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# AT73C240 vs AT73C213 - Software Integration

## 1. Scope

The goal of this document is to help a software team that already uses the AT73C213 product to easily integrate the new AT73C240 product in their application.

This document describes the registers that are changed or removed between the AT73C213 product and the AT73C240 product.

In the tables that follow, the registers that have changed are highlight in blue and the registers that have been removed are highlight in red.

## 2. Product Description

The AT73C240 is a fully integrated, low-cost, combined stereo audio DAC and audio power amplifier circuit.

The stereo DAC section is a complete high performance, stereo, audio digital-to-analog converter. It comprises a multibit sigma-delta modulator with dither, continuous time analog filters and analog output drive circuitry.

Master clock is 256 or 384 times the input data rate, allowing choice of input data rate up to 48 kHz, including standard audio rates of 48, 44.1, 32, 16 and 8 kHz.

The DAC section is followed by a volume and mute control and can be simultaneously played back directly through a stereo 32 Ohm headset pair of drivers.

The stereo 32 Ohm headset pair of drivers also includes a mixer of a LINEL and LINER pair of stereo inputs.

The Audio Power Amplifier is a differential amplifier designed in CMOS technology. It is capable of driving an 8 Ohm Loudspeaker at maximum power of 440mW.

The volume, mute, power down, de-emphasis controls and audio formats are digitally programmable via a serial bus and the digital audio data are provided through a multi-format I2S interface.



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**Power  
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**Application Note**

6484A-PMAAC-04-Jun-09



### 3. Operating Conditions

**Table 3-1.** Operating Condition Table For AT73C240 Product

Parameter/Function	Pads	Conditions	Min	Max	Unit
Storage Temperature	--		-55	150	°C
Operating Temperature	--		-40	85	°C
Audio Power Input Voltage	VBAT		3.0	5.5	V
Digital Input Voltage	VDIG		2.4	3.3	V
Analog Input Voltage	AVDD, AVDDHS		2.7	3.3	V

