

**Programmes After Market Services
NPM-5 Series Transceivers**

User Interface Module MU4

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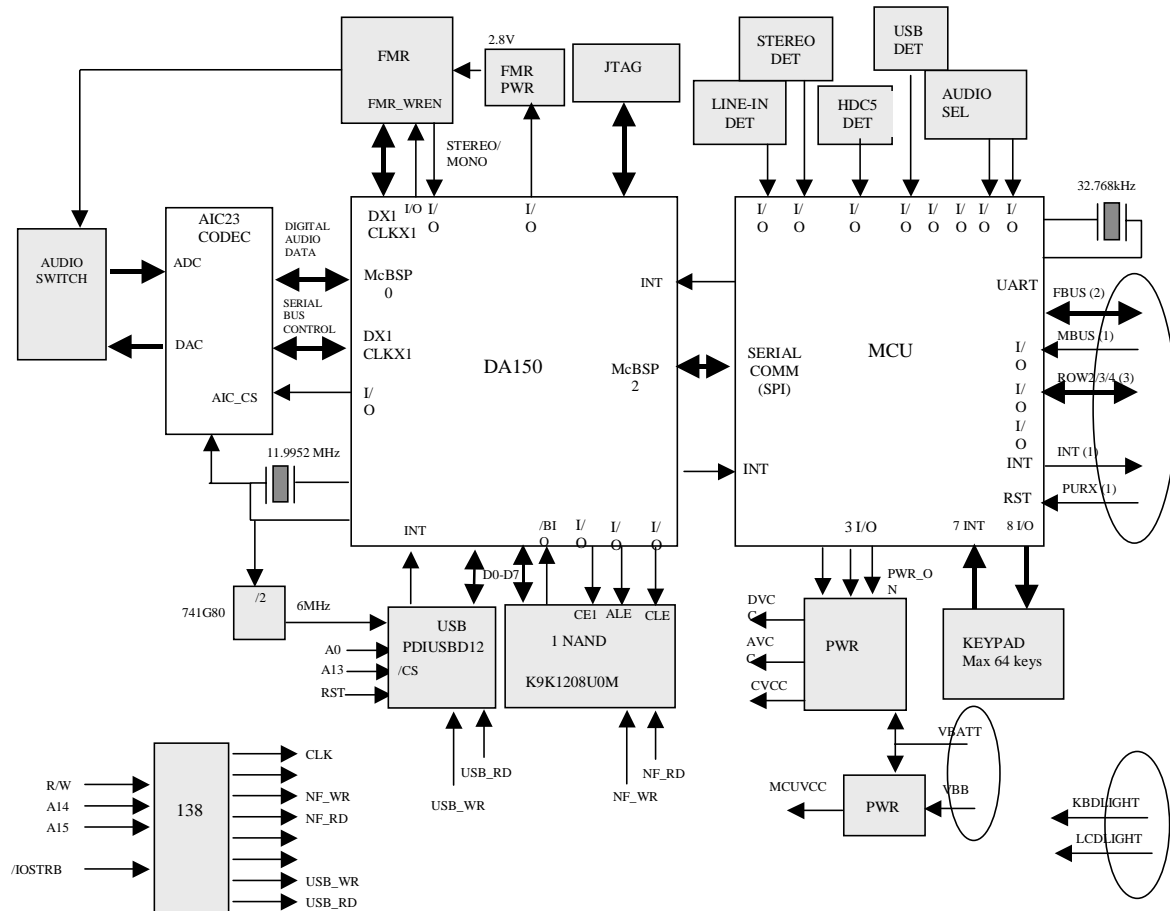
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UI MODULE MU 4

