Stellaris® Intelligent Display Module Single-Board Computer (IDM-SBC) Reference Design Kit

User's Manual

RDK-IDM-SBC-UM-05

Copyright © 2009–2011 Texas Instruments

Copyright

Copyright © 2009–2011 Texas Instruments, Inc. All rights reserved. Stellaris and StellarisWare are registered trademarks of Texas Instruments. ARM and Thumb are registered trademarks, and Cortex is a trademark of ARM Limited. Other names and brands may be claimed as the property of others.

Texas Instruments
108 Wild Basin, Suite 350
Austin, TX 78746
http://www.ti.com/stellaris

Table of Contents

Chapter 1: Stellaris® Intelligent Display Module Single-Board Computer RDK Overview 9
Kit Contents 10
Using the RDK 10
Features 11
Board Overview 12
Board Specifications 12
Chapter 2: Hardware Description 13
Block Diagram 13
Functional Description 14
Microcontroller 14
Debugging 14
Expansion Connector 14
Power and Interface Terminal Block 15
Clocking 15
Reset 15
SDRAM 15
Power Supplies 16
USB 16
Ethernet 16
Color QVGA LCD Touch Panel 16
I^2S Audio 18
Controller Area Network (CAN) 18
Serial Flash and microSD Card 18
Chapter 3: Software Development 21
Software Description 21
Source Code 21
Tool Options 21
Programming the IDM-SBC 22
Appendix A: Schematics 25
Appendix B: Bill of Materials (BOM) 29
Appendix C: Component Details 31

List of Figures

Figure 1-1. Intelligent Display Module Single-Board Computer 9
Figure 1-2. IDM-SBC Board Overview Diagram 12
Figure 2-1. Intelligent Display Module Single-Board Computer Block Diagram 13
Figure 2-2. Debug Connection Pinout 14
Figure 2-3. Expansion Connector 14
Figure 2-4. Pluggable Terminal Blocks 15
Figure C-1. Component placement plot for top 31

List of Tables

Table 2-1. LCD-Related Signals 17
Table 2-2. I^2S Audio-Related Signals 18
Table 2-3. CAN-Related Signals 18
Table 2-4. Serial Flash and microSD-Related Signals 19
Table B-1. RDK-IDM-SBC Bill of Materials (BOM) 29

CHAPTER 1

Stellaris® Intelligent Display Module Single-Board Computer RDK Overview

The Stellaris® Intelligent Display Module Single-Board Computer (RDK-IDM-SBC) is a reference design for a complete QVGA touch-screen user interface for control, automation, and instrumentation applications. The design features the powerful Tempest-class LM3S9B92 microcontroller. The IDM-SBC offers USB, Ethernet, CAN, 8 MB of SDRAM, 1 MB of serial Flash, integrated 256 KB flash, and 96 KB SRAM, and provides simplified software development for the RDK using The Stellaris comprehensive graphics library and ARM development tools from ARM tools partners. The 8 MB of SDRAM is connected to the LM3S9B92 microcontroller using the External Peripheral Interface (EPI) bus available as a feature on Tempest-class devices. The efficient performance and robust integration of an ARM® Cortex™-M3 microcontroller, positions the IDM-SBC for use in building access controllers and security systems, intelligent white goods and home appliances, thin clients, and factory automation applications.

This user's manual provides comprehensive information on the reference design hardware and software.

Figure 1-1. Intelligent Display Module Single-Board Computer

Kit Contents

The RDK-IDM-SBC reference design kit contains everything needed to develop and run a range of applications using Stellaris microcontrollers:

- IDM-SBC board
- 8 Ω Speaker
- Retractable ethernet cable
- USB flash memory stick
- microSD card
- Power supply adaptor cable
- 2-position and 6-position terminal blocks
- 24 V wall power supply with international plug-set
- MDL-ADA2 10-pin to 20-pin JTAG adapter module
- Reference Design Kit CD with tools, complete documentation, and source code including:
  - Quickstart Guide
  - User's Manual
  - Software Reference Manual
  - Board Data Sheet
  - BOM
  - Schematics
  - Gerber files

The source code can be modified and compiled using any of the following tools:

- Keil™ RealView® Microcontroller Development Kit (MDK-ARM)
- IAR Embedded Workbench
- Code Sourcery GCC development tools
- Code Red Technologies development tools
- Texas Instruments' Code Composer Studio™ IDE

Using the RDK

The recommended steps for using the RDK are:

- **Follow the Quickstart guide included in the kit.** The Quickstart guide will help get the display module up and running in minutes.
- **Use your preferred ARM tool-chain and the Stellaris Graphics library to develop touch-panel, USB, and Ethernet applications.** Software applications can be loaded into IDM flash memory using either the Ethernet boot loader or a JTAG/SWD debug interface. See Chapter 3, "Software Development," for the programming procedure. The *Stellaris Graphics Library Software Reference Manual* and the *Stellaris Peripheral Driver Library Software Reference Manual* each contain specific information on software structure and function.
- **Customize and integrate the hardware to suit an end application.** This user's manual is an important reference for understand circuit operation and completing hardware modification.

Features

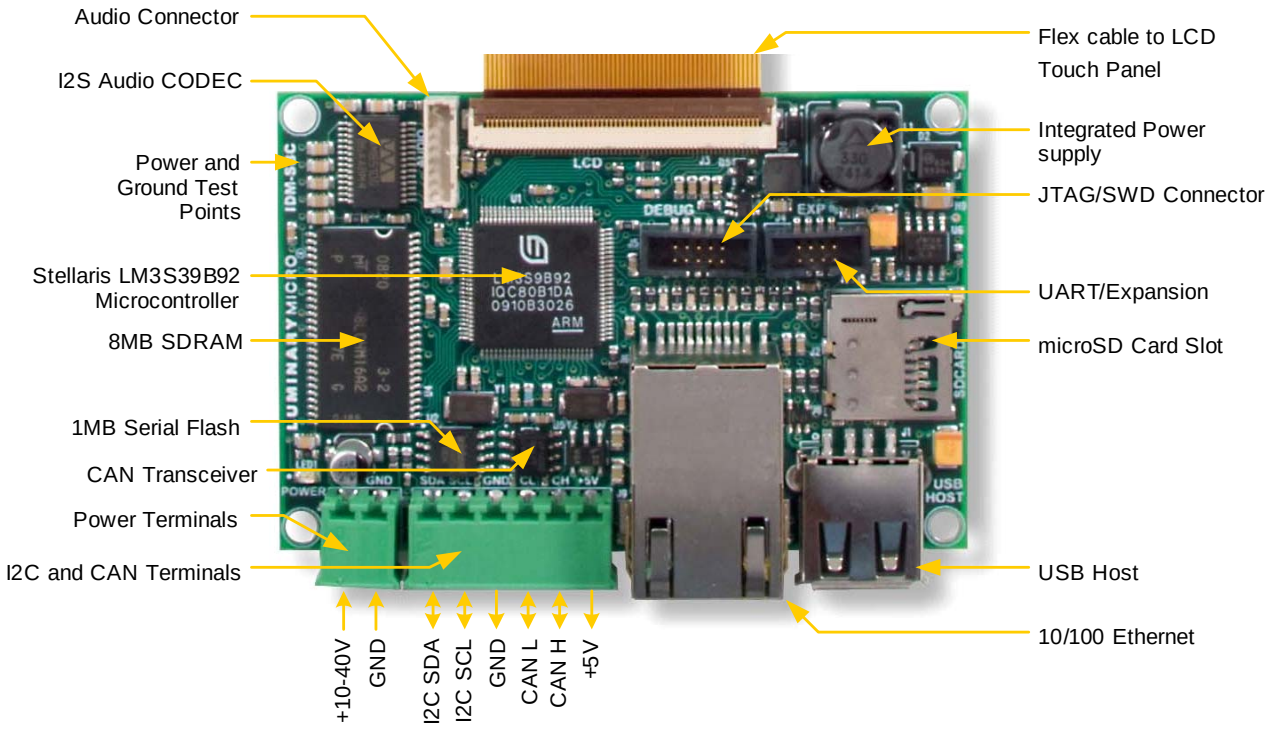
The RDK-IDM-SBC reference design kit provides the following features:

