PRACTICAL DEVICES
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XM6
Headphone Amplifier

User's Manual

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Thank you, and congratulations on your purchase of the XM6 Portable Headphone Amplifier!

We've worked very hard to provide you with what may be one of the most advanced, feature packed, and best sounding headphone amplifiers on the market today. The XM6 is designed to be durable, flexible, easy to use, practical, and above all, sound great. Each unit is carefully manufactured, and then rigorously tested for performance, durability, and sound quality.

If you have any questions that are not answered by this manual, please feel free to send us an email. Enjoy the amp!

Yours truly,

James Forest
President & CEO

PLEASE READ!

A Word About Protecting Your Hearing: The most valuable piece of audio equipment you own are your ears. Smart people protect their hearing. When using the XM6, or any headphones, *get in the habit of removing the headphones from your ears* whenever you:
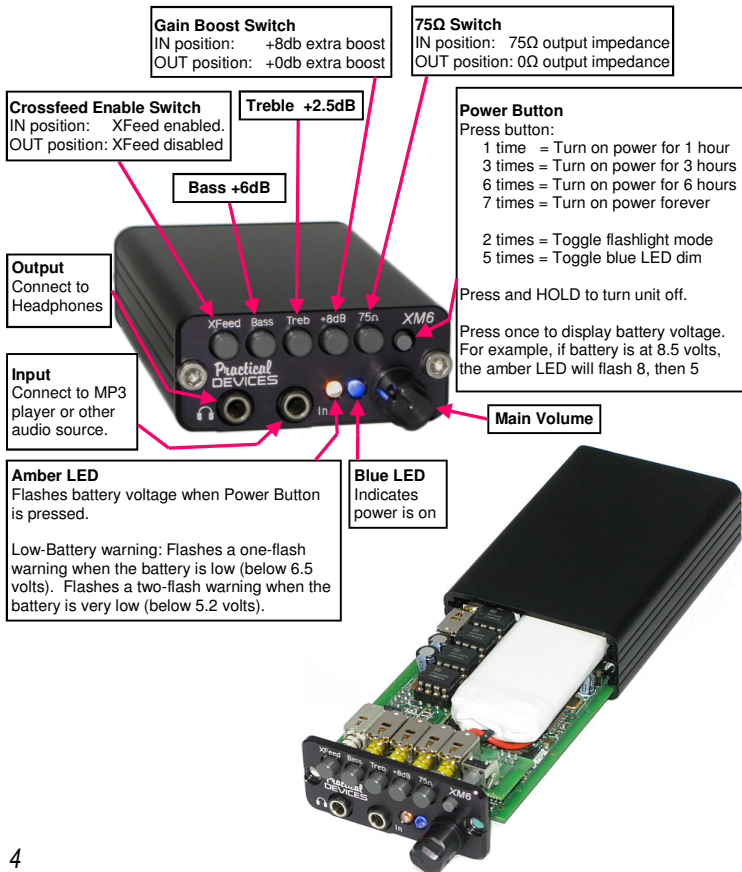
- Turn the XM6 on;
- Connect or disconnect any cables, including the USB cable;
- Turn your computer off/on/sleep/standby with the USB cable connected;
- Press the USB select button on the back of the XM6.
- Do ANYTHING that may cause a sudden burst of loud sound.

Your only have one set of ears, and you can't replace them. *Always* listen to music at reasonable volume, and most importantly, *use good common sense*.

Table of Contents

XM6 Block Diagram

Gain Boost Switch
IN position: +8db extra boost
OUT position: +0db extra boost

75Ω Switch
IN position: 75Ω output impedance
OUT position: 0Ω output impedance

Crossfeed Enable Switch
IN position: XFeed enabled.
OUT position: XFeed disabled

Treble +2.5dB

Power Button
Press button:

1 time = Turn on power for 1 hour
3 times = Turn on power for 3 hours
6 times = Turn on power for 6 hours
7 times = Turn on power forever

2 times = Toggle flashlight mode
5 times = Toggle blue LED dim

Press and HOLD to turn unit off.

Press once to display battery voltage.
For example, if battery is at 8.5 volts,
the amber LED will flash 8, then 5

Bass +6dB

Output
Connect to
Headphones

Input
Connect to MP3
player or other
audio source.