This document describes the MU4 UI module of the NMP-5 phone

Figure 1: UI module Block diagram #1

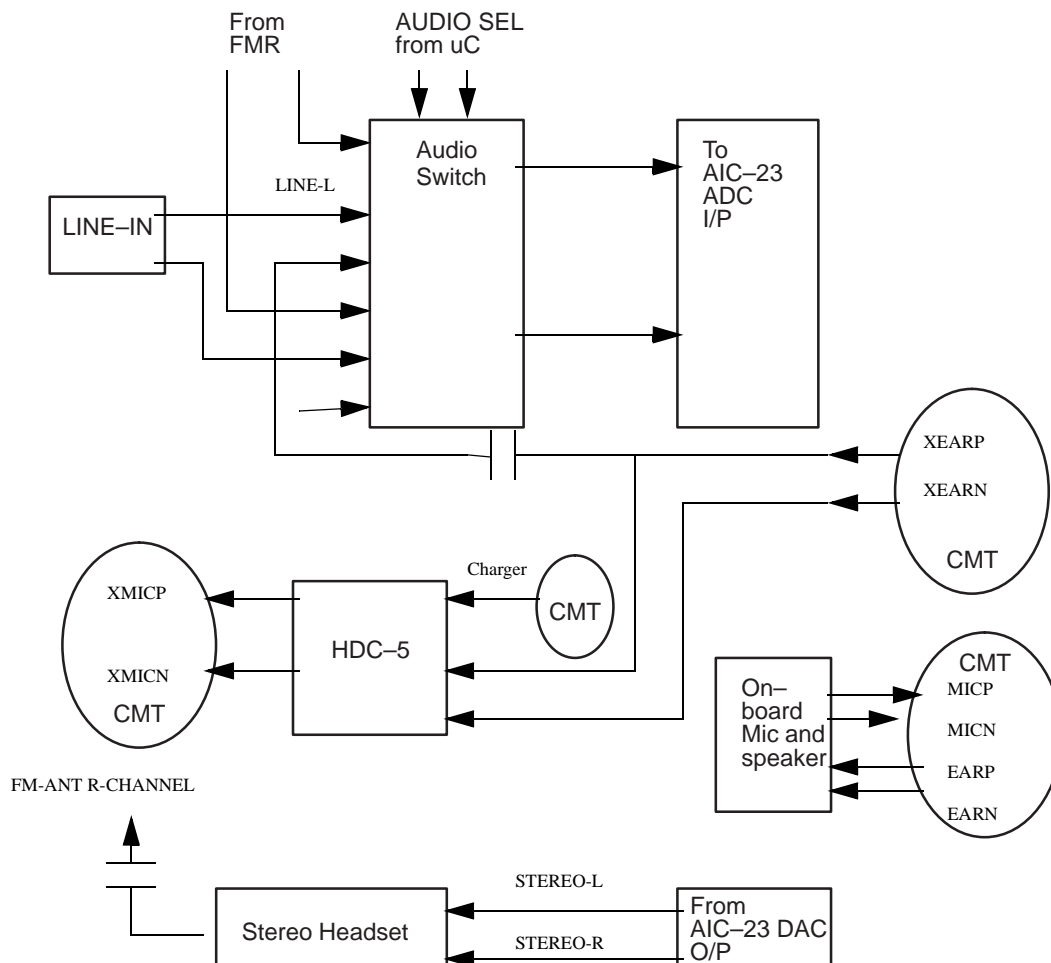


The UI module is connected to the CMT module using a 36-pin connector.

The UI module comprises two standard 2.5mm audio jacks, one for stereo headphones, and the other for line-in signal.

A special 4-pin 2.5mm jacks for the HDC-2 headset with microphone. The internal microphone and earpiece for phone audio are routed through the UI module.

Figure 2: Audio Section Block Diagram



Overview of UI

The UI module is a separate board consisting of:

- QWERTY keyboard (52 keys),
- music engine,
- FMR,
- microcontroller,
- display,
- microphone,
- earpiece,
- Line-In connector,
- Stereo connector and

- HDC5 connector.

The UI is running directly from EMC filtered battery power (power signal VB in the CMT module). The UI module includes own voltage regulators. The main communication interface with the CMT module is asynchronous serial FBUS for sending and receiving control messages. Analog audio for microphone, earpiece, external microphone and external earpiece are routed from the CMT module to the UI module.

The LCD is directly connected to the CMT module via the 36-pin connector.

The keyboard is completely controlled by the microcontroller of the UI module. The microcontroller takes the overall control of the UI module. It handles energy management by turning off circuits that are not needed at a given moment. It handles audio routing functions, connectors detect, and the keyboard function. The microcontroller turns the audio switches to the right positions for different listening or recording configurations. It controls directly the on-board DSP music engine.

The DSP engine controls the FMR and the audio codec.

The UI module goes to sleep mode when there is no music or keyboard activity going on and it is woken up by a key-press or by a serial bus message received from the CMT module. When the phone is switched off, the UI module is totally switched off.

HW Block Specifications with Descriptions

Power Management

The UI module is powered directly from battery (Vbatt) and has its own regulators. The voltages available on the UI board are

- μ VCC (2.8V MCU voltage),
- CVCC (1.6V DSP core voltage),
- DVCC (2.8V DSP I/O voltage),
- AVCC (2.8V peripherals voltage),
- FMVCC (2.8V, FMR voltage).

The CMT module baseband voltage (VBB) is used for phone power on detection and as the enabling signal for the MCU's regulator.

The UI module's MCU can start normal operation as soon as the VBB is asserted. VBB is used as the main enabler signal for the UI regulator. The MCU will poll the PURX signal (goes to high state) provided the MBUS signal is in the high state. If the MBUS signal is in low state during power up, the UI module must stay in reset. When the MBUS is in the low state means that the CMT module is being connected to the prommer for SW update. The MBUS signal must be checked latest 1.5ms after the release of the PURX signal. The PURX signal is used as remote reset signal and the UI module will stay in reset whenever the PURX is in low state.

Microcontroller

TI MSP430F135 (Flash version) MCU is selected for the project, which is the heart of the UI module. It handles all keyboards functions (45 QWERTY, 3 phone functions, 2 hot keys, 2 volume keys), audio connectors detect, audio routing, power management and handle FBUS protocol. It communicates with the phone via FBUS and with DSP via synchronous serial communication mode. The keyboard interface is implemented using 8 I/Os for row selection and 7 I/Os for column selection. The microcontroller goes to low power sleep mode if there is no activity. Keypress is one way to activate the MCU. The phone will reset the UI module via PURX.

DSP Music Engine

This music engine is TI DSP TMS320DA150. It handles MP3/AAC decoding, AAC encoding, FMR control and audio codec control. Peripherals connected to this engine are the NAND Flash Memory, NAND Flash Interface devices, USB interface device and audio codec.