- Bright QVGA LCD touch-screen display
  - 262 K colors, 3.5" QVGA 320 x 240 pixels
  - White LED backlight with resistive touch panel
- Advanced audio
  - I^2S mono Codec for high-quality audio
  - 0.8 W amplifier directly drives external 8-Ohm speaker
- Serial connectivity options
  - USB 2.0 Host
  - 10/100 Ethernet MAC and PHY
  - 1 MBPS Controller Area Network (CAN)
  - I^2C Interface for external peripherals and sensors
  - UART serial port with TTL signal levels
- High performance microcontroller
  - 32-bit ARM® Cortex™-M3 core
  - 256 KB single-cycle flash, 96 KB single-cycle SRAM
  - 80 MHz operation
- Versatile board-level memories
  - 8 MB SDRAM connected by EPI
  - 1 MB serial flash connected by SPI
  - microSD card slot
  - USB Host connector for external mass-storage devices
- Power supply
  - Wide input range 12-40 Vdc power supply with auxiliary 5 V power output
- Screw terminal block for I^2C, CAN, and power connections
- Compact 2.0” x 3.0” PCB footprint
- Easy to customize
  - Includes full source code, example applications, and design files
  - Develop using tools supporting Keil™ RealView® Microcontroller Development Kit (MDK-ARM), IAR Embedded Workbench, Code Sourcery GCC development tools, Code Red Technologies development tools, or Texas Instruments’ Code Composer Studio™ IDE (using a Stellaris evaluation kit or preferred ARM Cortex-M3 debugger)
  - Supported by Stellaris Graphics Library and StellarisWare® Peripheral Driver Library
  - Comes with factory-programmed quickstart game demo application
  - Ethernet boot loader for firmware update

Board Overview

Figure 1-2 shows an overview of the board.

Figure 1-2. IDM-SBC Board Overview Diagram



Board Specifications

The following list shows the IDM-SBC's board specifications:

- Board supply voltage range: 10-40 Vdc
- Board supply current with 24 V supply
  - 55 mA (1.3 W) when running qs-blox application at 50 MHz
- 5 V power output (for USB Host or +5 V terminal)
  - 5 V +/- 5% at 500 mA
- Dimensions (excluding LCD panel):
  - 2.00" x 3.00" x 0.60" (L x W x H)
- Speaker
  - Impedance: 8 Ω (±1 Ω)
  - Output power: 0.8 W
  - Format: Mono
- RoHS status: Compliant

CHAPTER 2

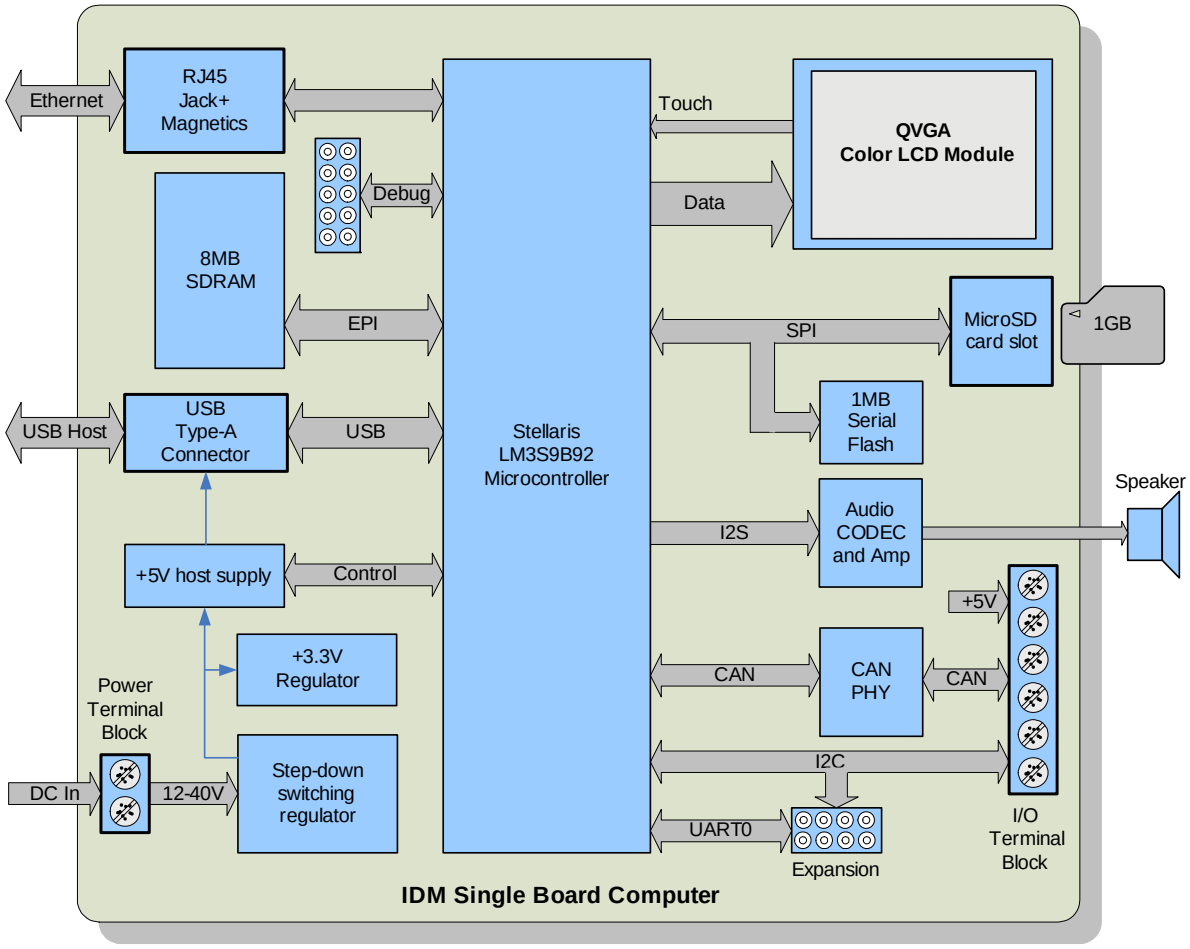
Hardware Description

The IDM-SBC design uses a Stellaris® LM39B92 microcontroller to handle display functions, touch-screen control, Ethernet, USB, CAN, and other peripheral functions. Only a few additional ICs are necessary to complete the design. The entire circuit is built on a compact four-layer printed circuit board. All design files are provided on the RDK-IDM-SBC CD.