### 4. Glossary

**DAC** -- Digital to Analog Converter

**SPI** -- Serial Peripheral Interface

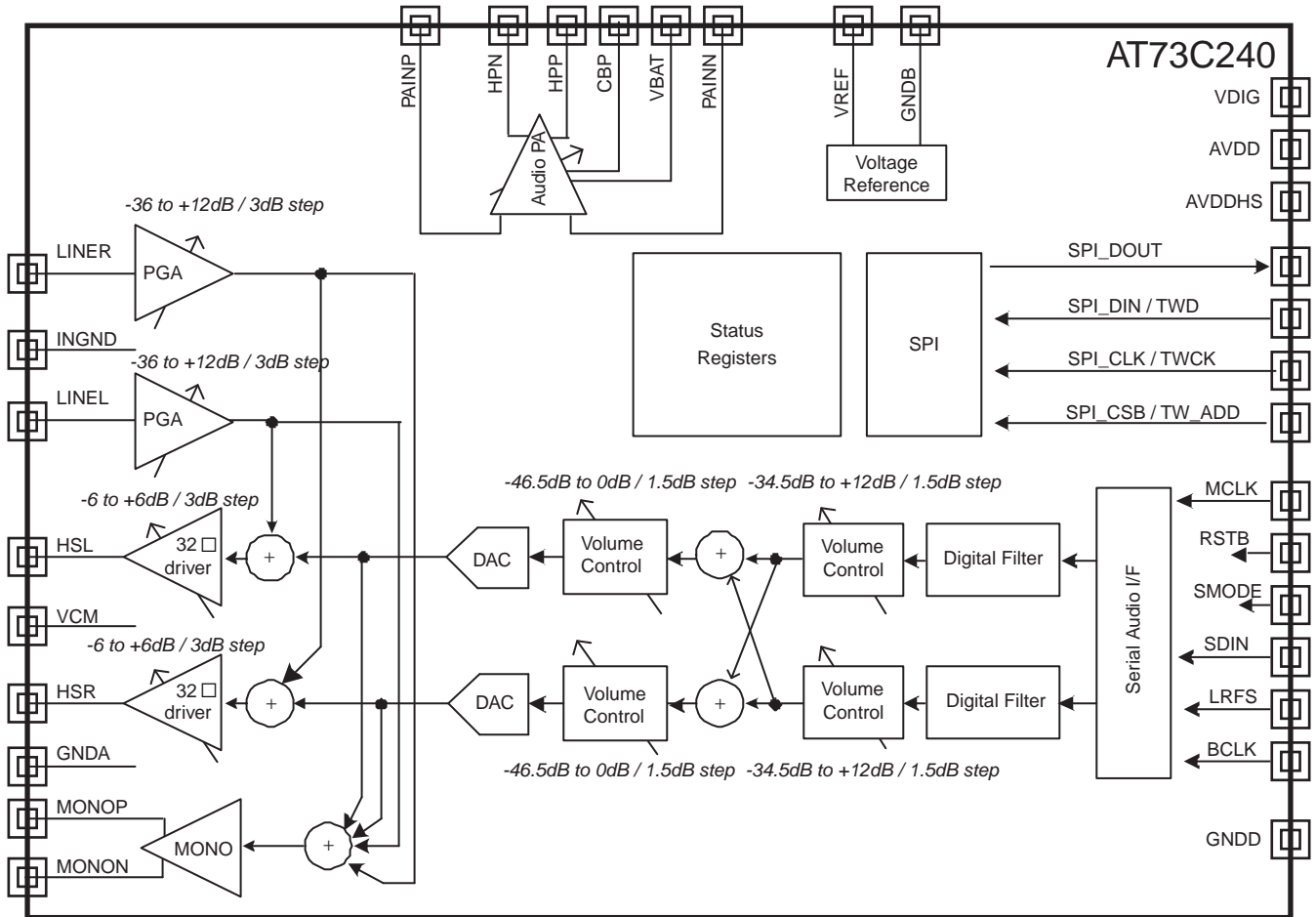
**TWI** -- Two Wire Interface

**PA** -- Audio Power Amplifier

**I<sup>2</sup>S** -- Integrated Interchip Sound Interface

## 5. AT73C240 Block Diagram

Figure 5-1. AT73C240 Block Diagram



## 6. User Interface : Register Table

### 6.1 AT73C213 Register Table

Address	Register	Name	Access	Reset State
0x00	DAC_CTRL	DAC Control	Read/Write	0x00
0x01	DAC_LLIG	DAC Left Line In Gain	Read/Write	0x05
0x02	DAC_RLIG	DAC Right Line In Gain	Read/Write	0x05
0x03	DAC_LMPG	DAC Left Master Playback Gain	Read/Write	0x08
0x04	DAC_RMPG	DAC Right Master Playback Gain	Read/Write	0x08
0x05	DAC_LLOG	DAC Left Line Out Gain	Read/Write	0x00
0x06	DAC_RLOG	DAC Right Line Out Gain	Read/Write	0x00
0x07	DAC_OLC	DAC Output Level Control	Read/Write	0x22
0x08	DAC_MC	DAC Mixer Control	Read/Write	0x09
0x09	DAC_CSFC	DAC Clock and Sampling Frequency Control	Read/Write	0x00
0x0A	DAC_MISC	DAC Miscellaneous	Read/Write	0x00
0x0C	DAC_PRECH	DAC Precharge Control	Read/Write	0x00
0x0D	DAC_AUXG	Dac Auxiliary input gain Control	Read/Write	0x05
0x10	DAC_RST	DAC Reset	Read/Write	0x00
0x11	PA_CRTL	Power Amplifier Control	Read/Write	0x00

