0995

8.5 SD IDE Bridge Controller Datasheet

C-Guys, INC.
19925 Stevens Creek Blvd, Suite 200,
Cupertino, CA 95014.

8.6 SanDisk SD Card Product Manual

SanDisk Corporation
140, Caspian Court,
Sunnyvale, CA 94089.
Phone: 408-542-0500