Block Diagram

Figure 2-1 shows the IDM-SBC block diagram.

Figure 2-1. Intelligent Display Module Single-Board Computer Block Diagram



Functional Description

This section describes the IDM-SBC's hardware design in detail.

Microcontroller

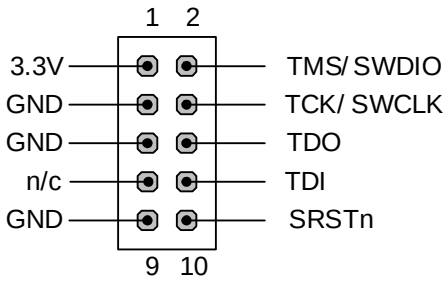
The Stellaris LM39B92 is an ARM Cortex-M3-based microcontroller with 256-KB flash memory, 80-MHz operation, Ethernet, USB, EPI and a wide range of peripherals. See the LM39B92 data sheet (order number DS-LM39B92) for complete device details.

The IDM-SBC's LM39B92 microcontroller is factory programmed with a quickstart demo program. The quickstart program resides in on-chip flash memory and runs each time power is applied, unless the quickstart has been replaced with a user program.

Debugging

The microcontroller supports JTAG and SWD debugging as well as SWO trace capabilities. To minimize board area, the IDM-SBC uses a 0.050" pitch header (J6) which matches ARM's fine-pitch definition (Figure 2-2). Some in-circuit debuggers provide a matching connector. Other debuggers can be used with the MDL-ADA2 adaptor board included in the RDK.

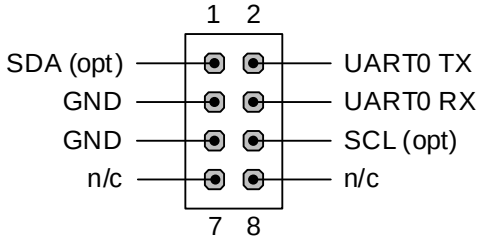
Figure 2-2. Debug Connection Pinout



Expansion Connector

UART0 signals from the microcontroller are available on J4, an internal expansion connector. The pin-out of this connector is compatible with the power/UART cable used by the ICDI board included in the EK-LM3S9B90 and EK-LM3S9B92 evaluation kits. This then provides a convenient Virtual Com port interface to a PC. A pair of I^2C signals are also available, however, jumpers connecting SCL and SDA are normally omitted to avoid conflict with digital signals from the ICDI board.

Figure 2-3. Expansion Connector[1]

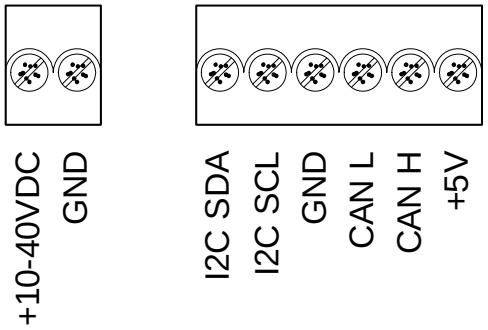


1. Revision A PCBs transpose UART0 RX and TX signals and are, therefore, incompatible with ICDI connections.

Power and Interface Terminal Block

Power, CAN, and I^2C interfaces are provided through 3.5 mm pluggable terminal blocks. For convenience, the RDK includes the plugs. See the BOM for complete part numbers.

Figure 2-4. Pluggable Terminal Blocks



I2C is a short-distance intra-device bus that can be used to add capabilities such as an ADC (for analog measurement) or digital inputs and outputs.

CAN is best suited for communication between devices. Refer to the CAN specification for complete details on data rates and bus length.

Clocking

The IDM-SBC board uses a 16.0-MHz (Y2) crystal to complete the LM3S9B92 microcontroller's main internal clock circuit. An internal PLL, configured in software, multiples this clock to higher frequencies for core and peripheral timing.

A 25.0 MHz (Y1) crystal provides an accurate timebase for the Ethernet PHY.

Reset

The RESETn signal into the LM3S39B92 microcontroller connects to the JTAG/SWD debug connector and to a simple R-C filter circuit to extend reset timing at power up.

The LCD Module has special Reset timing requirements requiring a dedicated control line from the microcontroller.

SDRAM

The LM3S9B92 features an External Peripheral Interface (EPI) module, a high-speed 8/16/32-bit parallel bus for connecting external peripherals or memory without glue logic. Supported modes include SDRAM, SRAM and Flash memories, as well as Host-bus and FIFO modes.

On the IDM-SBC, the SDRAM device interfaces directly to the EPI and adds 8MB of memory (4M x 16) which, once configured, becomes part of the LM3S9B92's memory map at either 0x6000.0000 or 0x8000.0000.

The SDRAM interface multiplexes DQ00..14 and AD/BA0..14 without requiring external latches or buffers. Of the 32 EPI signals, only 24 are used in SDRAM mode, with the remaining signals used for non-EPI functions on the board.

Power Supplies

The RDK-SBC has a wide input range switching-power supply that creates a 5V 1A rail for board operation. The LM22672 step-down regulator switches at 500KHz with an efficiency of greater than 90%. Board functions require only about 150 mA with the remaining capability available for external interfaces such as USB host.

A low drop-out (LDO) regulator (U7) converts the +5V power rail to +3.3V to power digital devices including the microcontroller and SDRAM.

USB

The LM3S9B92's full-speed USB controller is configured for Host mode, allowing the SBC to connect directly to USB Flash sticks and other USB devices.

U9, a fault-protected switch, controls and monitors power to the USB host port. USB_EPEN, the control signal from the microcontroller, has a pull-down resistor to ensure host-port power remains off during reset. The power switch will immediately cut power if the attached USB device draws more than 1 Amp, or if the switches' thermal limits are exceeded by a device drawing more than 500mA. USB_PFLT indicates the over-current status back to the microcontroller.