Main Volume

Amber LED
Flashes battery voltage when Power Button
is pressed.

Low-Battery warning: Flashes a one-flash
warning when the battery is low (below 6.5
volts). Flashes a two-flash warning when the
battery is very low (below 5.2 volts).

Blue LED
Indicates
power is on

XM6 Block Diagram, cont.

Crossfeed Adjuster
Turn this potentiometer to adjust the amount of Crossfeed, from near-stereo to 100% mono.

Source Select Switch
OUT position: Source is USB DAC
 IN position: Source is front panel input

Aux Connector
Auxiliary connector for future expansion. Includes Line-Out, power, and USB control signals.

Multimedia Controller stick
 Push **IN** = Play/Pause
 Push **LEFT** = Previous Track
 Push **RIGHT** = Next Track
The joystick works in USB mode only. You may have to configure your OS and/or media player for full functionality.

Power Connector
Used to power and recharge the XM6. Use only the AC adapter supplied from Practical Devices.
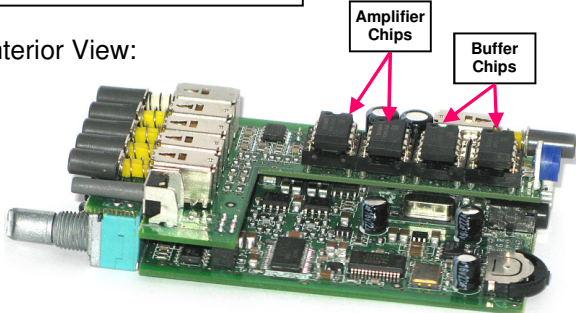Note: Before plugging in the AC adapter: unplug the USB cable, plug in the adapter, then reconnect the USB cable.

USB Connector:
Mates with Mini-USB type B 5-pin plug.

Interior View:

Amplifier Chips

Buffer Chips

Connecting Your XM6

1. Connect your headphones to the output jack.

2. Connect a suitable source to the input jack, as pictured. Sources may be MP3 or CD players, iPods, or any line-level devices. Alternatively, you may connect the XM6's rear panel USB port. Be sure to set the rear panel source-select switch (switch-out selects front panel input; switch-in selects USB).


i *Your headphones can have an impedance of 24 to 600 ohms.*

USB DAC

To use the XM6's USB DAC, simply connect the XM6 to your computer, using the included USB cable.

- The XM6's rear panel USB connector takes a "Mini USB Type B 5-pin plug".
- You may connect the XM6 through a USB hub, if desired.
- The XM6 will not recharge from the USB cable.
- **IMPORTANT**: If the USB cable is connected, and you want to plug in the AC adapter: you must 1) unplug the USB cable, 2) plug in the adapter, then 3) reconnect the USB. Failure to do so can cause USB hang-ups.

Driver Support (Windows7, Windows XP and Windows Vista): Windows7, XP and Windows Vista have built-in drivers to support the XM6. The first time you plug in the XM6, the drivers will automatically install:
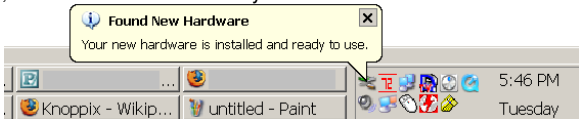
You may have to choose the XM6 to be the default audio device (Start→ Settings→ Control Panel→ Sounds and Audio Devices→ Audio→ Sound playback Default device). If your media-playing software (Winamp, Windows Media Player, etc) was running when you plugged in the XM6, you may have to **exit and restart** the media-playing software.

Driver Support (Linux, MAC OS): Most Linux distributions natively support the XM6, using ALSA. Mac OS X and OS 9 also support the XM6

IMPORTANT: Get in the habit of **REMOVING YOUR HEADPHONES** when doing such things as:

- connecting or disconnecting the USB cable, or
- Waking your computer up, or putting it to sleep, hibernation, or shutdown
- Switching the XM6's rear panel switch
- Connecting or disconnecting the XM6's Line-In connector

Doing so will prevent your ears from being exposed to excessively-loud bumps, thumps, clicks, or overly-loud music. Smart people protect their hearing!