The music memory storage is 64MB and the USB support Ver 1.1 interface. Interface between audio codec and DSP is via a serial bus. The FM is controlled by the DSP via serial bus and is switched to power down state when not in used. The DSP is supported by bootloading using NAND FLASH. The NAND read/write uses address-decoding technique.

Audio Codec

The audio codec is a high-performance stereo device. Features utilized include stereo-line input with analog bypass, stereo headphone amplifier with volume control. The control is through serial configuration and is done by the DSP engine. The audio-interface is configured as DSP mode where the digital audio interface is compatible with McBSP ports of the DSP engine.

FM receiver

FM radio circuitry is implemented using radio IC TEA5757 and it is situated on the UI module.

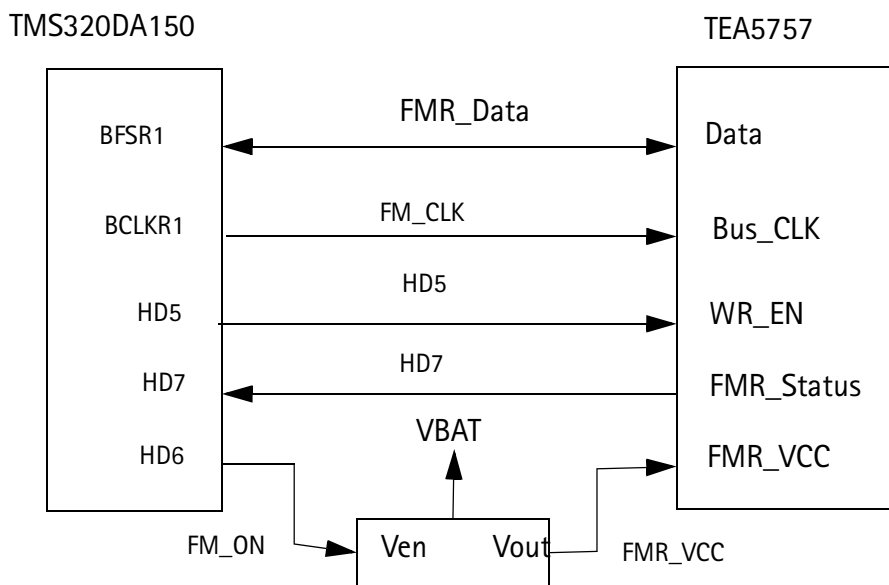
In FM reception the HDD2 headphones ground wire is used as antenna.

TEA5757 is an integrated AM/FM stereo radio circuit including digital tuning and control functions. The NPM-5 radio is implemented as superheterodyne FM stereo receiver. FM stage of the TEA5757 incorporates a tuned RF stage, a double balanced mixer, one pin oscillator and is designed for distributed IF ceramic filters. IF frequency is 10.7 MHz.

The MCU controls the channel tuning and other controls. The UPP CTSI block generates a 75kHz Reference clock.

The MCU SW controls the FM radio circuitry through a serial bus interface. TEA5757 features a digital interface to the UI module DSP for tuning and other controls.

Figure 3: FM radio to DSP interface



Audio Block

The audio block consists of the various connectors, audio multiplexer, and various components for audio switching functions. The microcontroller will detect if headsets are connected for routing the audio to the right headset or phone internal microphone and earpiece. Audio signal from Line-In and FMR are routed into the codec for encoding. Audio signal from the phone is routed to the codec for volume control. Music/FM/phone is made available at the Stereo HDC-2 headset.

HW Interface

UI DC Characteristics

This section describes the supply voltages and power consumption of the UI board:

Table 1: Table 1Supply Voltages and Power Consumption

Line Symbol	Min.	Typ.	Max	Unit/Notes
Supply Battery Voltage	3.1	3.6	5.2	Vbatt
Regulated Supply Voltage	2.7	2.8	2.85	V
Current Consumption, Max, MP3 Player Active	-	78	90	mA
Current Consumption, Max, AAC Player Active	-	78	90	mA
Current Consumption, Max, AAC Encoder Active	-	-	130	mA
Current Consumption, Max, FM Radio Active	-	48	60	mA
Current Consumption, Max, USB Uploading	-	-	90	mA
Current Consumption, Max, USB Downloading	-	-	90	mA
Current Consumption, Max, Phone Call using Stereo Headset	-	30	60	MA

Line Symbol	Min.	Typ.	Max	Unit/Notes
Current Consumption, Max, Phone Call using Internal Earpiece	-	150	200	mA
Current Consumption, stand by, sleep	-	150	200	uA
Current Consumption, Max, Phone off	-		10	uA

Note: Current consumption readings stated above does not include the current consumed by the LEDs, which are active.

CMT-UI Interface Connector Electrical Specifications

This section describes the signal and electrical specifications of the 36-pins connector between the CMT and UI module.