### 6.2 AT73C240 Register Table

Address	Register	Name	Access	Reset State
0x00	DAC_CTRL	DAC Control	Read/Write	0x00
0x01	DAC_LLIG	DAC Left Line In Gain	Read/Write	0x05
0x02	DAC_RLIG	DAC Right Line In Gain	Read/Write	0x05
0x03	DAC_LMPG	DAC Left Master Playback Gain	Read/Write	0x08
0x04	DAC_RMPG	DAC Right Master Playback Gain	Read/Write	0x08
0x05	DAC_LLOG	DAC Left Line Out Gain	Read/Write	0x00
0x06	DAC_RLOG	DAC Right Line Out Gain	Read/Write	0x00
0x07	DAC_OLC	DAC Output Level Control	Read/Write	0x22
0x08	DAC_MC	DAC Mixer Control	Read/Write	0x09
0x09	DAC_CSFC	DAC Clock and Sampling Frequency Control	Read/Write	0x00
0x0A	DAC_MISC	DAC Miscellaneous	Read/Write	0x00
0x0B	IS_CTRL	I <sup>S</sup> synchronous	Read/Write	0x00
0x0C	DAC_PRECH	DAC Precharge Control	Read/Write	0x00
0x10	DAC_RST	DAC Reset	Read/Write	0x00
0x11	PA_CRTL	Power Amplifier Control	Read/Write	0x0F

## 7. DAC Control Register : DAC\_CTRL

### 7.1 AT73C213 Register

Register Name: DAC\_CTRL (Address = 0x00)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
<b>ONPADRV</b>	<b>ON AUXIN</b>	ONDACR	ONDA CL	ONLNOR	ONLNOL	ONLNIR	ONLNIL

Bit	Name	Description	Reset Value
0	ONLNIL	Left channel line in amplifier (L to power down, H to power up)	Low
1	ONLNIR	Right channel line in amplifier (L to power down, H to power up)	Low
2	ONLNOL	Left channel line out driver (L to power down, H to power up)	Low
3	ONLNOR	Right channel line out driver (L to power down, H to power up)	Low
4	ONDA CL	Left channel DAC (L to power down, H to power up)	Low
5	ONDACR	Right channel DAC (L to power down, H to power up)	Low
<b>6</b>	<b>ON AUXIN</b>	<b>Differential mono auxiliary input amplifier (L to power down, H to power up)</b>	<b>Low</b>
<b>7</b>	<b>ONPADRV</b>	<b>Differential mono PA driver (L to power down, H to power up)</b>	<b>Low</b>

### 7.2 AT73C240 Register

Register Name: DAC\_CTRL (Address = 0x00)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
<b>Not Used</b>	<b>ONPADRV</b>	ONDACR	ONDA CL	ONLNOR	ONLNOL	ONLNIR	ONLNIL

Bit	Name	Description	Reset Value
0	ONLNIL	Left channel line in amplifier (L to power down, H to power up)	Low
1	ONLNIR	Right channel line in amplifier (L to power down, H to power up)	Low
2	ONLNOL	Left channel line out driver (L to power down, H to power up)	Low
3	ONLNOR	Right channel line out driver (L to power down, H to power up)	Low
4	ONDA CL	Left channel DAC (L to power down, H to power up)	Low
5	ONDACR	Right channel DAC (L to power down, H to power up)	Low
<b>7</b>	<b>ONPADRV</b>	<b>Differential mono PA driver (L to power down, H to power up)</b>	<b>Low</b>
	<b>Not Used</b>	--	<b>Low</b>

## 8. DAC Output Level Control Register : DAC\_OLC

### 8.1 AT73C213 Register

Register Name: DAC\_OLC (Address = 0x07)

Reset State: 0x22 (Access: Read/Write)

7	6	5	4	3	2	1	0
RSHORT	ROLC			LSHORT	LOLC		

Bit	Name	Description	Reset Value
2:0	LOLC	Left channel output level selector	Low, High, Low
3	LSHORT	Left channel short circuit indicator	Low
6:4	ROLC	Right channel output level selector	Low, High, Low
7	RSHORT	Right channel short circuit indicator	Low

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**Table 8-1.** Output Level Control

LOLC / ROLC	Gain	Unit	LOLC / ROLC	Gain	Unit
000	6	dB	011	-3	dB
010	3	dB	≥100	-6	dB
010	0	dB			

### 8.2 AT73C240 Register

Register Name: DAC\_OLC (Address = 0x07)

Reset State: 0x22 (Access: Read/Write)