Ethernet

With its fully integrated 10/100 Ethernet MAC and PHY, the LM3S9B92 requires only a standard Jack with integrated magnetics and a few passive components. The TX and RX signals are routed to the jack as a differential pair. The PHY incorporates MDI/MDI-X cross-over, so the function of the TX and RX pairs can be swapped in software.

The Ethernet jack incorporates two status LEDs that can be controlled directly by the Ethernet PHY or by those same pins in GPIO mode.

Color QVGA LCD Touch Panel

The IDM-SBC features a TFT Liquid Crystal graphics panel with 320 x 240 pixel resolution. The face of the panel is protected during shipping by a thin, protective plastic film which should be removed before use.

The panel should be laid on a flat surface during evaluation, to protect it from damage and maximize the sensitivity of the touch screen.

Features

Features of the LCD Panel include:

- Kitronix K350QVG-V1-F display
- 320 x RGB x 240 dots
- 3.5" 262K colors
- Wide temperature
- White LED backlight
- Integrated RAM
- Resistive touch panel

Control Interface

The Color LCD module has a built-in controller IC with a multi-mode parallel interface. The EVB uses an 8-bit 8080 type interface with GPIO Port D providing the data bus.

Table 2-1. LCD-Related Signals

Microcontroller Pin	Board Function
PE6/ADC1	Touch X+
PE3	Touch Y-
PE2	Touch X-
PE7/ADC0	Touch Y+
PB7	LCD Reset
PD0..7	LCD Data Bus 0..7
PH7	LCD Data/Control Select
PB0	LCD Read Strobe[a]
PH6	LCD Write Strobe
PJ7	Backlight control

a. LCD Read function not available on LM3S9B92 Rev B1. See rework note in schematic.

Backlight

The white LED backlight must be powered for the display to be clearly visible. U9 (FAN5331B) implements a 20mA constant-current LED power source to the backlight. The backlight is controlled by the microcontroller using GPIO PJ7. The timer connected to this pin could be configured to provide a modulated dimming signal

Because the FAN5331B operates in a constant current mode, its output voltage will jump up if the LCD should become disconnected. To prevent over-voltage failure of the IC or diode D5, a zener (D6) clamps the voltage. The current will limit to 20mA, but the total board current will be higher than when the LCD panel is connected. If the LCD is not connected, avoid over-heating the backlighting circuit, by setting PJ7 low to completely shut-down the circuit.

Power

The LCD module has internal bias voltage generators and requires only a single 3.3V dc supply.

Resistive Touch Panel

The 4-wire resistive touch panel interfaces directly to the microcontroller, using 2 ADC/GPIO channels and 2 GPIO-only signals. The microcontroller creates a resistive divider by driving Y+ and Y- with 3.3V (V_{OH}) and 0V (V_{OL}) respectively. A voltage representing the Y-axis position is then read on the X+ terminal. The process then repeats for the other axis. Note that when the screen is not being touched, the X+ or Y+ sense inputs are floating. The software implements a special state to discharge the capacitor (C10 or C15) to 0V and detect this condition.

Refer to the StellarisWare® source code for additional information on touch panel implementation.

I²S Audio

The IDM-SBC has advanced audio capabilities using an I2S-connected Wolfson WM8510 CODEC. The CODEC's integrated amplifier can directly drive an 8 Ω speaker. Although the CODEC supports a microphone input, pin count limits on the LM3S9B92 result in this feature being unconnected. The Microphone signals are still routed to connector J8 in-case the user wishes to wire the ADCDAT signal to the LM3S9B92.

Table 2-2. I²S Audio-Related Signals

Microcontroller Pin	Board Function
PB3/I2C0SDA	CODEC Configuration Data
PB2/I2C0SCL	CODEC Configuration Clock
PE5/I2STXSD	Audio Out Serial Data
PE4/I2STXWS	Audio Out Framing signal
PB6/I2STXSCK	Audio Out Bit Clock
PF1/I2STXMCLK	Audio Out System Clock

The Audio CODEC has a number of control registers which are configured using the I2C bus signals. CODEC settings can only be written, but not read, using I2C. Refer to the StellarisWare® example applications for programming information and to the WM8510 data sheet for complete register details.

In the default configuration, the LM39B92 provides the master Bit Clock (BCLK) and System Clock (MCLK) to the CODEC. Since the CODEC has only one set of clock I/Os for both audio-out and audio-in functions, only the LM39B92 I²S module transmit clocks are connected.

DriverLib provides I²S source code, with most examples showing Audio Output.

Controller Area Network (CAN)

Controller Area Network (CAN) is a multicast, shared serial bus standard for connecting automotive or industrial systems. The IDM-SBC board includes a CAN transceiver (U5) capable of communicating at up to 1Mb/s. The end-points of the CAN bus should be properly terminated with 120? resistors.

Table 2-3. CAN-Related Signals

Microcontroller Pin	Board Function
PB5/CAN0TX	CAN Transmit Data
PB4/CAN0RX	CAN Receive Data

Serial Flash and microSD Card

To supplement the LM3S9B92 microcontroller's internal Flash memory, the IDM-SBC board includes a 1MB on-board serial Flash memory and a microSD card slot. Both devices share a SPI

(Serial Peripheral Interface) bus. These memories are typically used for data storage and for large code images which are copied into SDRAM for execution.

Table 2-4. Serial Flash and microSD-Related Signals

Microcontroller Pin	Board Function	Jumper Name
PA2/SSI0CLK	Clock from SPI module	SCLK
PA3	microSD Card chip select	SDCSn
PA4/SSI0RX	Receive data from SPI module	MISO
PA5/SSI0TX	Transmit data from SPI module	MOSI
PF0	Serial Flash chip select	FLCSn

The microSD card is used in SPI mode. 4-bit and 1-bit SD card modes are not supported.

CHAPTER 3

Software Development

This chapter provides general information on software development as well as instructions for Flash memory programming.

Software Description

The software provided with the IDM-SBC provides access to all of the peripheral devices supplied in the design. The Stellaris Peripheral Driver Library is used to operate the on-chip peripherals, the Stellaris Graphics Library is used to render graphical displays on the touch screen, and a set of board-specific drivers are provided to access the off-chip functionality on the IDM-SBC.

The Stellaris Graphics Library provides two levels of support for rendering graphical elements. In the lowest level, basic drawing primitives are provided, such as lines, circles, rectangles, and text rendering. Each primitive supports clipping to a single clipping rectangle, allowing only a portion of the display to be affected by the drawing primitives. Building upon the drawing primitives is a widget set, which combines the drawing of graphical elements with reactions to pointer events (in this case, presses on the touch screen). The widget set includes push buttons, check boxes, radio buttons, sliders, listboxes, and drawing canvases. By using the widget set, complex interactive graphical displays can be constructed quickly.

A set of drivers for the on-board peripherals is also provided. This includes a driver for the touch screen, the audio codec, the USB, CAN, and the microSD card. Ethernet is supported by TCP/IP stacks and example applications, all within the StellarisWare® libraries.