Table 2: CMT Module Interface Connector Electrical Specifications

Pin	Name	Min.	Typ	Max	Unit	Notes
1	PURX	0		VBB	V	Power up reset from CMT module, active low
2	Charge	0	8.4	16.9	V	Raw charging voltage from charge connector on UI board to charge IC on phone PWB
3	LCDRST X	0.7xV BB	low- high	0.3xVBBVBB	V	LCD Reset input.Active low
4	GND	0	0	0	V	
5	SCLK	0.7xV BB	low- high	0.3xVBBVBB4	VMHz	LCD Serial clock input
6	VBB	2.7	2.8	2.85	V	Regulated supply voltage from phone, only for I/O voltage reference and phone power on indication
7	SDA	0.7xV BB	low- high	0.3xVBB VBB	V	LCD Serial data input
8	Vbatt	3.1	3.6	5.2	V	Supply voltage from battery
9	LCDCSX	0.7xV BB	low- high	0.3xVBB VBB	V	LCD Chip select input.Active low
10	LCDCDX	0.7xV BB	low- high	0.3xVBB VBB	V	LCD Control input
11	Vbatt	3.1	3.6	5.2	V	Supply voltage from battery
12	ROW4	0.7xV BB	Low- high	0.3xVBB VBB	V	General purpose input or output pin to CMT module.
13	ROW3	0.7xV BB	Low- high	0.3xVBB VBB	V	General-purpose output pin to CMT module.

Pin	Name	Min.	Typ	Max	Unit	Notes
14	GND	0	0	0	V	
15	ROW2	0.07xV _{BB}	Low-high	0.3xV _{BB}	V	General purpose input pin to CMT module
16	KBDLIGHT	0	Ca. max	V _B	V	
17	LCD-LIGHT	0	Ca. max	V _B	V	
18	V _{BB}	2.7	2.8	2.85	V	Regulated supply voltage from phone, only for I/O voltage reference and phone power on indication
19	Charge	0	8.4	16.9	V	Raw charging voltage from charge connector on UI board to charge IC on phone PWB
20	V _{batt}	3.1	3.6	5.2	V	Supply voltage from battery (V _B)
21	FBUSRX	0.168	Low-high	0.84 2.85	V	Serial interface between UI and CMT module. Output from UI module
22	MBUS	0.168	low-high	0.84 2.85	V	Prommer detection. (@ V _{BB} =2.85V)
23	FBUSTX	0.224	Low-high	0.62 2.85	V	Serial interface between UI and CMT module. Input to UI module
24	GND	0	0	0	V	
25	XMICN					External Microphone -.
26	XMICP					External Microphone.
27	GND	0	0	0	V	
28	XEARP					External Earpiece
29	XEARN					External Earpiece
30	GND	0	0	0	V	
31	EAR-					Internal Earpiece
32	EAR+					Internal Earpiece.
33	GND	0	0	0	V	
34	MIC-					Internal Microphone -
35	MIC+					Internal Microphone +
36	GND	0	0	0	V	

HDC-5 Connectors Electrical Specifications

Table 3: HDC-5 Charger and headset connector Electrical Specification

Pin	Name	Min.	Typ	Max	Unit	Notes
1	MIC+					Internal Microphone.
2	MIC-					Internal Microphone.
3	CHRGR+	0		16.9	V	Max. open voltage for ACP-7
		0		850	mA	Max. charge-current with ACP-9
4	GND	0		0	V	
5	DC_CRL	0		0	V	Charger Control is grounded.
6	XMICP					External Microphone connector +
7	XMICN					External Microphone connector -
8	XEARP					External Earpiece connector +.
9	XEARN					External Earpiece connector -
10	INT					Headset detect, connected to MCU

Table 4: Headphones connector Electrical Specification

Pin	Name	Min.	Typ	Max	Unit	Notes
1	Phones L/R	-	-	DC3V, 100mA	V/mA	MAX RATING
2	GND	0		0	V	Ground Potential

Table 5: Line In connector Electrical Specification

Pin	Name	Min.	Typ	Max	Unit	Notes
1	Phones L/R	-	-	DC3V, 100mA	V/mA	MAX RATING
2	GND	0		0	V	Ground Potential

Table 6: Mini-B USB connector Electrical Specification

Pin	Name	Min.	Typ	Max	Unit	Notes
1	Electrical Interface	-	-	DC30V/1A	V/A	MAX RATING
2	GND	0		0	V	Ground Potential

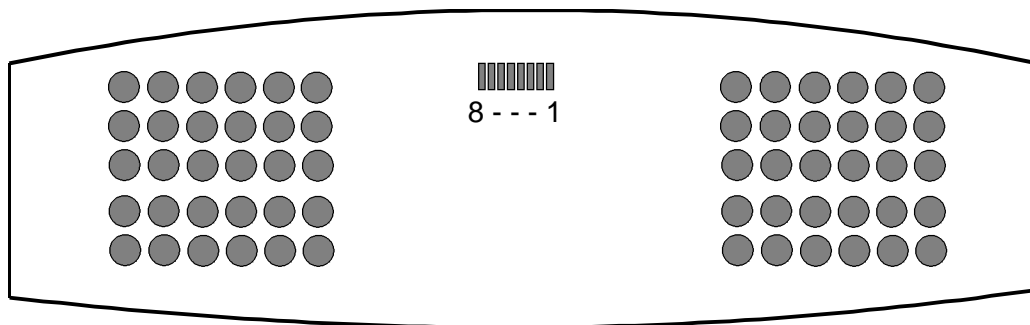
LCD Module Interface

This section is the summary of the GD47 LCD Electrical Specification.

