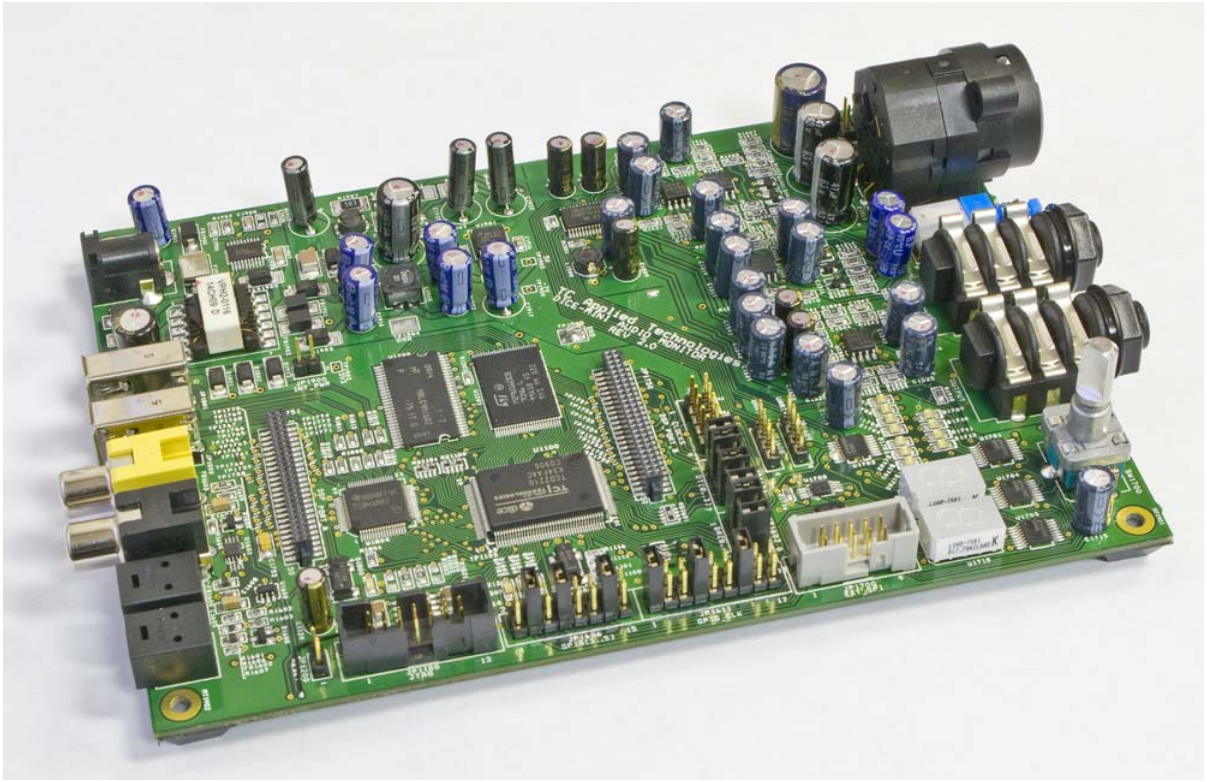
EVM003
Rev 2.0 Users Guide



File: EVM003 Users Guide

Printed: 21 March 2010

Updated: 21 March 2010

Version: 1.5

Revision history

When	Who	What
2009-10-20	GIANA	Document Started
2009-10-30	GIANA	Add descriptions, rev 1.0
2009-11-08	BRIANK	Edits for publication, rev 1.1
2009-11-27	BRIANK	Various edits
2009-12-21	BRIANK	Updated EVM photos, rev 1.3
2010-02-01	BRIANK	Change naming to EVM003, rev 1.4
2010-03-21	BRIANK	Updated default jumper settings for JP601 and JP1602, rev 1.5