The IDM-SBC is also supplied with a set of example applications that utilize the Stellaris Peripheral Driver Library and the Stellaris Graphics Library, along with the board-specific drivers for the on-board peripherals. These applications demonstrate the capabilities of the IDM-SBC, and provide a starting point for the development of the final application for use on the IDM-SBC. All example applications are integrated with the Stellaris boot loader to allow automatic firmware updates to be performed over the serial port using the LM Flash Programmer application.

Source Code

The complete source code for the IDM-SBC is included on the RDK-IDM-SBC CD. See the Quickstart Guide for a detailed description of initial RDK hardware set up and how to install the source code. The source code and binary files are installed in the DriverLib tree.

Tool Options

The source code installation includes directories containing projects and/or makefiles for the following tool-chains:

- Keil™ RealView® Microcontroller Development Kit (MDK-ARM)
- IAR Embedded Workbench
- Code Sourcery GCC development tools
- Code Red Technologies development tools
- Texas Instruments' Code Composer Studio™ IDE

Evaluation versions of these tools may be downloaded from www.ti.com/stellaris. Note that, due to code size restrictions, the evaluation versions of the tools may not build all example programs for the IDM. A full license is necessary to re-build or debug all examples.

Instructions on installing and using each of the evaluation tools can be found in the Quickstart guides (for example, Quickstart-Keil, Quickstart-IAR) which are available for download from the evaluation kit section of our web site at www.ti.com/stellaris.

For detailed information on using the tools, refer to the documentation included in the tool chain installation or visit the website of the tools supplier.

Programming the IDM-SBC

The IDM-SBC software package includes pre-built binaries for each of the example applications. If you installed DriverLib to the default installation path of C:\STELLARISWARE, you can find the example applications for the IDM in “C:\STELLARISWARE\BOARDS\RDK-IDM-SBC”.

The Stellaris LM Flash Programmer is a free tool for programming Stellaris microcontrollers. It can be used in two modes to update the firmware on the IDM-SBC. Most IDM-SBC example applications are designed for use with the Stellaris boot loader which supports updating of the main application firmware over Ethernet (this requires a board with Rev C or later of the LM39B92 microcontroller). Alternatively, the LM Flash Programmer utility can be used in conjunction with any Stellaris evaluation board to program the IDM-SBC. The Stellaris evaluation board acts as a USB-to-JTAG/SWD hardware interface and should be used in cases where the boot loader image is not present or where the main application image is not behaving correctly and cannot transfer control to the boot loader. However, in normal operation, it is more convenient to program via Ethernet.

To program example applications into the IDM-SBC using the Ethernet-based firmware update (this requires a board with Rev C or later of the LM39B92 microcontroller):

1. Install the LM Flash Programmer utility on a Windows PC.
2. Ensure that the IDM is connected to the same subnet of your Ethernet as the Windows PC that will be used to program the device.
3. Apply power to the IDM.
4. Run LM Flash Programmer.
5. In the Configuration tab, select “Manual Configuration - see below” in the “Quick Set” list.
6. Select “Ethernet Interface” in the list below “Interface” and fill in the IP and MAC addresses for the IDM you are trying to program. Each example application shows this information somewhere on the IDM display. Note that it may take several seconds for the IP address to be allocated.
7. If your PC has multiple network adapters, select the appropriate adapter in the “Ethernet Adapter” list.
8. Move to the Program tab and click the Browse button. Navigate to the example applications directory (the default location is “C:\STELLARISWARE\BOARDS\RDK-IDM-SBC””.
9. Each example application has its own directory. Navigate into the example directory that you want to load and then go to the /gcc directory which contains the binary (*.bin) files. Select the application binary file and click Open. Files that start with a “bl_” prefix are boot loader images and cannot be updated using this method.
10. Click the Program button to start the download process.
11. The program starts once the download is complete.

To replace the boot loader image or to program example applications into the IDM-SBC using a Stellaris evaluation board to provide JTAG/SWD functionality:

1. Install LM Flash Programmer on a Windows PC.
2. Connect the MDL-ADA2 10-pin to 20-pin adapter (included in the RDK) to the evaluation board ribbon cable. This converts the standard 20-pin ARM header on the evaluation board to a fine pitch ARM header.
3. Carefully connect the socket of the adaptor board to J1 on the IDM.
4. Apply power to the IDM and connect the evaluation board (available separately) to a USB port.
5. Run LM Flash Programmer.
6. In the Configuration Tab use the Quick Set control to select LM39B92.
7. Move to the Program Tab and click the Browse button. Navigate to the example applications directory (the default location is “C:\STELLARISWARE\BOARDS\RDK-IDM-SBC).
8. Each example application has its own directory. Navigate into the example directory that you wish to load and then into the /gcc directory which contains the binary (*.bin) files. Files named with a “bl_” prefix are Stellaris boot loader images while those without the prefix are main application images. Select the binary file and click Open.
9. Set the “Erase Method” to “Erase Necessary Pages” and check the “Verify After Program” box.

NOTE: Setting “Erase Entire Flash” when attempting to replace a main application image will erase the boot loader image and result in a hang when the IDM next boots. If this occurs, reflash a boot loader image using these instructions.

10. If flashing a boot loader image, set the “Program Address Offset:” value to 0x0000. If programming a main application image, set this value to 0x1000.
11. Next, click on the Program button to start the Erase, Download, and Verify process.
12. Program execution will start once Verify is complete.