Table 7: LCD module interface

Pin	LineSymbol	Parameter	Min.	Typical / Nominal	Max.	Unit	Notes
1	VBB	Supply voltage	2.7	2.8	3.3	V	
					240	uA	
2	SCLK	Serial clock input	0		4.0	MHz	
			0		VBB	V	
3	SDA	Serial data input	0		0.3xVBB		
			0.7xVBB		VBB		
4	LCDCDX (ROW5)	Control/display data flag input	0		0.3xVBB		Control Data
			0.7xVBB		VBB		
5	LCDCSX	Chip select input	0		0.3xVBB		Active
			0.7xVBB		VBB		Low
6	GND	Ground		0			
7	VOUT	DC/DC voltage converter output	6	-	9		
8	LCDRSTX	Reset	0		0.3xVBB		Active
			0.7xVBB		VBB		Low

Figure 4: LCD module connector numbering



MCU Interface Electrical Interface

MCU interface with Phone signal lines and keyboard that supports 45 QWERTY keys, 3 phone function keys, 2 side keys and 2 volume keys.

Table 8: MCU Interface

Line Symbol	Min.	Typ	Max	Unit	Note	
Digital I/O	- VOH	μ CVCC- 0.25	-	μ CVCC	V	High-level output voltage
Digital I/O	- VOL	0	-	GND + 0.6	V	Low-level output voltage
XT1	-30ppm	32.768	+30ppm	KHz		Crystal frequency

Plug-In Detect Electrical Interface

This section describes the typical plug-in detect voltage of respective connector.

Table 9: Plug-In Detect Interface

Line Symbol	Min.	Typ	Max	Unit	Note
LIN_DET (Line-In Detect)	AVCC - 0.25	-	AVCC	V	MCU GPIO
ST_DET (Stereo Headset Detect)	AVCC - 0.25	-	AVCC	V	MCU GPIO
HDC5_INT1 (HDC5 Headset Detect)	AVCC - 0.25	-	AVCC	V	MCU GPIO
USB_DET_INT (USB Detect)	AVCC - 0.25	-	AVCC	V	MCU GPIO

Power Management

This section summarises the various voltage regulator power management electrical specifications for devices on the UI board:

Table 10: Regulators' Power Management

Line Symbol	Min.	Typ	Max	Units	Note
DVCC	2.7	2.8	2.85	V	DSP device I/O voltage
CVCC	1.42	1.6	1.65	V	DSP device core voltage
μ CVCC	2.7	2.8	2.85		MCU supply voltage
FM_VCC	2.7	2.8	2.85	V	FMR supply voltage
AVCC	2.7	2.8	2.85	V	Analog voltage
USB_VCC	3.0	3.1	3.2		USB supply voltage

DSP Peripherals Electrical Interface

This section describes the general electrical characteristic of the DSP music engine.

Table 11: DSP Peripherals Interface

Line Symbol	Min.	Typ	Max	Unit	Note	
Digital I/O						
	- VIL	-0.3	-	0.8	V	Low level input
	- VIH	2.2	-	DVCC + 0.3	V	High level input
	- VOL	-	-	0.4	V	Low level output
	- VOH	2.4	-	DVCC	V	High level output
CLKIN	-30ppm	11.9952 MHz	+30 ppm	MHz	Clock/Oscillator input.	Depend on application

Audio Codec Electrical Interface

This section describes the general electrical characteristic of the audio codec.

Table 12: Table 12Audio Codec Interface

Line Symbol	Min.	Typ	Max	Unit	Note	
XTI/MCLK	-30ppm	11.9952 MHz	+30ppm	MHz	Master clock input. CLK from DSP.	Depends on Application
Digital I/O						
	- VIL	-	-	0.3 x AVDD	V	Input Low Level
	- VIH	0.7 x AVDD	-	-	V	Input High Level
	- VOL			0.1 x AVDD	V	Output Low Level
	- VOH	0.9 x AVDD	-	-	V	Output High Level

FMR Electrical Interface

This section describes the general electrical characteristic of the FMR.

Table 13: FMR Interface

Line Symbol	Min.	Typ	Max	Unit	Note	
Digital I/O						
	- VIL	-	-	0.6	V	Input Low Level
	- VIH	1.4	-	-	V	Input High Level
	- VOL	-	-	0.6	V	Output Low Level
	- VOH				V	Output High Level

Line Symbol	Min.	Typ	Max	Unit	Note	
F_CLK	-30ppm	75	+ 30ppm	kHz	Clock input	
Tuning Characteristic	- Vtune	0.85	-	FM_VCC - 0.75		Tuning range

Audio Performance Specifications

Music Features

- Support all common data rates for MP3/AAC playback
- AAC encoding with <32ks/s sample rate.
- Auto mute FM when there is incoming call.
- Auto pause MP3/AAC playback when there is incoming call.
- Support to secure music from Internet/CD's through Digital Rights Management.

Specifications

This section describes the general data rate of the music engine.

Table 14: Audio Performance Specifications Audio Code Performance Specifications

Line Symbol	Min.	Typ	Max	Unit	Note
MP3 Decoding Data Rate	-	-	128K	Bit/sec	
AAC Decoding Data Rate	-	-	128K	Bit/sec	
AAC Encoding Symbol Rate	-	22.05K	32K	Samples/sec	

This section describes the general performance characteristic of the audio codec.