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1 Features

- State of the art DICE Mini (TCD2210)
  - Firmware for DICE-JR (TCD2220) can also be prototyped with the EVM003
  - IEEE1394 FireWire interface with hardware streaming engine
  - Patented precision JetPLL™ which maximizes the clocking accuracy of audio samples
  - Various format digital audio interfaces
  - Any-to-any Audio Router
  - 18x16 on-chip hardware mixer with hardware metering support
  - 16 KB on-chip SRAM
- 1394 Physical layer chip
- 8 MB SDRAM and 2MB flash storage
- A Microphone/Line-level input
  - Selectable Microphone input gain and switchable phantom power
- An Instrument/Line-level input
- A Line-level/Headphone output
- SPDIF and ADAT inputs and outputs
- User Interface prototyping elements
  - Rotary Encoder with push switch
  - 8+4 element LED bar, for VU metering or debug status
  - (2) 7-Segment LED s
- (2) Serial I/O headers
  - For debugging and firmware development, two UART ports are provided. One of the UART ports can be used to interface with an external MIDI port.
- Dedicated External SPI port for peripheral expansion
- Configurable GPIO, Data and Clock routing
  - All of DICE Mini's digital audio ports, clocks and GPIO lines (except GPIO0 and GPIO1) are routed to through configurable pin headers for prototyping
- DSP port
  - Optional Freescale DSP56374 and DSP56725 based DSP expansion boards are available
- 1394 Bus powered, or DC powered
- JTAG debugging and programming port
- Fully-functioning firmware examples
- Host 1394 Audio Drivers provided, including Customizable Control Panel
  - OSX Leopard and Snow Leopard, 32-bit and 64-bit – Core Audio
  - Windows XP (x86/x64), Windows Vista (x86), Windows 7 (x86/x64) – ASIO+WDM
  - Drivers customized with manufacturer's vendor info provided at no charge
- Cross-platform Host development and test utilities

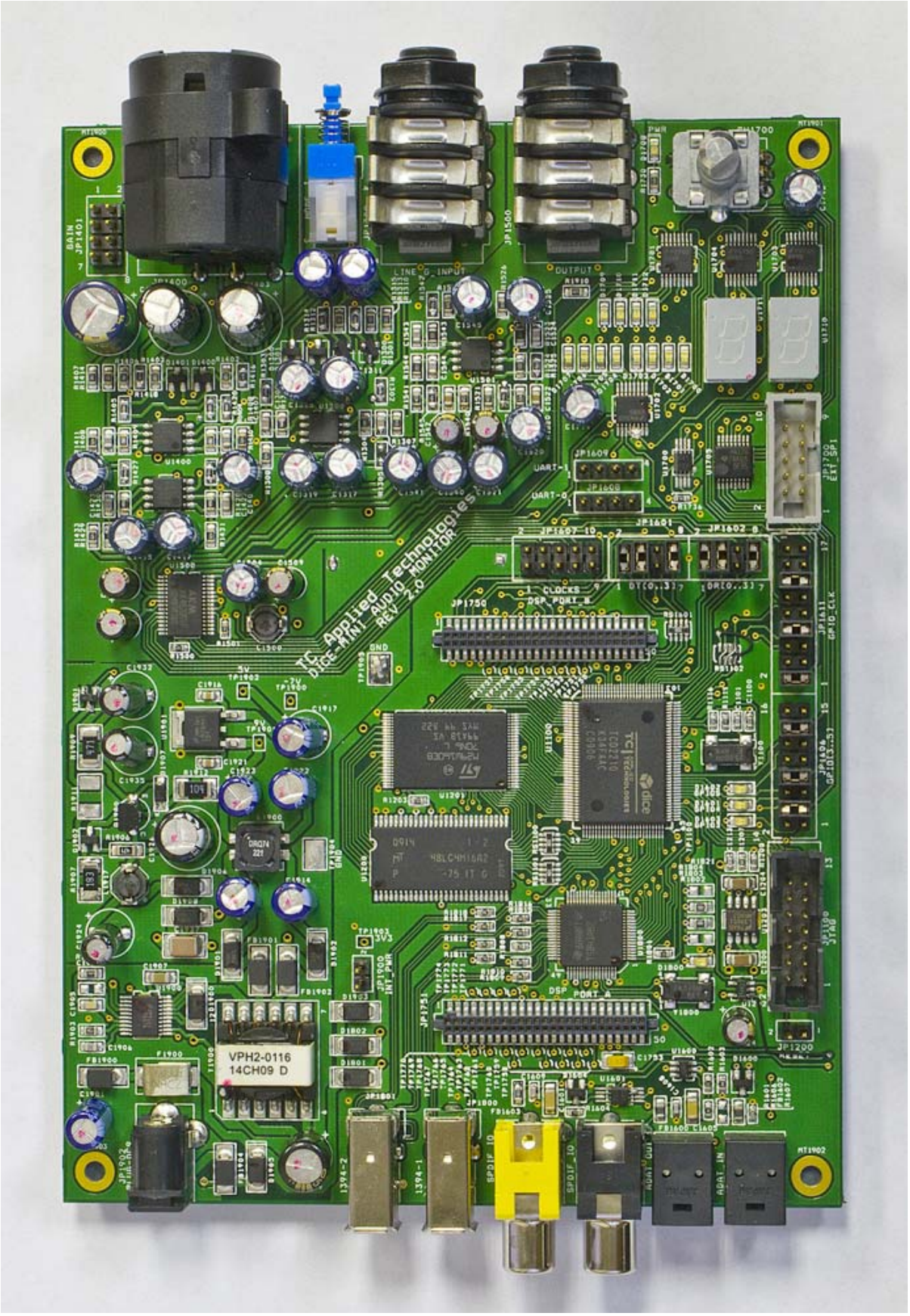
TC Applied Technologies
DICE MINI AUDIO MONITOR
REV 2.0
VPH2-0116
14CH09 D