7	6	5	4	3	2	1	0
RSHORT	ROLC			LSHORT	LOLC		

Bit	Name	Description	Reset Value
2:0	LOLC	Left channel output level selector	Low, High, Low
3	LSHORT	Left channel short circuit indicator	Low
6:4	ROLC	Right channel output level selector	Low, High, Low
7	RSHORT	Right channel short circuit indicator	Low

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**Table 8-2.** Output Level Control

LOLC / ROLC	Gain	Unit	LOLC / ROLC	Gain	Unit
000	-5	dB	011	2.5	dB
010	-2.5	dB	≥100	5	dB
010	0	dB			

## 9. DAC Miscellaneous Register : DAC\_MISC

### 9.1 AT73C213 Register

Register Name: DAC\_MISC (Address = 0x0A)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
<b>VCMCAPSEL</b>	<b>Not Used</b>	DINTSEL		DITHEN	DEEMPEN	NBITS	

Bit	Name	Description	Reset Value
1:0	NBITS	Data Interface Word Length	High, Low
2	DEEMPEN	De-emphasis enable	Low
3	DITHEN	Dither enable	Low
5:4	DINTSEL	I2S data format selector	Low, Low
<b>6</b>	<b>Not Used</b>	--	<b>Low</b>
<b>7</b>	<b>VCMCAPSEL</b>	<b>VCM decoupling capacitor selector</b>	<b>Low</b>

### 9.2 AT73C240 Register

Register Name: DAC\_MISC (Address = 0x0A)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
<b>Not Used</b>	<b>VCMCAPSEL</b>	DINTSEL		DITHEN	DEEMPEN	NBITS	

Bit	Name	Description	Reset Value
1:0	NBITS	Data Interface Word Length	High, Low
2	DEEMPEN	De-emphasis enable	Low
3	DITHEN	Dither enable	Low
5:4	DINTSEL	I2S data format selector	Low, Low
<b>6</b>	<b>VCMCAPSEL</b>	<b>VCM decoupling capacitor selector</b>	<b>Low</b>
<b>7</b>	<b>Not Used</b>	--	<b>Low</b>



## 10. I<sup>2</sup>S Synchronous Register : IS\_CTRL

### 10.1 AT73C213 Register

This register does not exist for AT73C213 product

### 10.2 AT73C240 Register

Register Name: IS\_CTRL (Address = 0x0B)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
Not Used	Not Used	Not Used	Not Used	Not Used	IS_CTRL	Not Used	Not Used

Bit	Name	Description	Reset Value
0	Not Used	--	Low
1	Not Used	--	Low
2	IS_CTRL	Active synchronous I2S master clock	Low
3	Not Used	--	Low
4	Not Used	--	Low
5	Not Used	--	Low
6	Not Used	--	Low
7	Not Used	--	Low

## 11. DAC Precharge Register : DAC\_PRECH

### 11.1 AT73C213 Register

Register Name: DAC\_PRECH (Address = 0x0C)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
<b>PRCHGPDRV</b>	<b>PRCHGAUX</b>	<b>PRCHGLNOR</b>	<b>PRCHGLNOL</b>	PRCHGLNIR	PRCHGLNIL	PRCHG	ONMSTR

Bit	Name	Description	Reset Value
0	ONMSTR	Master power on control	Low
1	PRCHG	Master pre-charge	Low
2	PRCHGLNIL	Left channel Line In pre-charge	Low
3	PRCHGLNIR	Right channel Line In pre-charge	Low
4	<b>PRCHGLNOL</b>	<b>Left channel Line Out pre-charge</b>	<b>Low</b>
5	<b>PRCHGLNOR</b>	<b>Right channel Line Out pre-charge</b>	<b>Low</b>
6	<b>PRCHGAUX</b>	<b>Differential mono auxiliary input pre-charge</b>	<b>Low</b>
7	<b>PRCHGPDRV</b>	<b>Differential mono PA driver pre-charge</b>	<b>Low</b>

### 11.2 AT73C240 Register

Register Name: DAC\_PRECH (Address = 0x0C)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
Not Used	Not Used	Not Used	<b>PRCHGPDRV</b>	PRCHGLNIR	PRCHGLNIL	PRCHG	ONMSTR