Table 15: Audio Codec CharacteristicFMR Performance Specifications

Line Symbol	Min.	Typ	Max	Unit	Note	
Stereo In to ADC	- Vin	-	-	1	VRMS	Input signal level (0 dB)
	- G (prog)	-34.5		12	dB	Programmable gain
	- G (step)		1.5		dB	Programmable gain steps
Stereo Head-phone Output	- VHPO	-	-	1	VRMS	0-dB full-scale output voltage
	- Po (RL = 32 Ohm)	-	30	-	mW	Maximum output power
	- S/N	90	97	-	dB	Signal-to-Noise ratio. Condition applied @ 3.3V supply
	- G (prog)	-73		6	dB	Programmable gain
	- G (step)		1		dB	Programmable gain steps
Analog Bypass	- VAB	-	-	1	VRMS	0-dB full-scale output voltage

This section describes the general performance characteristic of the FMR.

Table 16: FMR Characteristics

Line Symbol	Min.	Typ	Max	Unit	Note	
FM Charac- teristics	- VAF	-	45	55	mV	Audio Output. With 1mV RF sensitivity input voltage. Before Audio codec
	- VRF	-	15	22	dB μ V	RF sensitivity input voltage. With (S+N)/N = 26dB
	- (S+N)/N	45	50	-	dB	Signal plus Noise-to-Noise ratio. With 1mV RF sensitivity input.
	- THD	-	1	3	%	Total harmonic distortion.

Parts Lists

MU4_ I (0201816) HW4.00

EDMS issue 2.1

Item	Code	Description	Value	Type
C101	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C102	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C103	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C104	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C105	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C106	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C107	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C108	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C109	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C110	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C111	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C112	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C113	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C114	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C115	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C201	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C202	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C203	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C301	2320548	Ceramic cap.	33 p	5 % 50 V 0402
C302	2320548	Ceramic cap.	33 p	5 % 50 V 0402
C303	2320548	Ceramic cap.	33 p	5 % 50 V 0402
C304	2320548	Ceramic cap.	33 p	5 % 50 V 0402
C305	2320548	Ceramic cap.	33 p	5 % 50 V 0402
C306	2320548	Ceramic cap.	33 p	5 % 50 V 0402
C307	2320548	Ceramic cap.	33 p	5 % 50 V 0402
C308	2320548	Ceramic cap.	33 p	5 % 50 V 0402
C309	2320137	Ceramic cap.	470 n	10 % 10 V 0603
C310	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C311	2320481	Ceramic cap.	5R 1 u	10 % 0603
C312	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C313	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C314	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C315	2321011	Ceramic cap.		50 V
C316	2321011	Ceramic cap.		50 V
C401	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C402	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C501	2320481	Ceramic cap.	5R 1 u	10 % 0603
C502	2320778	Ceramic cap.	10 n	10 % 16 V 0402

Item	Code	Description	Value	Type
C503	2320481	Ceramic cap.	5R 1 u	10 % 0603
C504	2320481	Ceramic cap.	5R 1 u	10 % 0603
C505	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C506	2320481	Ceramic cap.	5R 1 u	10 % 0603
C507	2320481	Ceramic cap.	5R 1 u	10 % 0603
C508	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C509	2320481	Ceramic cap.	5R 1 u	10 % 0603
C510	2320481	Ceramic cap.	5R 1 u	10 % 0603
C511	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C512	2320481	Ceramic cap.	5R 1 u	10 % 0603
C513	2320481	Ceramic cap.	5R 1 u	10 % 0603
C514	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C515	2611671	Tantalum cap.	22 u	20 % 4 V 3.2x1.6x1.6
C516	2320481	Ceramic cap.	5R 1 u	10 % 0603
C517	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C518	2320481	Ceramic cap.	5R 1 u	10 % 0603
C603	2611671	Tantalum cap.	22 u	20 % 4 V 3.2x1.6x1.6
C604	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C605	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C606	2611671	Tantalum cap.	22 u	20 % 4 V 3.2x1.6x1.6
C607	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C608	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C609	2611671	Tantalum cap.	22 u	20 % 4 V 3.2x1.6x1.6
C610	2611671	Tantalum cap.	22 u	20 % 4 V 3.2x1.6x1.6
C611	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C612	2611671	Tantalum cap.	22 u	20 % 4 V 3.2x1.6x1.6
C614	2320481	Ceramic cap.	5R 1 u	10 % 0603
C616	2320137	Ceramic cap.	470 n	10 % 10 V 0603
C617	2320137	Ceramic cap.	470 n	10 % 10 V 0603
C618	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C619	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C622	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C623	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C624	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C625	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C626	2320481	Ceramic cap.	5R 1 u	10 % 0603
C627	2320481	Ceramic cap.	5R 1 u	10 % 0603
C630	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C631	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C632	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C633	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C635	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C636	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C637	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402

Item	Code	Description	Value	Type
C639	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C640	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C641	2611671	Tantalum cap.	22 u	20 % 4 V 3.2x1.6x1.6
C642	2611671	Tantalum cap.	22 u	20 % 4 V 3.2x1.6x1.6
C643	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C645	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C647	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C648	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C649	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C650	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C651	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C652	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C653	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C654	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C655	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C801	2320137	Ceramic cap.	470 n	10 % 10 V 0603
C802	2320137	Ceramic cap.	470 n	10 % 10 V 0603
C803	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C804	2610203	Tantalum cap.	2.2 u	20 % 10 V 2.0x1.3x1.2
C805	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C806	2320789	Ceramic cap.	12 n	10 % 16 V 0402
C807	2320789	Ceramic cap.	12 n	10 % 16 V 0402
C808	2320481	Ceramic cap.	5R 1 u	10 % 0603
C809	2320481	Ceramic cap.	5R 1 u	10 % 0603
C810	2320137	Ceramic cap.	470 n	10 % 10 V 0603
C811	2321007	Ceramic cap	x7r 22n k 16v	0402
C812	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C813	2320576	Ceramic cap.	470 p	5 % 50 V 0402
C814	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C815	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C816	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C817	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C818	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C819	2320637	Ceramic cap.		50 V
C821	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C822	2320558	Ceramic cap.	82 p	5 % 50 V 0402
C823	2340001	Ceramic cap.		50 V
D301	4864471	Led	Green	1
D302	4864471	Led	Green	1
D303	4864471	Led	Green	1
D304	4864471	Led	Green	1
D305	4864471	Led	Green	1
D306	4864471	Led	Green	1
D307	4864471	Led	Green	1

Item	Code	Description	Value	Type
D308	4864471	Led	Green	1
D801	4110931	Cap. diode x 2	BBY66-05	S
D802	4110931	Cap. diode x 2	BBY66-05	S
F601	3203801	Chip bead array	2x1000r	0405
F602	3203801	Chip bead array	2x1000r	0405
F603	3203801	Chip bead array	2x1000r	0405
F604	3203801	Chip bead array	2x1000r	0405
F801	4550099	Cer.filter	10.7+-0.0225mhz	3.4x2.6
F801	4550099	Cer.filter	10.7+-0.0225mhz	3.4x2.6
F802	4550145	Cer filter	10.7+-0.03mhz 3	3.45x3.1
F802	4550145	Cer filter	10.7+-0.0225mhz	3.45x3.1
F803	4550145	Cer filter	10.7+-0.03mhz 3	3.45x3.1
F803	4550145	Cer filter	10.7+-0.0225mhz	3.45x3.1
J301	5400221	SM, conn	2x18m p1.0 pwb/pwb	H+AD0-
J301	5400221	SM, conn	2x18m p1.0 pwb/pwb	H+AD0-
J401	5400219	SM conn.	usb mini-b	p0.8 90deg
J401	5400219	SM, conn usb	mini-b p0.8	90deg
L301	3203743	Ferr.bead 0r03	42r/100mhz 3a	0805
L601	3203749	Ferr.bead 1000r/	100mhz 0.1a	0603
L602	3203749	Ferr.bead 1000r/	100mhz 0.1a	0603
L603	3203749	Ferr.bead 1000r/	100mhz 0.1a	0603
L801	3641541	Chip coil	47 n 2 % Q=60/500 MHz	0805
L802	3645079	Chip coil	63 n 2 % Q=60/500 MHz	0805
L803	3645083	Chip coil	33 n 5 % Q=60/500 MHz	0805
L804	3645067	Chip coil	330 n 5 % Q=48/250 MHz	0805
M101	6330017	Rivet nut	m 1.6	dmd08438
M101	6330017	Rivet nut	m1.6	dmd08438
R101	1620043	Res network	0w03 4x100k j	0804
R102	1620043	Res network	0w03 4x100k j	0804
R104	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R105	1430746	Chip resistor	560	5 % 0.063 W 1.000
R201	1430792	Chip resistor	33 k	5 % 0.063 W 3.000
R202	1430792	Chip resistor	33 k	5 % 0.063 W 3.000
R301	1430778	Chip resistor	10 k	5 % 0.063 W 1.000
R302	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R303	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R304	1430770	Chip resistor	4.7 k	5 % 0.063 W 6.000
R305	1430774	Chip resistor	6.8 k	5 % 0.063 W 1.000
R306	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R307	1430145	Chip resistor	100 k	1 % 0.063 W 0402
R308	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R309	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R310	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R311	1430804	Chip resistor	100 k	5 % 0.063 W 12.000