Power Button Functions

Power Button

The power button functions are activated by pressing repeatedly within a three second window:

|	
1 press:	Turn unit on. The XM6 turns off automatically after **one** hour.
3 presses:	Turn unit on for **three** hours.
6 presses:	Turn unit on for **six** hours.
7 presses:	Turn unit on. The XM6 will not turn itself off.
Press and hold:	Turn unit off.

i *The unit will respond to button presses by flashing the blue LED once for each hour it will stay on.*

Additional power button functions:

2 presses:	Toggle flashlight mode (all LEDs on full).
5 presses:	Toggle LED dimming.

Crossfeed Controls

Crossfeed Enable Switch

Crossfeed Adjuster
Only works when switch is enabled.
Mono
↕
Stereo
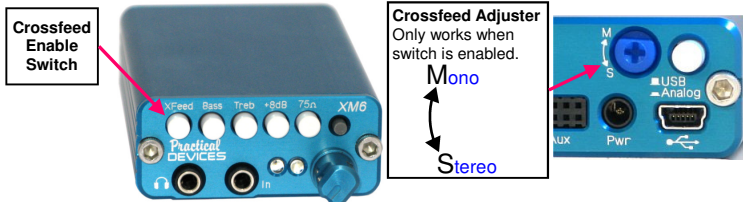
The XM6's Active Crossfeed circuit simulates the sound stage of loudspeakers, through your headphones.

- Press the Switch IN to activate Crossfeed.
- Leave the button OUT for full stereo operation, bypassing the Crossfeed circuit entirely.

Use a small screwdriver (Philips or Straightblade) to adjust the Crossfeed Potentiometer:

- All the way clockwise to produce a mono signal;
- All the way counter-clockwise to produce a near-stereo image.

Why would you want Crossfeed? Most music is mixed to be listened to on loudspeakers. The studio technicians mixing the recording assume there will be alot of crosstalk, since with speakers the listener's left ear clearly hears the right speaker's output, and vice versa. Thus, most music is mixed with a very wide stereo soundstage.

With headphones, however, the left ear only hears the left channel, and the right ear only hears the right channel, with nearly zero crosstalk. This can, for many recordings, cause the soundstage to appear to be "in the center of your head". Further, some recordings (early Beatles recordings are infamous for this) have each instrument and vocal track panned 100% to either left or right, which can almost immediately cause listener fatigue. Crossfeed corrects this by blending some of the left channel into the right, and vice-versa.
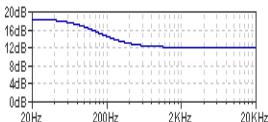
Bass and Treble Boost

You may use the bass and treble boost buttons to give the following approximate boosts:
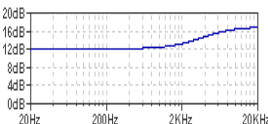
Bass Boost: +6dB @ 100Hz
Treble Boost: +3dB @ 10kHz

Frequency response with Bass Boost enabled

Frequency response with Treble Boost enabled

Gain Boost

With the volume knob at full, your XM6 will deliver +10dB of gain. Additionally, you can enable the gain boost switch, which will give you an extra +8dB of gain, for a total of approximately +18dB.

In order to get the best possible noise floor, you should **not** enable the Gain Boost unless:

   a) the volume of your headphones is too quiet, and,
   b) you have already tried turning up the volume of your source (mp3 player).

i Usually, the Gain Boost is only needed when using headphones which have an impedance **greater** than around 150 ohms.

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75Ω Output Impedance

You can insert a 75 ohm impedance at the output jack by pushing the 75Ω switch:

Switch = OUT; Normal mode.
Output Impedance: 0Ω

Switch = IN; High-impedance mode.
Output Impedance: 75Ω

Why would you want 75Ω output impedance?

There are several headphone systems which can benefit. In particular, etymotic's ER-4P in-ear headphones, when used with the 75Ω feature enabled, perform nearly identically to the generally-regarded-as-much-better ER-4S's.   Other headphones, **especially lower-impedance headphones**, can also benefit. It is a matter of personal preference.

Testing the Battery

The XM6 can test its own battery:

When the XM6 is turned on, the amber LED will display the battery voltage by flashing. For example, if the voltage is 8.5 volts, the LED will flash 8 times, then 5 times.

To see the battery voltage if the unit is already on, press the power button

The XM6 will warn you if the power falls below certain thresholds:

- At around 6.5 volts, the amber LED will begin to flash.