Bit	Name	Description	Reset Value
0	ONMSTR	Master power on control	Low
1	PRCHG	Master pre-charge	Low
2	PRCHGLNIL	Left channel Line In pre-charge	Low
3	PRCHGLNIR	Right channel Line In pre-charge	Low
4	<b>PRCHGPDRV</b>	<b>Differential mono PA driver pre-charge</b>	<b>Low</b>
5	Not Used	--	Low
6	Not Used	--	Low
7	Not Used	--	Low



## 12. DAC Auxiliary Input Gain Register : DAC\_AUXG

### 12.1 AT73C213 Register

Register Name: DAC\_AUXG (Address = 0x0D)

Reset State: 0x05

Access: Read/Write

7	6	5	4	3	2	1	0
Not Used	Not Used	Not Used	<b>AUXG</b>				

Bit	Name	Description	Reset Value
<b>4:0</b>	<b>AUXG</b>	<b>Differential mono auxiliary input analog gain selector</b>	<b>Low, Low, High, Low, High</b>
5	Not Used	--	Low
6	Not Used	--	Low
7	Not Used	--	Low

**Table 12-1.** AUXG Selection Table

AUXG	Gain	Unit		AUXG	Gain	Unit
00000	20	dB		01001	-12	dB
00001	12	dB		01010	-15	dB
00010	9	dB		01011	-18	dB
00011	6	dB		01100	-21	dB
00100	3	dB		01101	-24	dB
00101	0	dB		01110	-27	dB
00110	-3	dB		01111	-30	dB
00111	-6	dB		10000	-33	dB
01000	-9	dB		≥10001	< -60	dB

### 12.2 AT73C240 Register

This register does not exist for AT73C240 product

## 13. DAC Reset Register : DAC\_RST

### 13.1 AT73C213 Register

Register Name: DAC\_RST (Address = 0x10)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
Not Used	Not Used	Not Used	Not Used	Not Used	<b>RESMASK</b>	RESFILZ	RSTZ

Bit	Name	Description	Reset Value
0	RSTZ	Active low reset of the audio codec	Low
1	RESFILZ	Active low reset of the audio codec filter	Low
<b>2</b>	<b>RESMASK</b>	<b>Active high reset mask of the audio codec</b>	<b>Low</b>
3	Not Used	--	Low
4	Not Used	--	Low
5	Not Used	--	Low
6	Not Used	--	Low
7	Not Used	--	Low

### 13.2 AT73C240 Register

Register Name: DAC\_RST (Address = 0x10)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	RESFILZ	RSTZ

Bit	Name	Description	Reset Value
0	RSTZ	Active low reset of the audio codec	Low
1	RESFILZ	Active low reset of the audio codec filter	Low
2	Not Used	--	Low
3	Not Used	--	Low
4	Not Used	--	Low
5	Not Used	--	Low
6	Not Used	--	Low
7	Not Used	--	Low



## 14. Power Amplifier Control Register : PA\_CTRL

### 14.1 AT73C213 Register

Register Name: PA\_CTRL (Address = 0x11)

Reset State: 0x00

Access: Read/Write

7	6	5	4	3	2	1	0
Not Used	APAON	APAPRECH	APALP	APAGAIN			

Bit	Name	Description	Reset Value
3:0	APAGAIN	Audio power amplifier gain selector	Low, Low, Low, Low
4	APALP	Audio power amplifier low power	Low
5	APAPRECH	Audio power amplifier precharge	Low
6	APAON	Audio power amplifier enable	Low
7	Not Used	--	Low

### 14.2 AT73C240 Register

Register Name: PA\_CTRL (Address = 0x11)

Reset State: 0x0F

Access: Read/Write

7	6	5	4	3	2	1	0
Not Used	Not Used	APAON	APAPRECH	APAGAIN			

Bit	Name	Description	Reset Value
0	APAGAIN	Audio power amplifier gain selector	High, High, High, High
4	APAPRECH	Audio power amplifier precharge	Low
5	APAON	Audio power amplifier enable	Low
6	Not Used	--	Low
7	Not Used	--	Low

## 15. Revision History

Doc. Rev	Date	Comments	Change Request Ref.
6484A	04-Jun-09	Creation	



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