Figure 1 – EVM003 Board

2 Block Diagram

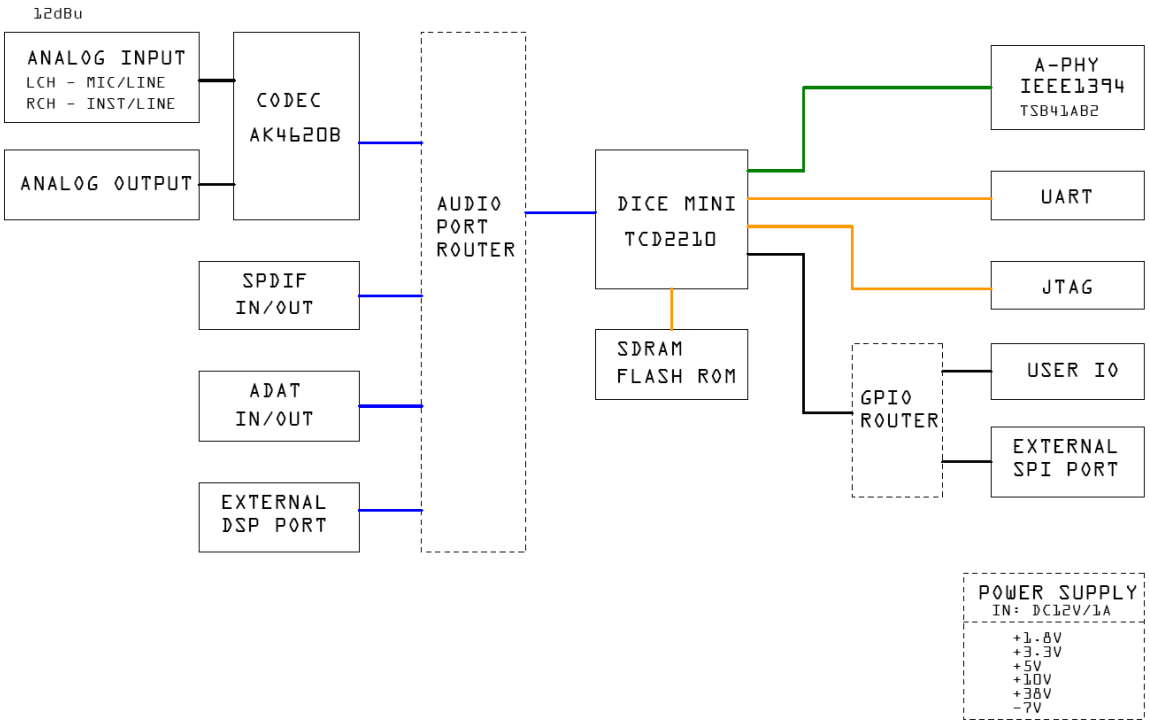

Figure 2 – EVM003 Block Diagram

3 On Board Connectors and Jumpers

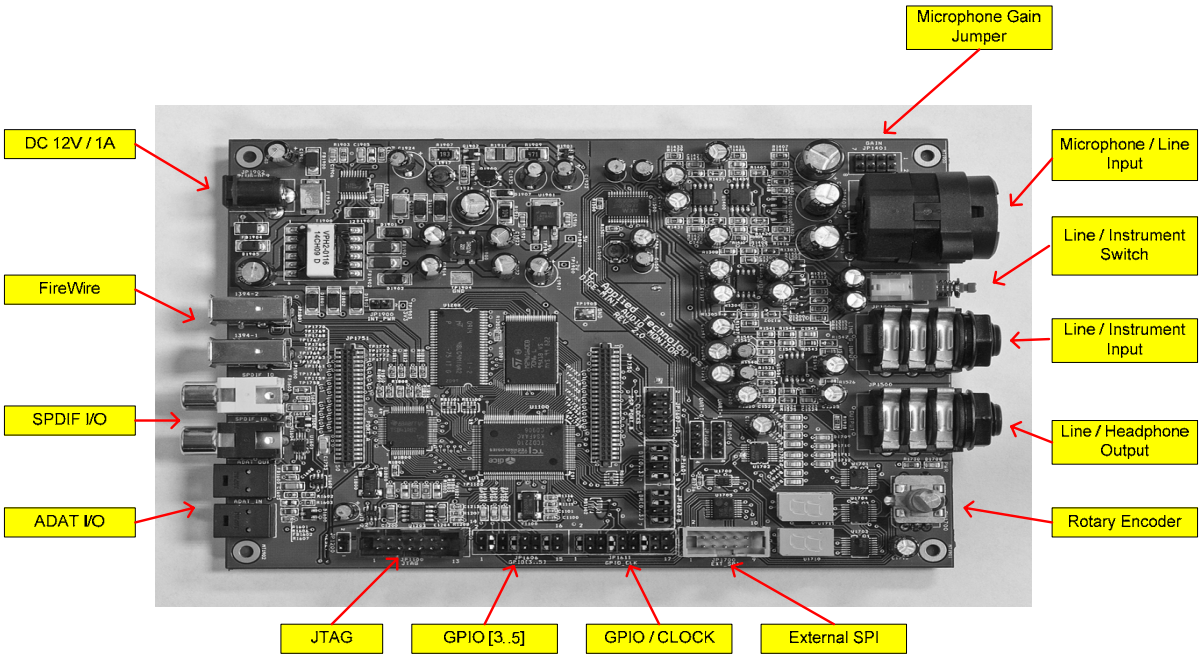

Figure 1 - Connectors and Jumpers

2.1 Analog Input & Output

2.1.1 Microphone/Line input (L-ch) – JP1400

The XLR / TRS combination connector is used for this input, where XLR is used for microphone or a ¼" TRS connector is used for balanced line input. The microphone input is equipped with adjustable gain up to 48dB in 12dB steps by moving a jumper in the JP1401 header. 48V phantom power is provided for this channel and is activated under the control of the firmware. This control is mapped to a SPI port address. To use this firmware feature interactively, a Command Line Interpreter (CLI) command can be used at run-time.

To use as line input, use ¼" TRS jack and make sure to remove a jumper from J1401 Gain Control header.

The line input level is 12dBu max.

Pin#	Pin#	Gain (dB)
1	2	48
3	4	36
5	6	24
7	8	12
None	**None**	0

Table 1 - Microphone gain jumper JP1401

Figure 2 - Microphone/line

2.1.2 Instrument / Line input (R-ch) – JP1300

The right input channel is designed to be used as either instrument (high impedance) or line input. The push switch SW1300 controls this input mode with pushed-in for instrument input mode and pushed-out for line input mode.

The line input level is 12dBu max.

Position	Input Mode
Out	Line
In	Instrument

Table 2- Input mode switch

Figure 3 - Instrument/Line input