- Below around 5.2 volts, the amber LED will double-flash, indicating the battery is very low.

Multimedia Controller Joystick

Your XM6 is equipped with a rear panel Joystick, which has the following functions:

▶▶ **Next Track**

◀◀ **Previous Track**

▶ⅠⅠ **Play/Pause Toggle**

These functions only work when listening to USB audio.

We have arranged the joystick such that when you are looking at the *front* of the XM6, and reach around to the rearpanel joystick, pushing the stick to your *left* is PreviousTrack, and to your *right* is NextTrack (left to right, just like reading a book).

i Sometimes, in order for the joystick to work, you have to **enable multimedia hotkeys** in the application software you are using. For example: In **Winamp**:

Rightclick -> Options -> Preferences -> Global Hotkeys
Tick the box "Enable default multimedia key support"

Most media player software (iTunes, Windows Media Player, TLV) work as-is. Due to the multitude of applications in existence, Practical Devices can't offer support for any particular problems with your application!

Aux Connector

The rear panel of your XM6 has an Auxiliary Connector, for future expandability. The connector is 2x4 pins with 2mm pitch. The pinout is proprietary, but Practical Devices has released it into the public domain; the pinout is shown below:
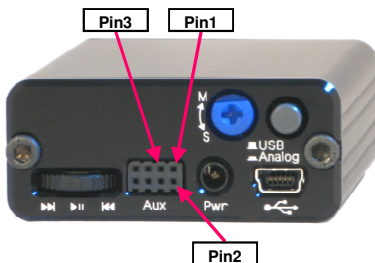
Pin	Function
1	Analog Line Out RIGHT
2	Joystick_PreviousTrack
3	GROUND Analog
4	Joystick_PlayPause
5	Analog Line Out LEFT
6	Joystick_NextTrack
7	USB+5V
8	GROUND Digital

Disassembling the Unit

FOR ADVANCED USERS ONLY!
If you want to replace the amplifier or buffer chips, you will need to disassemble the unit. Here's how:

1. Turn the unit off, and unplug all cables.

2. Remove the volume knob using the supplied .035" hex key.

3. Remove the two screws on the rear panel, and the two screws on the front panel, using the included 7/64" hex key.

Push circuit board and battery from rear.

4. From the rear, push the circuit board and battery out the **front** of the case.

5. Using tweezers or a small flat screwdriver, gently wedge the chips out of their sockets. Take care not to bend the pins of the chips. See Figure 1.

6. Insert the new chips (also known as "rolling" the amp). Make sure pin 1 (denoted by a dot on the chip) is oriented properly. Take care not to bend the pins. Alternatively, copper Busbars may be used instead of buffer chips (see Figure 2).
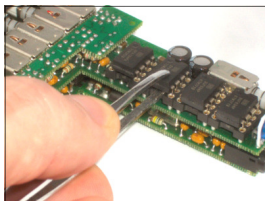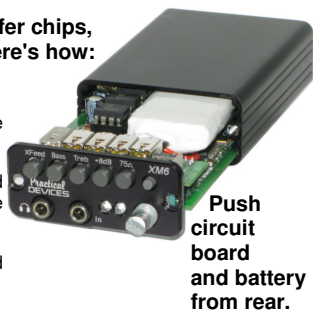
Pin 1

Op-Amp chips   **Buffer chips**

What opamps and buffers can I use? See the FAQ on page 17,.

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Figure 1. Removing chips: Wedge tweezers or a small flat screwdriver between chip and socket, and gently work chip up and out.

Figure 2. Busbars installed
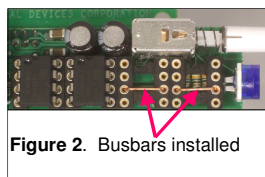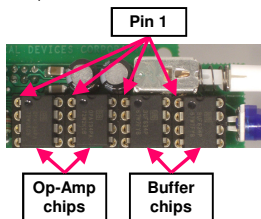
Reassembling the Unit

1) Install Battery:
- Connect battery connector with proper polarity (there are markings "RED WIRE" and "BLACK WIRE" on the PCB to help).
- Battery cable neatly underneath battery.
- One side of the battery is "flatter" than the other. Orient battery with flatter side facing **UP**.