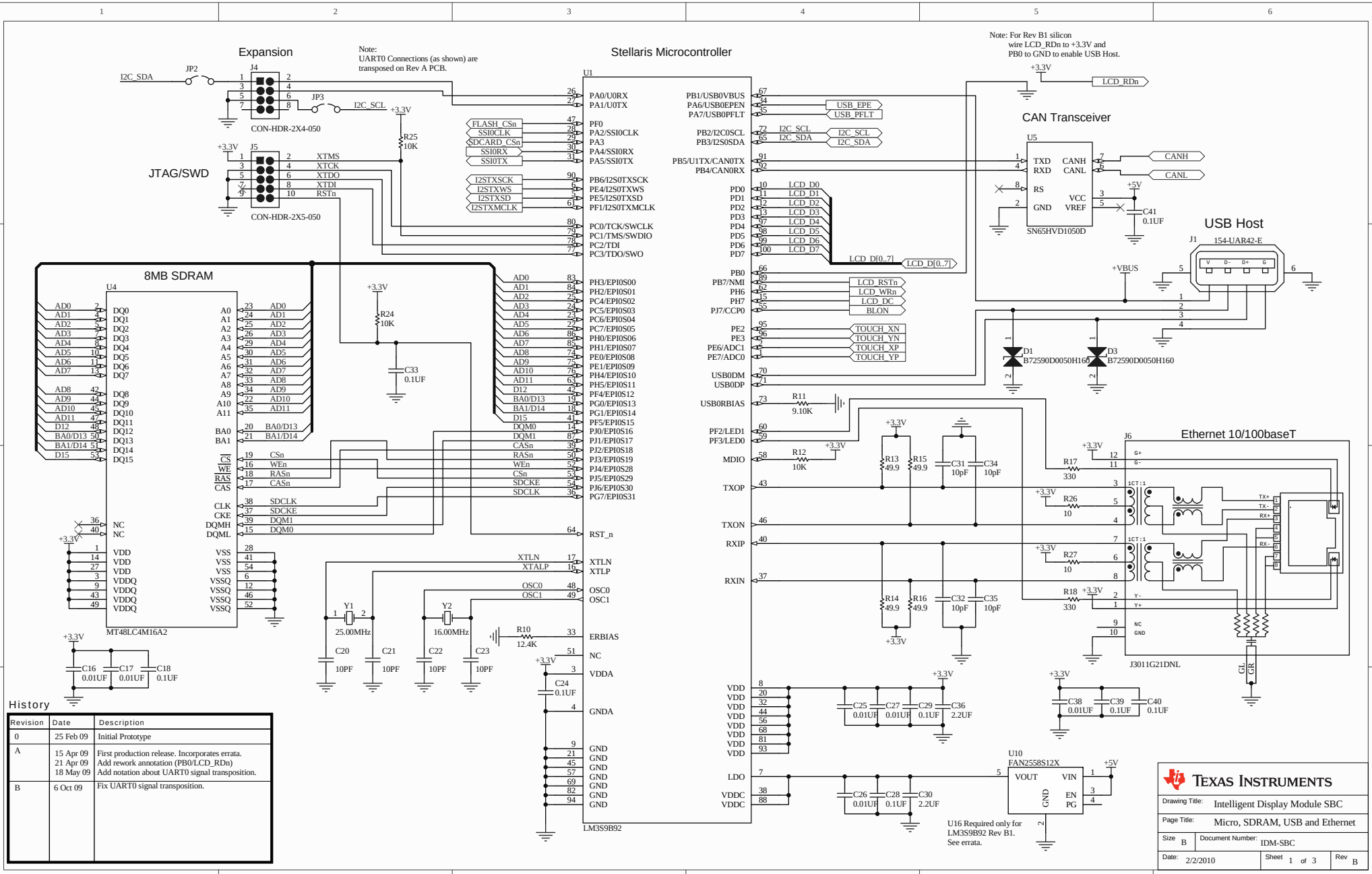
The Debuggers in each of the tool-chains also include Flash programming capabilities, including support for high-performance in-circuit debug interfaces.

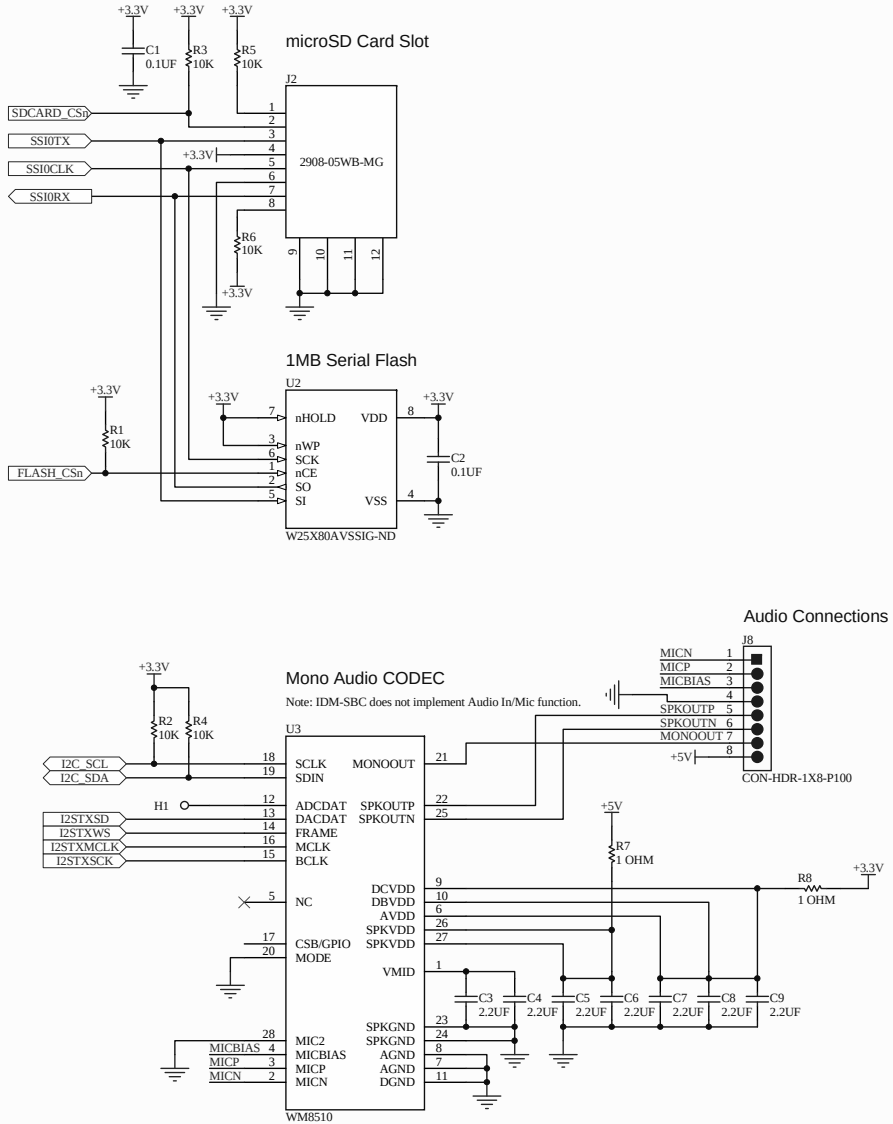
A P P E N D I X A

Schematics

This sections contains the schematic diagrams for the Intelligent Display Module Single-Board Computer.