Item	Code	Description	Value	Type
R312	1430830	Chip resistor	0w06 1k0 j	From PWB version MU4_04 &sup
R313	1430830	Chip resistor	1.0 M	5 % 0.063 W 8.000
R401	1430830	Chip resistor	1.0 M	5 % 0.063 W 8.000
R402	1430770	Chip resistor	4.7 k	5 % 0.063 W 6.000
R403	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R404	1430796	Chip resistor	47 k	5 % 0.063 W 5.000
R405	1430708	Chip resistor	18	5 % 0.063 W 2.000
R406	1430708	Chip resistor	18	5 % 0.063 W 2.000
R407	1430830	Chip resistor	1.0 M	5 % 0.063 W 8.000
R408	1430830	Chip resistor	1.0 M	5 % 0.063 W 8.000
R409	1430802	Chip resistor	82 k	5 % 0.063 W 1.000
R410	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R602	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
R603	1430760	Chip resistor	1.8 k	5 % 0.063 W 1.000
R605	1430770	Chip resistor	4.7 k	5 % 0.063 W 6.000
R606	1430796	Chip resistor	47 k	5 % 0.063 W 5.000
R607	1430796	Chip resistor	47 k	5 % 0.063 W 5.000
R608	1430770	Chip resistor	4.7 k	5 % 0.063 W 6.000
R609	1430796	Chip resistor	47 k	5 % 0.063 W 5.000
R610	1430770	Chip resistor	4.7 k	5 % 0.063 W 6.000
R613	1430144	Chip jumper		2.000
R614	1430144	Chip jumper		2.000
R615	1430770	Chip resistor	4.7 k	5 % 0.063 W 6.000
R619	1620047	Res network	0w03 4x4k7 j	0804
R623	1430754	Chip resistor	1.0 k	5 % 0.063 W 1.000
R701	1430830	Chip resistor	1.0 M	5 % 0.063 W 8.000
R702	1620079	Res network	0w06 4x1m j	0804
R703	1430830	Chip resistor	1.0 M	5 % 0.063 W 8.000
R704	1430830	Chip resistor	1.0 M	5 % 0.063 W 8.000
R705	1430830	Chip resistor	1.0 M	5 % 0.063 W 8.000
R801	1430762	Chip resistor	2.2 k	5 % 0.063 W 1.000
R802	1430730	Chip resistor	150	5 % 0.063 W 1.000
R803	1430800	Chip resistor	68 k	5 % 0.063 W 1.000
R804	1430796	Chip resistor	47 k	5 % 0.063 W 5.000
R805	1430772	Chip resistor	5.6 k	5 % 0.063 W 1.000
R806	1430792	Chip resistor	33 k	5 % 0.063 W 3.000
R807	1430808	Chip resistor	150 k	5 % 0.063 W 1.000
R809	1430804	Chip resistor	100 k	5 % 0.063 W 12.000
S001	9517172	IC, MCU		NPM-
S002	9517171	IC, shield assembly	DSP	dmc04102 NPM-
S003	9517170	Fmr shield assembly		dmc04101 NPM-
S753	5200029	SM, sw tact	1pol 12vdc 50ma	90DEG
S754	5200029	SM, sw tact	1pol 12vdc 50ma	90DEG

Item	Code	Description	Value	Type
S755	5200029	SM, sw tact	1pol 12vdc 50ma	90DEG
S756	5200029	SM, sw tact	1pol 12vdc 50ma	90DEG
U101	4341201	IC, DSP	TMS320DA150PGE-160	PQFP144
U102	4340685	IC 1x inverter	Sn74ahc1g04	SOP5
U201	4341191	IC, flash mem.	64Mx8 50ns	TSOP48
U201*	4341235	IC FLASH	64Mx8 50ns	early versions
U202	4341175	IC, Demux 3:8	74lv138	tssop16
U301	4341183	IC, Msp 16 bit a/d	msp430f135	pqfp64
U301*	4341237	If 4341183 not available	msp430c1351IPM	MCU must be reflashed
U401	4341199	IC Usb control	pdiusbd12	tssop28
U402	4341195	IC 1xtrans supp usb	sn65220	sot23-6
U403	4341171	1xd-ff	74lvc1g80	sot23-5
U501	4341063	Reg 2.8v/150ma	lp3985	sot23-5
U502	4341063	Reg 2.8v/150ma	lp3985	sot23-5
U503	4341063	Reg 2.8v	lp3985	sot23-5
U504	4341063	Reg 2.8v/150ma	lp3985	sot23-5
U505	4341177	Reg 1.6v/100ma	lk112m16	sot23-5
U506	4341173	Reg 3.1v/150ma	lp3985-3.1	sot23-5
U601	4341197	IC Ste. codec w/af amp	tlv320aic23	t
U602	4341193	IC, 2xmux 4ch.analog	sn74lv14052apwr	TSSOP16 *
U801	4341023	IC Am/fm receiver	tea5757	lqfp48
V603	1825033	Chip varistor	vwm14v vc46v	0402
V604	1825033	Chip varistor	vwm14v vc46v	0402
V605	1825033	Chip varistor	vwm14v vc46v	0402
V606	1825033	Chip varistor	vwm14v vc46v	0402
V607	1825033	Chip varistor	vwm14v vc46v	0402
V608	1825033	Chip varistor	vwm14v vc46v	0402
V609	1825033	Chip varistor	vwm14v vc46v	0402
V701	1825033	Chip varistor	vwm14v vc46v	0402
V703	1825033	Chip varistor	vwm14v vc46v	0402
V704	1825033	Chip varistor	vwm14v vc46v	0402
V705	1825033	Chip varistor	vwm14v vc46v	0402
V706	1825033	Chip varistor	vwm14v vc46v	0402
V707	1825033	Chip varistor	vwm14v vc46v	0402
V708	1825033	Chip varistor	vwm14v vc46v	0402
V709	1825033	Chip varistor	vwm14v vc46v	0402
V710	1825033	Chip varistor	vwm14v vc46v	0402
V801	1727207	Trimmer pot.		0.1 W 2
Y101	4510325	Crystal	11,9952 M	+/-50PPM
Y301	4510293	Crystal	32.768 k	+/-20PPM 12.5PF
Y801	4510327	Crystal	75 k	+/-20PPM 12.5PF
	9854582	PWB MU4		128X53X1.15 M6 4/