2) Slide in PCB assembly, from the back of the case. Note the notch in the case for the volume knob.

3) Install the front panel, and screw it in.

**4) Install the rear panel. Before** screwing it down:
- Joystick top metal piece is not caught on rearplate;
- Rearplate must be flush against case, with no gap.

! **Important!** The joystick has a top metal piece. **Do not** let this metal piece catch the edge of the rearplate cutout! (if you do, you could break off the joystick when you tighten down the rear screws).

Joystick top metal piece should go **into** the rearplate cutout.
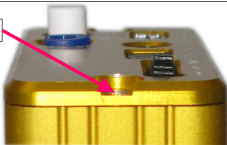
Beware! Joystick top metal piece catching edge of rearplate!

No gap here:
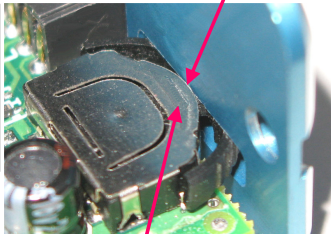
Joystick top metal piece

Other Reassembly Hints:
- Don't put excessive force on the volume knob. The pot is precision equipment, and doesn't like to be manhandled.
- Similarly, don't put excessive force on the power button
- Pushbutton switches (Bass, Treb, etc): Never try to remove the plastic pushbutton switch caps while the switch is in the "IN" position, or you *will* break the switch.
- **Don't** overtighten the setscrew for the volume knob!

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Battery System

Your XM6 is equipped with the **Lithium-Ion FastCharge™ System**, including an internal rechargeable battery, and an AC adapter/charger.

To recharge the XM6, just plug the charger into the powerjack on the rear of the XM6.

- The battery will fully charge within two hours. When charging is finished, the LED on the charger will turn from red to green.

- The battery will charge even if the XM6 is turned on.

- You can leave the charger connected indefinitely.

- You can expect up to 35 hours of use per charge, depending on installed options.

- Your Charger is a "World" charger—it will work with AC Mains voltages from 105 to 240 VAC, at 50 or 60Hz. If you are using the charger outside of North America, you may need a plug adapter (available from your local electronics store).

- **DO NOT** plug anything else into the powerjack, or damage may result.

NOTE: Only use the power supply that came with the XM6. Do not plug anything else into the powerjack, or damage may result.

Frequently-asked Questions

Can I use a line-level input to the XM6, such as from a CD/DVD player or VCR?

    Yes, the XM6 will accept a line-level input.

Can I use the XM6 to drive speakers?

    Usually, no. The XM6 was designed as a *headphone* amp, and will usually not do a good job of driving speakers, even small ones (most speakers have impedances of around eight ohms). What you are looking for is a *power* amplifier, not a *headphone* amplifier

What are my options for buffering the amp?

    The XM6 has two sockets for two *amplifier* chips, and two sockets for two *buffer* chips.

- Amplification: The XM6 comes with two OPA134 amplifier chips. There are many other amp chips you can also use.

- Buffering: you can use:
    1) Copper Busbars, which connect pins 3 and 6 of the buffer sockets. In this case, all output drive from the XM6 comes from the amplifier chips.
    2) AD8397 "DoubleCat" - a 2-channel amp and buffer chip, on an SOIC-to-two-DIP adapter. Install in the AMP sockets in place of the OPA134 chips, and use copper Busbars on the buffer sockets.
    3) BUF634 buffer chips from TexasInstruments, which are very strong and quiet dedicated buffers.

For more FAQs, see our website:

        http://www.practicaldevices.com/faq_xm6.htm

Troubleshooting

Here are some common problems, and possible solutions:

USB doesn't work:

- Unplug the USB connector, wait 10 seconds, then plug it back in, and restart your multimedia application.

- Remember: plugging in the AC adapter while USB is connected can cause USB malfunction. You must disconnect USB, connect the AC adapter, *then* reconnect USB. ***Always*** connect AC before USB!

- Is the rear switch set to USB?