- IDM-SBC Microcontroller, SDRAM, USB, and Ethernet on page 26
- IDM-SBC LCD Panel, Serial Memory, and Audio on page 27
- IDM-SBC Power and Interface on page 28

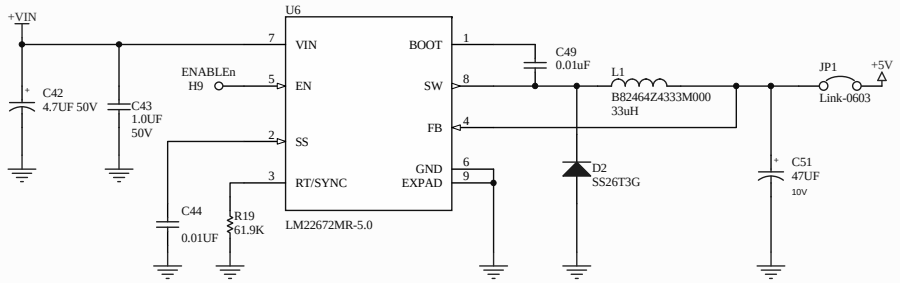

Expansion
Note:
UART0 Connections (as shown) are transposed on Rev A PCB.
Stellaris Microcontroller
Note: For Rev B1 silicon
wire LCD_RDn to +3.3V and
PB0 to GND to enable USB Host.
JTAG/SWD
CON-HDR-2X4-050
CON-HDR-2X5-050
8MB SDRAM
MT48LC4M16A2
LM3S9B92
CAN Transceiver
SN65HVD1050D
USB Host
154-UAR42-E
Ethernet 10/100baseT
J3011G21DNL
U16 Required only for
LM3S9B92 Rev B1.
See errata.
History
Revision | Date | Description
0 | 25 Feb 09 | Initial Prototype
A | 15 Apr 09
21 Apr 09
18 May 09 | First production release. Incorporates errata.
Add rework annotation (PB0/LCD_RDn)
Add notation about UART0 signal transposition.
B | 6 Oct 09 | Fix UART0 signal transposition.
TEXAS INSTRUMENTS
Drawing Title: Intelligent Display Module SBC
Page Title: Micro, SDRAM, USB and Ethernet
Size B
Document Number: IDM-SBC
Date: 2/2/2010
Sheet 1 of 3
Rev B



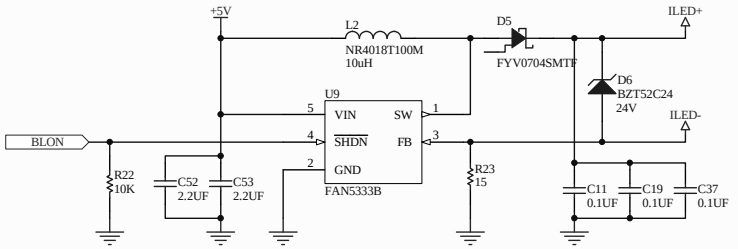
LUMINARY MICRO

Drawing Title:	Intelligent Display Module SBC
Page Title:	LCD Panel, Serial Memory and Audio
Size: B	Document Number: IDM-SBC
Date: 2/2/2010	Sheet 2 of 3
	Rev B

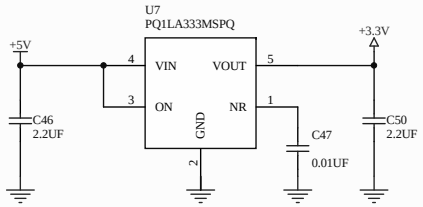
+5V 1A Switching Regulator

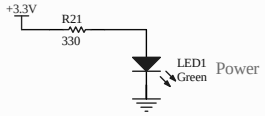


LED Backlight Controller



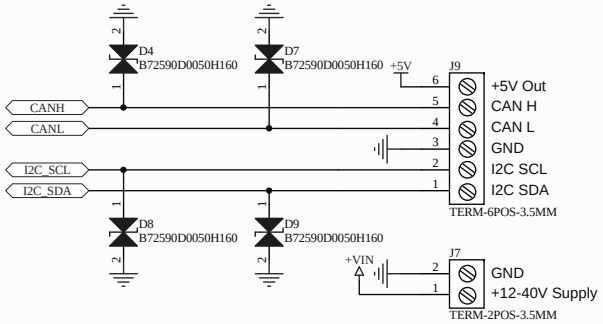
Main +3.3V 300mA Power Supply



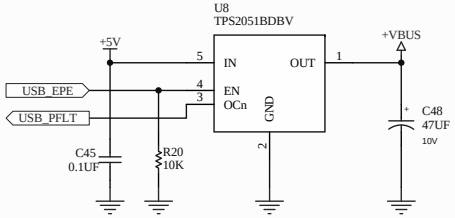


Power LED

Power and Interface Terminals



USB Power Switch



LUMINARY MICRO			
Drawing Title: Intelligent Display Module SBC			
Page Title: Power and Interface			
Size: B	Document Number: IDM-SBC		
Date: 2/2/2010	Sheet 3 of 3	Rev: B	

Bill of Materials (BOM)

Table B-1. RDK-IDM-SBC Bill of Materials (BOM)

Texas Instruments
IDM-SBC Reference Design — Rev B Issue 1
Bill Of Materials — 3-Nov-09

Item	Ref	Qty	Part Number	Description	Mfg
1	C1, C2, C11, C14, C18, C19, C24, C28, C29, C33, C37, C39, C40, C41, C45,	15	GRM188R71H104KA93D	Capacitor, 0.1uF 50V 10% 0603 X7R	TDK
2	C10, C12, C13, C15, C16, C17, C25, C26, C27, C38, C44, C47, C49	13	C0603C103J5RACTU	Capacitor, 0.01uF 50V 5% 0603 X7R	Kemet
3	C20, C21, C22, C23, C31, C32, C34, C35	8	C0603C100J5GACTU	Capacitor 10pF 50V 5% Ceramic NPO/COG 0603	Kemet
4	C3, C4, C5, C6, C7, C8, C9, C30, C36, C46, C50, C52, C53	13	TMK212BJ105KG-T	Capacitor 2.2uF 10V X5R 0805	Panasonic
5	C42	1	EEE-FK1H4R7R	Capacitor 4.7uF 50V Electro 4.3x5.8mm	Panasonic
6	C43	1	C1210C105K5RACTU	Capacitor 1.0uF 50V X7R 1210	Kemet
7	C48, C51	2	TPSB476K010R0250	Capacitor, 47uF 10V Tantalum LowESR 3528	AVX
8	D1, D3, D4, D7, D8, D9	6	B72590D0050H160	Diode, ESD protection high-speed 5.6WV 0402	Epcos
9	D2	1	SS26T3G	Diode Schottky 60V 2A SMB	OnSemi
9	D5	1	FYV0704SMTF	Diode, Schottky 40V 200mA SOT-23	Fairchild
11	D6	1	BZT52C24-V-GS08	Diode, Zener 24V 500mW SOD123	Vishay
12	J1	1	AU-Y1006-R 154-UAR42-E	Connector, USB Type A	Assmann Kobiconn
13	J2	1	2908-05WB-MG	Connector, Micro SD card, push-push SMT	3M
14	J3	1	10085901-6015ELF	Connector, FPC 60P, r/a 0.5mm pitch SMT	FCI
15	J4	1	C44-08BSA1-G	Header, 2x4 Shrouded 0.050" pitch SMT	Donconnex
16	J5	1	C44-10BSA1-G	Header, 2x5 Shrouded 0.050" pitch SMT	Donconnex
17	J6	1	HR961160C J3011G21DNL J3011G21DNLT	Connector, RJ45 with 10/100 magnetics, shielded SMT	Hanrun Pulse
18	J7a	1	284512-2	Terminal Block header 2pos 3.5mm pitch	Tyco
19	J7b	1	284506-2	Terminal Block plug 2pos 3.5mm pitch	Tyco
20	J8	1	DF13-8P-1.25DSA	Connector, 1x8 header 1.25mm pitch TH	Hirose
21	J9a	1	284512-6	Terminal Block header 6pos 3.5mm pitch	Tyco
22	J9b	1	284506-6	Terminal Block plug 6pos 3.5mm pitch	Tyco
23	L1	1	B82464Z4333M000	Inductor 33uH 0.08 Ohms 1.6A 10x10mm SMT	Epcos
24	L2	1	NR4018T100M	Inductor 10uH 1A 4x4mm	Taiyo Yuden
25	LED1	1	LTST-C171GKT	LED, 0805 SMT Green	LiteOn
26	R1, R2, R3, R4, R5, R6, R9, R12, R20, R22, R24, R25	12	ERJ-3GEYJ103V	Resistor, 10K 5% 0603	Panasonic
27	R10	1		Resistor 12.4K 1% 0603	Panasonic
28	R11	1		Resistor 9.10K 1% 0603	Panasonic
29	R13, R14, R15, R16	4		Resistor 49.9 Ohms 1% 0603	Panasonic
30	R17, R18, R21	3	ERJ-3GEYJ331V	Resistor 330 ohms 5% 0603	Panasonic
31	R19	1		Resistor 61.9K 1% 0603	Panasonic
32	R23	1		Resistor 15 Ohms 5% 0603	Panasonic
33	R7, R8	2		Resistor 1 Ohm 5% 0603	Panasonic
34	U1	1	LM3S9B92	IC, Microcontroller ARM Cortex Tempest-class TQFP-100	TI
35	U2	1	W25X80AVSSIG	IC, Serial Flash 8Mbit 3.3V SOIC-8	Winbond
36	U3	1	WM8510GEDS/V	IC, Audio CODEC, Mono w/Amp VoIP SSOP28	Wolfson
37	U4	1	MT48LC4M16A2P-7E:G TR	IC, SDRAM 64Mbit (4MBx16) 133MHz TSSOP54	Micron
38	U5	1	SN65HVD1050D	IC, CAN Transceiver SO-8	TI
39	U7	1	PQ1LA333MSPQ	IC, Voltage regulator 3.3V 300mA SOT-89	Sharp