2.1.3 Line/Headphone output (L-ch & R-ch) – JP1500

The line/headphone output is an unbalanced signal and provided through a ¼" TRS connector. Maximum output level is 12dBu.

Figure 4 - Line/Headphone output

2.2 SPDIF Input & Output

The RCA connector JP1600 is designed for SPDIF input and JP1603 for SPDIF output.

Both the SPDIF input and the output signal can be routed to any of available four DICE audio ports. The signal routing can be done using audio port header JP1601 for output and JP1602 for input. The default SPDIF input channel is DR2 and output channel is DT2.

Figure 5 - SPDIF Input and output

Figure 6 - ADAT Input and output

2.3 ADAT Input & Output

The ADAT TOS-link connector U1602 is input receiver and U1603 is transmitter.

In the same way as the SPDIF signals, these ADAT signals are connected to DICE audio port headers, JP1601 for output and JP1602 for input. The default ADAT input channel is DR3 and output channel is DT3.

2.4 1394 FireWire

Two 1394 connectors JP1800 and JP1801 are provided. Both 1394 connectors are isolated for Bus-power. The EVM003 board can be powered by the bus power on either of these ports. Bus power is input only and will not provide to external devices.

Figure 7 - Firewire Connector

2.5 User Interface

The rotary encoder with push switch and 12 (8 + 4) LED are provided for user interface prototyping. As default, the rotary encoder works as a volume controller for the signals sent to analog line output and SPDIF output.

Figure 8 - Rotary encoder

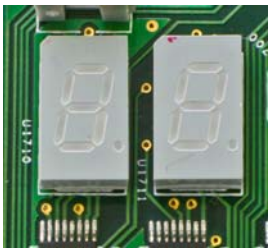

Figure 9 - 7 Segment LED

Figure 10 - 12 LED bar

The 7 segment LED indicates relative output level. Both the 7 segment LEDs and 12 (8+4) LED are mapped to a SPI address. See *SPI Port and Address Assignment* below.

2.6 DC Power Connector

The EVM003 requires a 12V / 0.3A DC source to DC power receptor JP1902 with center-pin positive. The board can also be powered by 1394 Bus-power.

Pin#	Description
Center	DC 12V
Ring	GND

Table 3 - DC power JP1902

Figure 11 - JP1902

3 Audio Clock, Signal, GPIO & User Interface

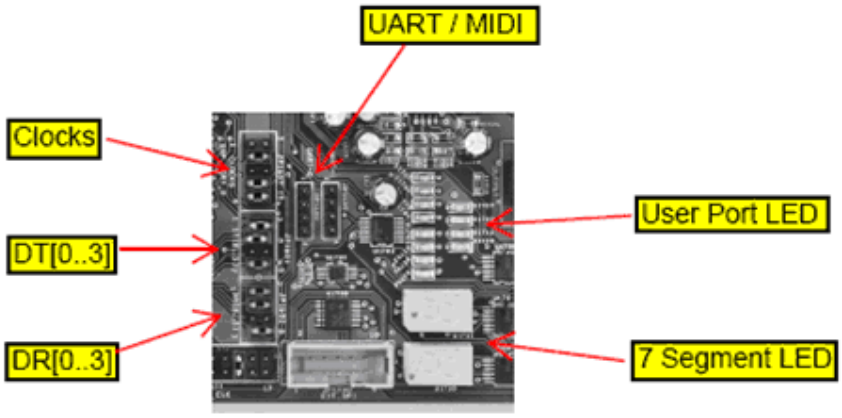

Figure 12 - Audio port and user interface

Consult the DICE MINI (TCD2210) User Guide and the EVM003 design files for signal descriptions.

3.1 Audio port

The DICE audio output port from DT0 to DT3, input port from DR0 to DR3 and clocks are connected to signal router headers JP1601, JP1607 and JP1602 respectively.

Default jumper settings are indicated in RED in the following tables. If necessary, DICE's signals can be ported externally from these headers.

SOURCE	PIN#	PIN#	DESTINATION
DT0	**7**	**8**	CODEC_SDIN
DT1	5	6	DSP_DR
DT2	**3**	**4**	SPDIF_OUT
DT3	**1**	**2**	ADAT_OUT

Table 4 - JP1601, Audio-Out Signal Jumper

DESTINATION	PIN#	PIN#	SOURCE
DR0	**7**	**8**	CODEC_SDOUT
DR1	5	6	DSP_DT
DR2	**3**	**4**	SPDIF_IN
DR3	**1**	**2**	ADAT_IN

Table 5 - JP1602, Audio-In Signal Jumper

SOURCE	PIN#	PIN#	DESTINATION
GND	1	2	GND
MCK0	3	4	AM_MCK0
GND	5	6	GND
BCK0	7	8	AM_BCK0
FCK0	9	10	AM_FCK0

Table 6 – JP1607, Audio Clock Jumper

3.2 GPIO Port

The DICE Mini GPIO[3..5] signals are connected to JP1606. GPIO[6..8] are connected to JP1611 pin header. In the default jumper settings, GPIO[3..5] are connected to the SPI address selector, however these pins can be connected to drive LED(s) or can be used to interface with the optional DSP board.

Name	Pin#	Pin#	Name
GPIO3	2	1	LED D1603
-//-	4	3	SPI_A2
GPIO4	6	5	LED D1601
-//-	8	7	SPI_A2
-//-	10	9	DSP_ACK
GPIO5	12	11	LED D1602
-//-	14	13	SPI_A0
-//-	16	15	DSP_IRQ

Table 7 - JP1606, GPIO[3..5] Assignment Jumper

The GPIO[6..8] signals are connected to the SW1700 rotary encoder with push switch as the default. These ports can be used as secondary DICE audio clock signals.

Name	Pin#	Pin#	Name
GPIO6	1	2	SW_D0 / ENC_A
-//-	3	4	DSP_MCK
MCK0	5	6	DSP_MCK
GPIO7	7	8	SW_D1 / ENC_B
-//-	9	10	DSP_FCK
FCK0	11	12	DSP_FCK
GPIO8	13	14	SW_D2 / ENC_PSH
-//-	15	16	DSP_BCK
BCK0	17	18	DSP_BCK

Table 8 - JP1611, GPIO[6..8] Assignment Jumper

3.3 SPI port and address assignment

The SPI port is connected to 7 addressable devices, 4 internal and 3 external ports. The lower 4 addresses were assigned for CODEC (AK4620), LED bar and Resets, two 7 segments LED and DSP port. The upper 3 addresses were assigned for external SPI port. The SPI address were selected by setting logic states of GPIO[3..5].

Address	SPI_A2 GPIO_3	SPI_A1 GPIO_4	SPI_A0 GPIO_5
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Figure 13 - SPI address vs GPIO[3..5]

Address#	Name	Description
0	SPI_NCS_CD	CODEC
1	SPI_NCS_LED	LED & Reset
2	SPI_NCS_7SG	7 Segment LED
3	SPI_NCS_DSP	DSP Select
4	EXT_NCS0	External SPI Port
5	EXT_NCS1	External SPI Port
6	EXT_NCS2	External SPI Port
7	Not used	

Table 9 - SPI Port Address Assignment

Bit#	Name	Bit#	Name
0	D1700	8	D1709
1	D1701	9	D1710
2	D1702	10	D1711
3	D1703	11	D1712
4	D1704	12	CODEC_NRST
5	D1705	13	N/A
6	D1706	14	DSP_NRST
7	D1707	15	PHANT_ENA

Table 10 - SPI Address 1 Bit Assignment

PIN#	SIGNAL	PIN#	SIGNAL
1	3.3V	2	SPI_CLK
3	GND	4	SPI_MOSI
5	EXT_MISO	6	GND
7	EXT_NCS0	8	EXT_NCS1
9	EXT_NCS2	10	GND

Figure 14 - External SPI port JP1700

4 Debug Ports

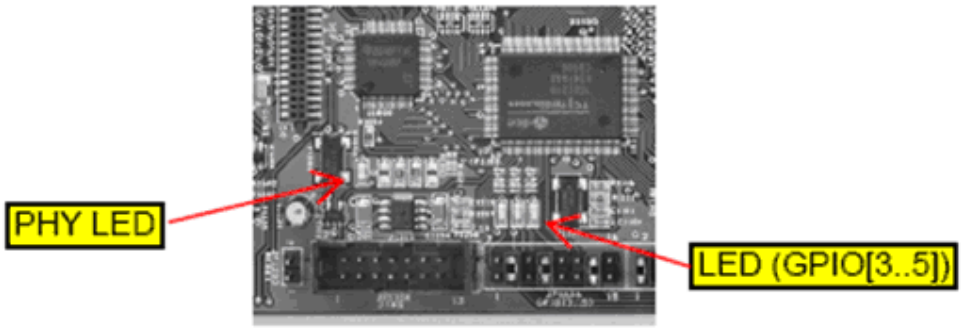

Figure 15 - UART, JTAG and GPIO LEDs

The EVM003 board is equipped with a standard 14-pin JTAG connector JP1100, two UART ports, JP1600 and JP1609 and 3 LEDs for debugging. UART0 is used for CLI interfacing by default. A level shifter is required for use with a PC Serial Port. The UART1 port can be used as MIDI interface port with additional minimal components. UART1 may also be used for serial debugging of firmware if a ROM monitor is present in flash, however JTAG debugging is preferred if your device supports MIDI.

By connecting the three LED's D1601, D1602 and D1603 to DICE's GPIO ports directly, the LED's can be used to monitor essential functions of the DICE Mini while developing firmware.

4.1 JTAG

PIN#	SIGNAL	PIN#	SIGNAL
1	3.3V	2	GND
3	NRST	4	GND
5	TDI	6	GND
7	TMS	8	GND
9	TCK	10	GND
11	TDO	12	PULLUP
13	3.3V	14	GND

Table 11 - JP1100 JTAG Connector

4.2 UART

Pin#	Signal Name
1	3.3V
2	TXD0 / TXD1
3	GND
4	RXD0 / RXD1

Table 12 - JP1600 & JP1609, UART Header

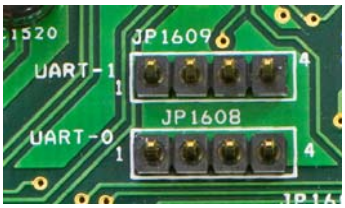

Figure 16 - UART port

4.3 LED

See GPIO[3..5] description for detail.

5 Master Reset & DC Power Test Point

The master board reset can be achieved by shorting pins 1 and 2 of JP1200.

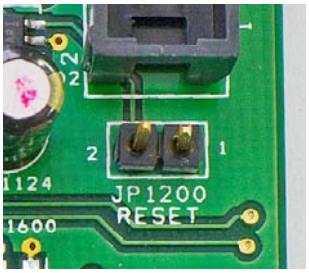

Figure 17 - Reset header JP1200

Internally generated DC rail 3.3V, 5V, -7V and 9V are connected to test points TP1903, TP1902, TP1900 and TP1901 respectively.

Figure 18 - 3.3V test point

Figure 19 - 5V, -7V and +9V test points

6 DSP Port

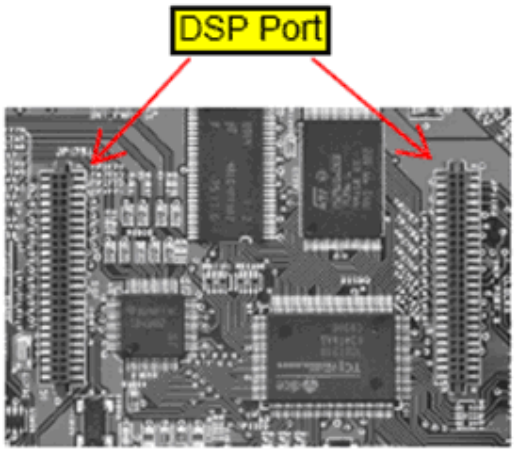

Figure 20 - DSP Port

6.1 Socket JP1750 & 1751 pin assignment

Two 0.05" pitch 2x25 pin sockets (SFM-125-02-S-D-LC) are provided for connecting the optional DSP board. A matching header, SAMTEC TFM125-12-S-D-A or equivalent, should be used for expansion boards that use this port.

3.3V, SPI accessible reset signal, audio clocks, audio input and output port, control/status signal (DSP_IRQ, DSP_ACK) and SPI signals are provided through these two sockets.

Pin#	Signal Name	Pin#	Signal Name
1	GND	2	DSP_NRST
3	GND	4	GND
5	GND	6	DSP_IRQ
7	GND	8	TP1770
9	TP1774	10	DSP_ACK
11	TP1773	12	TP1769
13	TP1772	14	GND
15	TP1771	16	TP1768
17	GND	18	TP1767
19	DSP_CLK	20	TP1766
21	GND	22	GND
23	GND	24	TP1765
25	GND	26	TP1764
27	GND	28	TP1763
29	GND	30	TP1762
31	GND	32	TP1761
33	GND	34	TP1760
35	GND	36	TP1759

Pin#	Signal Name	Pin#	Signal Name
37	GND	38	TP1758
39	GND	40	GND
41	3.3V	42	3.3V
43	3.3V	44	3.3V
45	NC	46	NC
47	NC	48	NC
49	NC	50	NC

Table 13 - JP1751, DSP Port-A

Pin#	Signal Name	Pin#	Signal Name
1	GND	2	GND
3	SPI_NCS_DSP	4	GND
5	SPI_MOSI	6	GND
7	SPI_MISO_DSP	8	GND
9	SPI_CLK	10	GND
11	GND	12	GND
13	DSAI_CLK	14	TP1757
15	DSAI_SYNC	16	GND
17	DSAI_DT	18	TP1756
19	DSAI_DR	20	GND
21	GND	22	TP1755
23	DSP_MCK	24	GND
25	DSP_BCK	26	TP1754
27	DSP_FCK	28	GND
29	DSP_DT	30	TP1753
31	DSP_DR	32	TP1752
33	GND	34	TP1751
35	PULLUP	36	TP1750
37	PULLUP	38	GND
39	GND	40	GND
41	3.3V	42	3.3V
43	3.3V	44	3.3V
45	NC	46	NC
47	NC	48	NC
49	NC	50	NC

Table 14 - JP1750, DSP Port-B

6.2 Optional DSP board

Optional Freescale DSP56374 and DSP56725 based DSP boards are available.

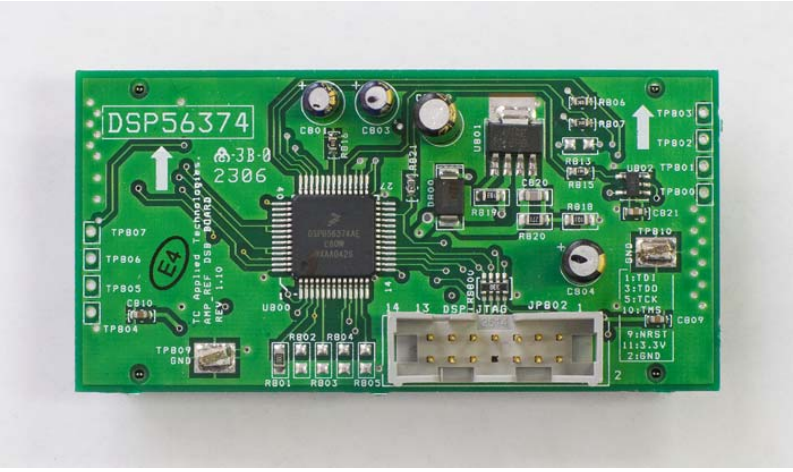

Figure 21 - DSP56374 DSP Board

7 Specifications

7.1 Mic/Inst/Line Input

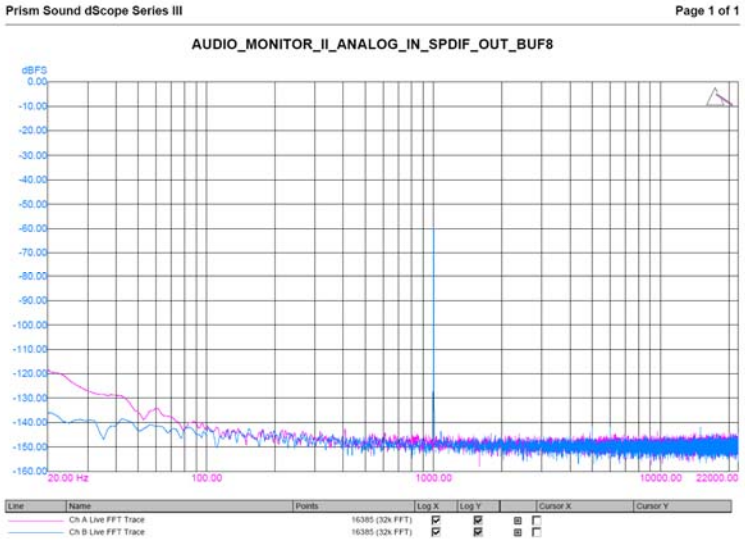

Figure 22 - Analog Input SPDIF Output

7.2 Line Output

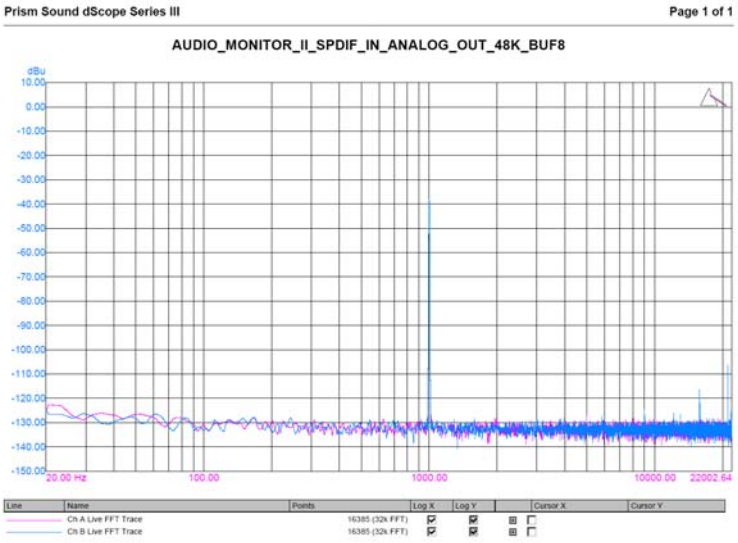

Figure 23 - SPDIF Input Analog Output

8 Summary

The DICE Mini EVM003 board is part of a complete and easy to use solution for development of advanced, high-performance audio devices, including Firmware, Host computer Drivers, Utilities and User Interfaces.

Contact TC Applied Technologies, Ltd. for development boards, design files, chip User Guides, Firmware development kit, Host development kits and other software.

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