- The USB port on your computer may be overloaded:
    - Try a different USB port
    - Try using a *powered* USB Hub, as shown in the diagram:

USB Hub

To Computer's USB

XM6
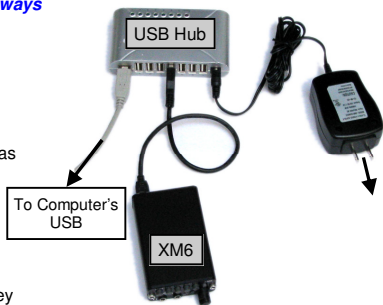
Joystick does not work:
You need to enable multimedia key support in your OS, or in your computer's media player. See Page 12.

Amp does not turn on or respond to pushing the power button:
- Battery is flat, and needs to be recharged or replaced.
- Disconnect the battery, **hold down the power button for 10 seconds,** then reconnect the battery.

Headphone volume is too quiet, even with the volume knob at full:
- Increase volume of source (MP3 player). If it is still too quiet, then use the Gain Boost.

Output is in one ear only; the other channel is dead:
- Check that all cables are **completely** plugged in all the way
- Check that your cable is a **stereo** cable, not a **mono** cable.

Output is louder in one ear than the other:
- Source is too strong—turn down volume on source
- Turn off +dB Gain Boost switch
- Headphone impedance is too low. Use headphones with a higher impedance.

Notes

Notes, cont.

Warranty and Guarantee

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Practical Devices stands behind its products with a full no-risk warranty and money-back satisfaction guarantee.

Practical Devices offers a 30-day money-back guarantee on all of our products. If, for any reason whatsoever, you are unsatisfied with your purchase, you may return it for your money back, including your original shipping cost. (The fine print: Unit must be returned within **30 days** of sale; Unit must be returned in the same undamaged, good working order as it was received; Practical Devices will refund you the original cost, plus the cost of the original shipping. Customer must pay for return shipping cost).

Further, we warranty, for a period of three (3) years, that our products are free from any defects in workmanship. Should you have any problems, we promise to make it right. (The fine print: warranty is in effect for a period of 3 years from date of purchase. Problems must be reported to sales@practicaldevices.com This warranty covers any defects in workmanship. It does not cover abuse, physical damage, or the like).

Should you need any service, please email us at
sales@practicaldevices.com

Specifications

Description:	Portable Audio Headphone Amplifier, with USB Upsampling and 24-bit 192kHz DAC.
Weight:	145 grams (5.1 oz)
Power Source:	Lithium-Ion Rechargeable System
External Power Supply:	Lithium-Ion adapter/charger, 120-240VAC, 50/60Hz worldwide compatible.
Battery Charge Time (approx.)	1.5 hours
Battery Life (approximate, depending on installed options):	35 hours
Maximum Gain:	+18.4 dB (Gain Boost enabled) +10.3 dB (Gain Boost disabled)
Frequency Response (20-20,000Hz, typical, front panel input):	+0.1dB, -0.3dB
-3dB Point (typical, front panel input):	21 kHz at top end; 9 Hz at low end
Total Harmonic Distortion (typical, front panel input)	0.0005%
Intermodulation Distortion (typical, front panel input)	0.003%
Signal to Noise ratio (20-20,000Hz, typical, front panel input):	110 dB
Dynamic Range (20-20,000Hz, typical):	110dB

Specifications (Continued)

Bass Boost (approx.)	+6dB @ 100Hz
Treble Boost (approx.)	+3dB @ 10kHz
Crossfeed	Active, user-adjustable from mono to stereo using potentiometer; User can bypass using pushbutton.
Auto Power-OFF	User selects between 1, 3, or 6 hour poweroff interval, or unit can be set to stay on indefinitely
Status Indicators	Two LEDS (one blue, one amber), indicating: low battery warning, battery voltage, and power.
Integrated Voltmeter accuracy (typical)	±100mV
Mechanicals	• Anodized aluminum case; • Glossy anodized & etched front and rearplates; • Polished aluminum volume knob; • FR-4 quad-layer Printed Circuit Board with 1 oz. copper
Other Features	• Turn on both LEDs to full brightness; • Dimming mode: Allows user to optionally dim the blue LED. • Play/Pause/NextTrack/PreviousTrack joystick when using USB.
USB DAC & Upconverter	**DAC:** Wolfson Microelectronics WM-series High-Performance stereo DAC, operating at 192kHz with 24-bit resolution. **Upconverter:** Texas Instruments SRC4192 192kHz Asynchronous High-Performance Sample Rate Converter.

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