Table B-1. RDK-IDM-SBC Bill of Materials (BOM) (continued)

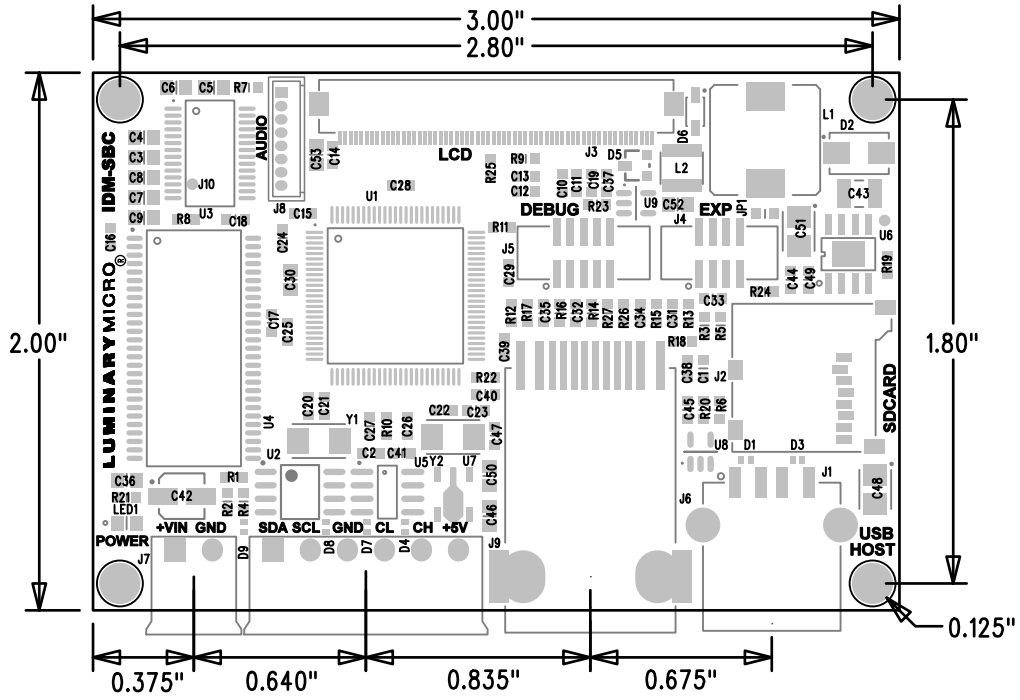
Item	Ref	Qty	Part Number	Description	Mfg
40	U6	1	LM22672MRE-5.0/NOP	IC, 5V 1A Step-down Switching Reg PSOP8	National
41	U8	1	TPS2051BDBV	IC, Fault protected power switch SOT23-5	TI
42	U9	1	FAN5333BSX	IC, White LED Driver IC SOT23-5	Fairchild
43	Y1	1	NX5032GA-25.000000MHZ	Crystal, 25.00MHz 5.0x3.2mm SMT	NDK
44	Y2	1	NX5032GA-16.000000MHZ	Crystal, 16.00MHz 5.0x3.2mm SMT	NDK
45		1	BD-IDMSBC-A	PCB, FR-4 4-layer ENIG Rev A 2.0" x 3.0"	Advanced
46		1	FS-K350QVG-V1-F	LCD Module 320 x 240 3.5" TFT with touch	Kitronix
47	U10	1	FAN2558S12X	IC, Voltage regulator 1.2V 0.18A SOT23-5	Fairchild
48	R26, R27	2		Resistor 10 Ohms 5% 0603	Panasonic
		117			
			Do not populate	H1, H9 (JP1-3 in Rev A PCB or later)	

Component Details

This appendix contains details on component locations, including:

- Component placement plot for top (Figure C-1)

Figure C-1. Component placement plot for top



IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Audio	www.ti.com/audio	Communications and Telecom	www.ti.com/communications
Amplifiers	amplifier.ti.com	Computers and Peripherals	www.ti.com/computers
Data Converters	dataconverter.ti.com	Consumer Electronics	www.ti.com/consumer-apps
DLP® Products	www.dlp.com	Energy and Lighting	www.ti.com/energy
DSP	dsp.ti.com	Industrial	www.ti.com/industrial
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Security	www.ti.com/security
Logic	logic.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Power Mgmt	power.ti.com	Transportation and Automotive	www.ti.com/automotive
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Mobile Processors	www.ti.com/omap		
Wireless Connectivity	www.ti.com/wirelessconnectivity		
	TI E2E Community Home Page		e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated