AT73C209-EK2 Evaluation Kit

User Guide
Section 1
Introduction

Congratulations on your purchase of the AT73C209-EK2. It is designed to give designers a quick start to evaluate the power management capability of the AT73C209 as well as for prototyping and testing of new designs.

1.1 Scope

This document describes the AT73C209-EK2 dedicated to products based on the 56H10 core. This board is designed to allow an easy evaluation of the products using demonstration software.

To increase its demonstration capabilities, this standalone board has several serial interfaces (Parallel Port and Two-wire Interface).

This user guide acts as a general getting started guide as well as a complete technical reference for advanced users.


Typical Applications

- Portable Music Players
- CD Players
- Handheld GPS

1.2 AT73C209-EK2 Features

The AT73C209-EK2 provides the following features:

- Power supply:
  - Transformer
  - External battery connection
  - USB

- Serial interfaces:
  - Parallel port, male type (converted to SPI)

- On-board resources:
  - Programmable digital step-up DC/DC converter
  - 2 programmable LDOs
  - Reset Generator
  - Programmable Stereo Audio DAC (16-bits, 18-bits or 20-bits)
  - 93 dB SNR Playback Stereo Channels
Introduction

- 32-Ohm/20 mW Stereo Headset Drivers with master volume and mute controls,
- Stereo Line Level input with volume control/mute and playback through the headset driver
- Microphone Preamplifier
- Stereo, Mono and reverse Stereo mixer,

- On-board buttons:
  - Power On
  - SPDIF to I2S converter reset

1.3 Deliverables

AT73C209-EK2 package contains the following items:

- An AT73C209-EK2 board
- One CD-ROM containing product’s software, user guide and a full data sheet.
AT73C209 is located in the center of the AT73C209-EK2 on the Components Side.
Figure 1-2. AT73C209-EK2 Components Side
2.1 Electrostatic Warning

The AT73C209-EK2 evaluation board is shipped in protective anti-static packaging. The board must not be subjected to high electrostatic potentials. A grounding strap or similar protective device should be connected when handling the board. Avoid touching the components, pins or any metallic element.

2.2 Requirements

In order to set up the AT73C209-EK2 evaluation board the following items are needed:

- The AT73C209-EK2 evaluation board itself.
- An output DC power source:
  - Transformer 5.5V to 9V DC max (minimum 500 mA is required if selected as a source)
  - External power supplies [see Table 3-2 for voltages ranges]
  - Battery and/or USB

2.3 PC System Requirements

For a correct operation of the AT73C209-EK2 evaluation board, the minimum hardware and software PC requirements are:

- Intel Pentium II processor
- 64 MB RAM
- 70 MB free hard disk space (for AT73C209 Evaluation board software installation)
- Windows® 95/98/2000/ME/XP and Windows NT® 4.0 or higher (For Win 2000/XP/NT DLPOR1O.EXE must be installed)
- Parallel port (COM port)
2.4 Instructions

2.4.0.1 To Start the AT73C209-EK2 Evaluation Board

- If the PC runs with Windows NT, 2000 install «DLPORTIO.exe».
- To install AT73C209-EK2 Test Interface, go to «Installer» folder of CD provided with evaluation kit, and double click on «setup.exe».
- Configure the on-board jumpers as in the relevant paragraphs:
  1. Section 2.6 on page 2-4
  2. Section 2.7 on page 2-7
  3. Section 2.8 on page 2-8,
  4. Section 2.9 on page 2-11,
- Connect the transformer.
- Connect parallel port.
- Connect Input and Output devices.
- To launch the software AT73C209 Test interface, click on AT73C209.exe.

2.4.0.2 To Turn Off the AT73C209-EK2 Evaluation Board

- Disconnect the chosen power supply.
2.5 Block Diagram

**Figure 2-1.** AT73C209-EK2 Block Diagram

![AT73C209-EK2 Block Diagram](image)
### 2.6 Power Supply

The AT73C209-EK2 is supplied with the following voltage sources:

*Figure 2-2. Power supply diagram*

![Power supply diagram](image)

#### 2.6.1 Transformer

*Table 2-1. Transformer Supply Voltage*

<table>
<thead>
<tr>
<th>Power supply source</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformer</td>
<td>5.5</td>
<td>9</td>
<td>V</td>
</tr>
</tbody>
</table>

The power supply voltage is regulated with on board circuitry. Input voltage on this connector should be included between 5.5V and 9V.

*Note:* This power supply input is NOT protected against polarization inversion.

*Figure 2-3. Transformer Connector*
2.6.2 External Power Supply

The AT73C209 is supplied by external power. This can be a USB source, a Disposable Battery or a Transformer.

There are two ways to power up the AT73C209:
1. USB and Battery
2. Battery and Transformer

(Table 2-2 details the optional input items.)

<table>
<thead>
<tr>
<th>Power Supply Source</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB</td>
<td>4.35</td>
<td>5.5</td>
<td>V</td>
</tr>
<tr>
<td>“Disposable” Battery AA or AAA size</td>
<td>0.9</td>
<td>1.8</td>
<td>V</td>
</tr>
<tr>
<td>Transformer</td>
<td>5.5</td>
<td>9</td>
<td>V</td>
</tr>
</tbody>
</table>

2.6.2.1 USB Setup

In order to connect the USB power supply, do the following:
1. Connect the USB (+) to the USB pad and USB (GND) to GND pad.
2. Close J26 pins 2 & 3.
3. In this case the position of the On/Off switch has no meaning.

![Operating the AT73C209 with a USB](image)

2.6.2.2 Battery Setup

In order to connect the battery, do the following:
1. Connect the Battery (+) to the Battery pad and Battery (-) to GND pad.
2. Close G1 pads (See Section 2.10.1 “Configuration Pads” on page 2-15).
3. Switch J1, in the correct position, to power the AT73C209.
2.6.2.3 Transformer Setup

In order to connect to the transformer, do the following:

1. Close J26 pins 1 & 2 with a jumper.
2. Connect the Transformer to J18.
3. In this case the position of the On/Off switch has no meaning.

Ground Setup

P3 connector provides a possibility to separate the digital ground from the analog ground. By default the evaluation card is supplied with both grounds connected.
2.7 Communication Interfaces

2.7.1 AT73C209-EK2 SPI

This board enables control of the AT73C209 via the SPI through the parallel port (J23).

If the user wants to program the AT73C209 with an external host, J15, J19 can be removed and the AT73C209 driven directly.

The SPI Communication protocol is described in the AT73C209 data sheet. In any case, using the SPI interface requires that a transformer be connected to J18.

Figure 2-8. AT73C209 SPI Configuration (J15, J19)

Note: For soldering instructions, see Section 2.10.1 "Configuration Pads" on page 2-15
2.8 On-Board Input Signal

On the AT73C209-EK2 there are several optional input signals. These inputs can be all driven or mixed directly through the internal amplifier.

2.8.1 Optical to Digital Converter (ODC)

The Optical to Digital Converter allows the user to connect an optical input line (J16) to the AT73C209 without any other necessary components (The plug type is Toslink).

2.8.1.1 ODC Set-Up

In order to connect the ODC with the I2S of the AT73C209, close G3, G4, G5 and G6 as shown in the following figure.

![Optical to Digital Converter](image)

**Note:** For soldering instructions, see Section 2.10.1 "Configuration Pads" on page 2-15

2.8.1.2 External Oscillator Configuration - Output Select

The external oscillator provides the sampling frequency for the Optical-to-I2S converter.

Two on-board configuration pads are available for configuring the 12.288 MHz oscillator (U6).

G7 pads provide Original Output Frequency (Frequency = 12.288 MHz) or Divided Output Frequency. The divider is configured as (Frequency/2 = 6,144MHz).

G8 pads provide On/Off selection. When the oscillator is off, the output goes to high impedance state.

**Table 2-3.** G7 and G8 - Oscillator Configuration Pads

<table>
<thead>
<tr>
<th></th>
<th>Pins 1&amp;2</th>
<th>Pins 2&amp;3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original frequency</td>
<td>G7</td>
<td></td>
</tr>
<tr>
<td>Divided frequency</td>
<td>G7</td>
<td></td>
</tr>
<tr>
<td>Oscillator on</td>
<td>G8</td>
<td></td>
</tr>
<tr>
<td>Oscillator off</td>
<td>G8</td>
<td></td>
</tr>
</tbody>
</table>
Figure 2-10. Original Frequency Output (Oscillator is “ON”)

Figure 2-11. Divided Frequency Output (Oscillator is “ON”)

Figure 2-12. Oscillator is “ON”

Figure 2-13. Oscillator is “OFF”
Starting Up the AT73C209-EK2 Board

2.8.2 RCA Inputs

The RCA type input connectors on the AT73C209-EK2 (J4 & J5) are connected directly to the amplifier’s input.

Connect J4 to left input signal.
Connect J5 to right input signal.

The line-in/microphone amplifier has an input range of 70 mVrms at maximum gain.

*Figure 2-14.* RCA Connectors (J4 & J5)

2.8.3 Microphone Input

The Microphone input on the AT73C209-EK2 (J7) is a 3.5 mm mono connector.

*Figure 2-15.* Microphone Input Connector (J7)

2.8.3.1 Microphone Output Measurement

The microphone input is driven directly by the AT73C209-EK2. The microphone output from the amplifier can be measured, or used in other applications, by connecting a probe to J28 pin Nº2.
2.8.3.2 Mixing and Amplifying the Microphone

In order to connect to the microphone input and be able to mix and amplify it, close the connectors J27 and J28 with a jumper.

2.9 On-Board Outputs Signals

2.9.1 Headset

The Headset output can be connected with a 3.5 mm connector to J6. The output impedance is 16 Ohms, 32 Ohms or 10K Ohms.
2.9.2 Generated Reset

The AT73C209 supports peripheral reset by connecting it to RSTB output.

2.9.3 Interrupt

The AT73C209 supports peripheral interrupt by connecting it to ITB output.

2.9.4 Load Current Measurement

All three output voltages and current generated by the AT73C209-EK2, can be measured by dedicated connectors.
2.9.4.1 FB/VBOOST Feed

The FB/VBOOST feed (G2) is connected by default.

**Figure 2-21.** FB/VBOOST Feed (G2)

2.9.4.2 Voltage Measuring

In order to measure the output voltages, connect a probe to J25. (see Figure 2-22 for J25 location)

- Pin N°1 - VBOOST.
- Pin N°2 - VANA.
- Pin N°3 - VFB.

**Figure 2-22.** Output Voltages Test Connector (J25)

### Table 2-4. Voltage Ranges

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Specification</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB (DC-DC)</td>
<td>2.7 Typ ----- 3.3</td>
<td>V</td>
</tr>
<tr>
<td>VBOOST (LDO1)</td>
<td>2.7 Typ ----- 3.5</td>
<td>V</td>
</tr>
<tr>
<td>VANA (LDO2)</td>
<td>2.4 Typ ----- 3</td>
<td>V</td>
</tr>
</tbody>
</table>
2.9.4.3 Current Measuring

In order to measure the output current: Connect an Ampermeter and a load resistor in serial to load pad (P4) and close with a jumper, the voltage output that you wish to measure (in J24). (see Figure 2-23 for P4 and J24 locations).

- Close pins N° 1 & 2 on J24 for VBOOST.
- Close pins N° 3 & 4 on J24 for VANA.
- Close pins N° 5 & 6 on J24 for VFB.

Figure 2-23. Current Measurement Set-Up
2.10 General Configuration

2.10.1 Configuration Pads

A configuration pad configures the AT73C209-EK2 Evaluation Board for custom application. The configuration is programmable by soldering a specific part of the configuration pad. To return to the initial configuration, the customer has to solder a short jumper.

*Figure 2-24.* Configuration Pads

![Configuration Pads](image1)

*Figure 2-25.* Configuration Pads with 2 Options

![Configuration Pads with 2 Options](image2)

2.10.1.1 Measurement Probing

Any measurement shall be done with a closed configuration pad.

*Figure 2-26.* Voltage Probing

![Voltage Probing](image3)
Figure 2-27. Current Probing

Not connected

No solder
Section 3

AT73C209-EK2 Software Interface

3.1 Software Panel

Figure 3-1. Software Panel - General Propose Page

- Master clock select
- DAC functionality
- Line in control
- DAC master out
- DAC line out
- Headset level control
- Program exit
- Optical to PS enable
- mixer control
- Mixing type selector
- VANA voltage control
- VBoost voltage control
- Input/Output select
Figure 3-2. Software Panel - Registers Page
Section 4

Technical Specifications

- **System Unit**
  - Physical Dimensions: $L=100 \times W=100 \times H=27$ mm
  - Weight: $70$ g

- **Operating Conditions**
  - Voltage Supply: $5.5V - 9V$

- **Connections**
  - Parallel Port Connector: SubD25 male
Section 5
PCB Layout

Figure 5-1. Layer 1 - Components Layer

Note: Size not to be scaled.
Figure 5-2. Layer 2 - Solder Layer

Note: Size not to be scaled.
Section 6

Schematics

Figure 6-1. AT73C209-EK2 Main Schematics Page
Figure 6-2. AT73C209-EK2 Level Shifter
Figure 6-3. AT73C209-EK2 S/PDIF Interface
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