WM8740 Evaluation Board User Handbook

October 2000, Rev 1.1

INTRODUCTION

This evaluation platform and documentation should be used in conjunction with the latest revision of the WM8740 datasheet. The datasheet gives device functionality information as well as timing and data format requirements.

This evaluation platform has been designed to allow the user ease of use and give optimum performance in device measurement as well as providing the user with the ability to listen to the excellent audio quality offered by the WM8740.

GETTING STARTED

PACKING LIST

The WM8740 Evaluation Kit contains:

- 1 WM8740-EV1B Evaluation Board
- 2 power cables (1 x 2-pin, 1 x 5-pin)
- 2 WM8740-EV1S 3.5" floppy disks containing control software
- This manual -1 WM8740-EV1M

CUSTOMER REQUIREMENTS

Minimum customer requirements are:

- D.C. Power supply of 5V
- D.C. Power supply of +12V and –12V
- Digital coaxial or optical data source
- 1 set of active stereo speakers
- PC and printer cable (for software control)

POWER SUPPLIES

Using the power leads provided with this evaluation kit, +5V should be applied to the +DVDD and +AVDD pins (pin1) of power connectors J8 and J23.

+12V should be supplied to pin 5 of J23 and –12V should be supplied to pin 3 of J23 for supplying the op-amps of the differential low pass filter (LPF) circuit.

BOARD FUNCTIONALITY

The interface to this board is via an optical (U3) or coaxial (J2) digital (AES/EBU, UEC958, S/PDIF, EIAJ CP340/1201) signal input. A direct digital input is available via one side of a 2x8 pin header (H1), data must be input in one of the WM8740 supported formats – see datasheet.

All WM8740 pins are accessible for easy measurement via the 14 pin headers (J3 & J5) running up each side of the device.

Any pins that perform control functions (i.e. mute, format, de-emphasis…) have a 3-pin header attached to them allowing the pin to be tied high, low or left unconnected. This gives the user easy access to change the device set-up.

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BOARD INPUT

At the direct digital input to the board (H1), footprints have been provided for line termination resistors and capacitors (C61, C62, C65, C66, R59, R60, R61, R69) to optimise the connection to the board. These may be required for best performance, depending on the characteristics of the source and cables used to input signals to the board.

The coaxial and optical inputs may be supplied with digital signals directly.

BOARD OUTPUT

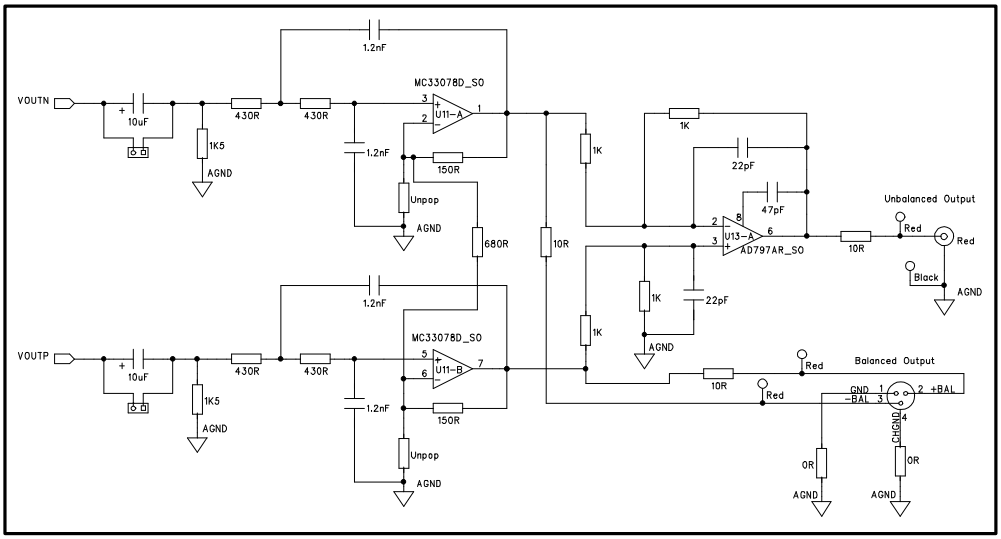


Figure 1 Differential Low Pass Filter Circuit

The differential output pairs from the WM8740 are passed through a differential low pass filter circuit as shown in Figure 1. This provides the user with two forms of output, balanced and unbalanced. The balanced outputs can be taken from XLR connectors J6 (Left) and J7 (Right), while the unbalanced outputs are offered on J1 (Left) and J4 (Right).

These options offer the user great flexibility for adding the evaluation platform to an existing system or merely to attach it to an audio analyser with the users preferred cable type.

Unfiltered outputs direct from the WM8740 can be measured on headers J3 (pin12 - VOUTRP, pin13 - VOUTRN) and J5 (pin2 - VOUTLN, pin3 - VOUTLP) if required.

Important - Note that there will be a 2.5V DC offset on the XLR outputs (J6 and J7) if the 2-pin links C14, C22, C37 AND C45 are shorted. Shorting these links will give measurable improvements but if being connected to a hi-fi amplifier for example, it is recommended that the shorting links be removed from C14, C22, C37 and C45 allowing the AC-coupling capacitors C13, C21, C36 and C44 to remove the DC offset.

There is no DC offset at the unbalanced outputs (J1 and J4) (i.e. the AC-coupling capacitors have no effect on DC level) due to the differential to single ended op-amp circuit design. For measurement purposes it is recommended that the AC-coupling capacitors be shorted out.

INTERFACES

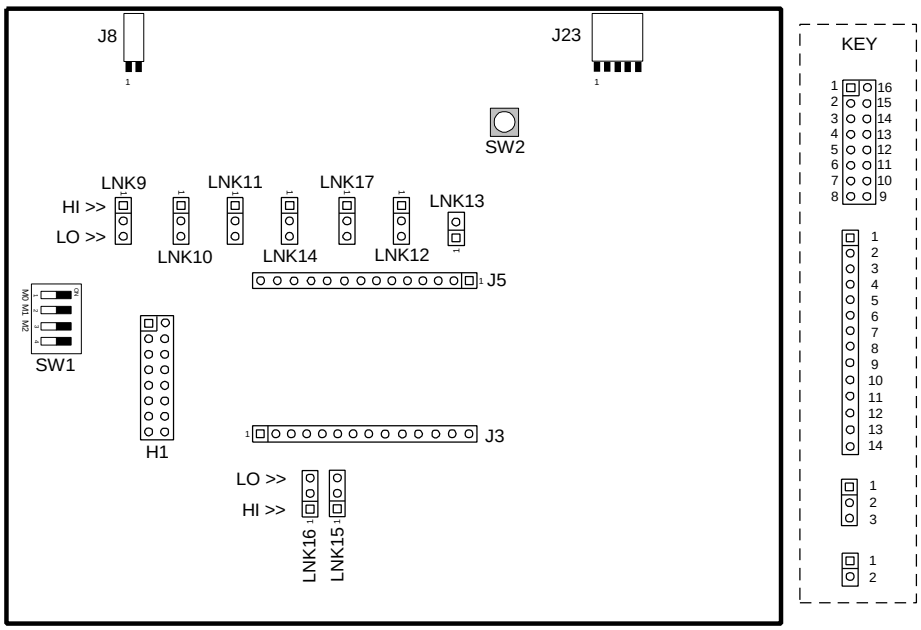


Figure 2 Interfaces

HEADERS

H1	
1/16	LRCIN
2/15	GND
3/14	DIN
4/13	GND
5/12	BCKIN
6/11	GND
7/10	SCKI
8/9	GND

J3	WM8740	
1	1	LRCIN
2	2	DIN
3	3	BCKIN
4	4	MODE8X
5	5	SCLK
6	6	DIFFHW
7	7	DGND
8	8	DVDD
9	9	AVDDR
10	10	AGNDR
11	11	VMIDR
12	12	VOUTRP
13	13	VOUTRN
14	14	AGND

J5		
1	15	AVDD
2	16	VOUTLN
3	17	VOUTLP
4	18	VMIDL
5	19	AGNDL
6	20	AVDDL
7	21	ZERO
8	22	RSTB
9	23	CSBIWO

10	24	MODE
11	25	MUTEB
12	26	MD/DM0
13	27	MC/DM1
14	28	ML/I2S

Table 1 Headers

LINKS

LINKS	SOFTWARE DEFAULT	DESCRIPTION
LNK9 (FORMAT)	LOW	These links are only usable in hardware mode: LNK9 LNK12 Mode LO LO 16-bit Normal LO HI 20-bit Normal HI LO 16-bit I2S HI HI 24-bit I2S
LNK12 (CSB/IWL)	LOW	
LNK10 (DE-EMPH1)	LOW	These links are only usable in hardware mode: LNK10 LNK11 DE-EMPHASIS LO LO Off LO HI 48kHz HI LO 44.1kHz HI HI 32kHz
LNK11 (DE-EMPH0)	LOW	
LNK13 (ZERO PIN)		1 – Zero pin output 2 – DGND
LNK17 (MODE)	HIGH	LO – In this position the device operates in hardware mode HI – In this position the device operates in software mode
LNK16 (MODE8X)	LOW	These links are only usable in hardware mode: LO – In this position 8xfs mode is not selected HI – In this position 8xfs mode is selected NC – LOW due to Internal pull-down
LNK15 (DIFFHW)	LOW	These links are only usable in hardware mode: LO – In this position Differential Mono mode is not selected HI – In this position Differential Mono mode is selected NC – LOW due to Internal pull-down
LNK14 (MUTE)	HIGH	LO – In this position MUTE is active HI – In this position MUTE is off NC – Automute is active if 1024 consecutive zero samples are detected

Table 2 Links

SWITCHES

SWITCH	SOFTWARE DEFAULT	DESCRIPTION
SW1 (DATA FORMAT)		M2 M1 M0 DATA FORMAT 0 1 0 L/R, I2S Compatible 1 0 1 L/R, 16-bit LSBJ 1 1 0 L/R, 18-bit LSBJ
SW2 (RESET)		This switch is only usable in hardware mode: OPEN – When this switch is de-pressed the WM8740 is functional CLOSED – When this switch is pressed the WM8740 is RESET

Table 3 Switches

MODES OF OPERATION

HARDWARE MODE

To operate the WM8740 in hardware mode, the jumper on link LNK17 (MODE) must be set LO. The headers on the board then become the active source for changing the device functions. A digital (AES/EBU, UEC958, S/PDIF, EIAJ CP340/1201) source may be supplied to the board via a coaxial input (J2) or optical input (U3). With the adjacent pins of header H1 shorted and the links and switches of tables 2 and 3 set correctly, the digital input signal will be the source of audio output for the connectors J1, J4, J6 and J7.

If the user wishes to supply their own timing and data then the jumpers of header H1 should be removed and pins 16(LRCIN), 14(DIN), 12(BCKIN) and 10(SCKI) should be used to input these signals direct to the device (see the WM8740 datasheet for timing and format support). Terminating resistor (R59, R60, R61, R69) and capacitor (C61, C62, C65, C66) sites have been included on the board to allow for cable impedance matching when using the board in this manner (They are left unpopulated on shipment from Wolfson).

For ultimate performance, it is possible to create a differential (DIFFHW) system using 2 WM8740-EV1B evaluation boards. Also, with the MODE8X function set active, a high performance external digital filter may be added to the system. Please refer to the WM8740 datasheet for further details on device configuration in this hardware mode.

SOFTWARE MODE

To operate the WM8740 in software mode, the jumper on link LNK17 (MODE) must be set to HI. The jumper on LNK12 (CSB/IWL) must be set low or left unconnected. The serial interface then becomes active on pins 28(ML), 27(MC) and 26(MD) of the WM8740, overriding the hardware link settings. RESETB also has a serial line for software control. The serial interface on the board can be connected to a PC via the printer port or any other standard parallel port. The port used can be selected through the software provided. The software supplied with this kit gives the user access to all the possible features of the WM8740.

Please refer to the WM8740 datasheet for full details of the serial interface timing and all register features.

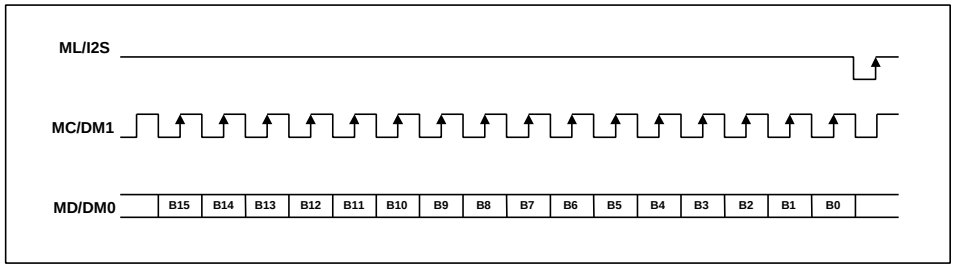


Figure 3 3-Wire (SPI) Serial Interface

	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
	NOT USED				ADDRESS			DATA								
M0	-	-	-	-	0	0	0	LDL	AL7	AL6	AL5	AL4	AL3	AL2	AL1	AL0
M1	-	-	-	-	0	0	1	LDR	AR7	AR6	AR5	AR4	AR3	AR2	AR1	AR0
M2	-	-	-	-	0	1	0	-	-	-	-	IW1	IW0	OPE	DEM	MUT
M3	-	-	-	-	0	1	1	IZD	SF1	SF0	CKO	REV	SR0	ATC	LRP	I^2S
M4	-	-	-	-	1	1	0	-	-	CDD	DIFF1	DIFF0	-	-	-	-

Table 4 Mapping of Program Registers

SERIAL INTERFACE SOFTWARE DESCRIPTION

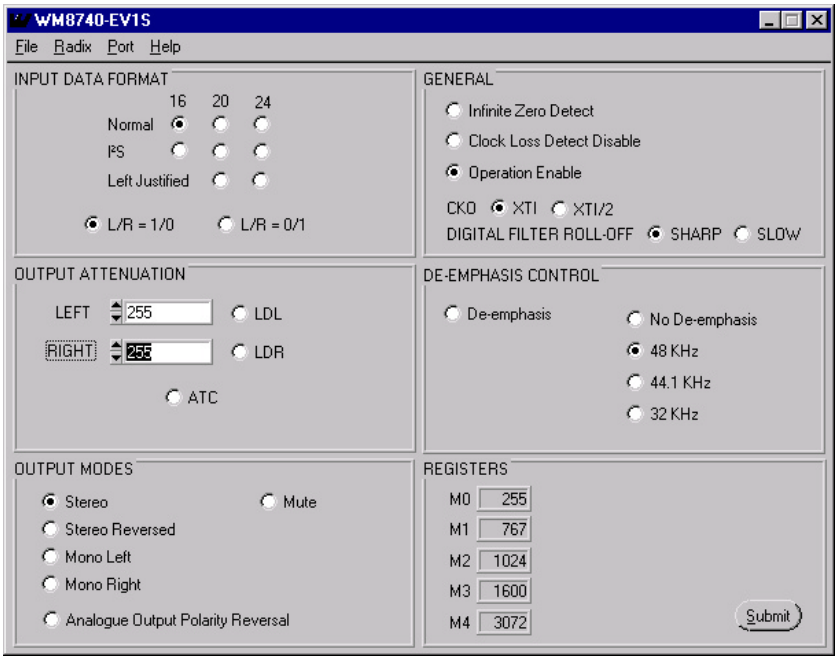


Figure 4 Default Screen Settings

Figure 4 shows the default settings of the WM8740 in software mode (default screen setting).

SOFTWARE MENU FEATURES

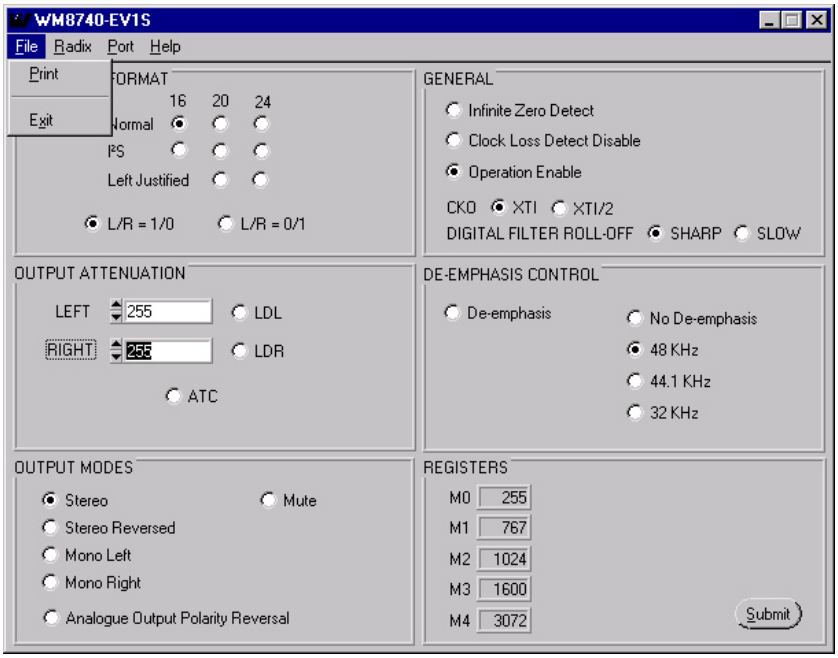


Figure 5 Options Available from the File Menu

Figure 5 shows the contents of the 'File' menu. The 'Print' option prints the current screen settings to the PC's default printer. The 'Exit' option quits the WM8740-EV1S software program.

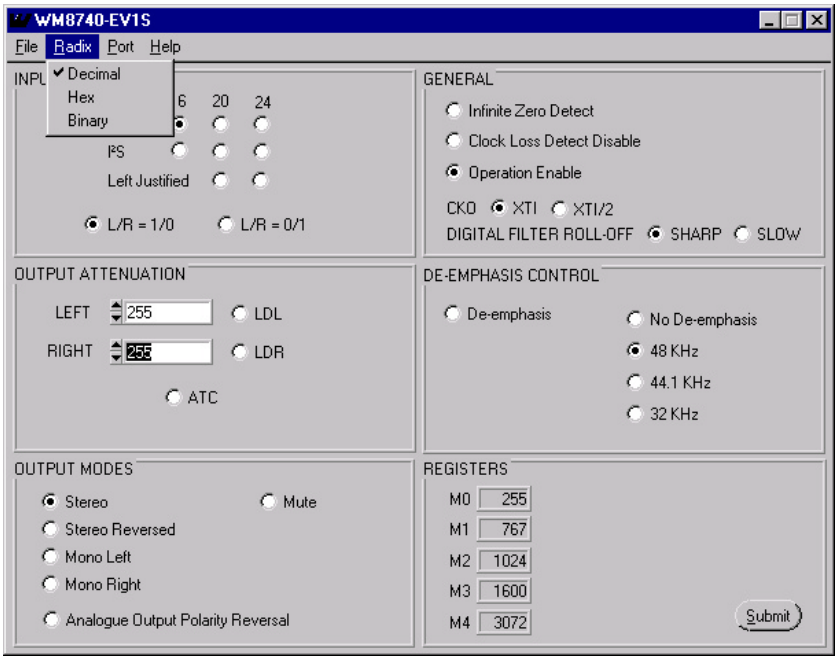


Figure 6 Radix Menu

Figure 6 shows the 'Radix' menu of the software allowing the user to change the way data is presented on the software user interface. When any of the three options are selected, the format of data in the Output Attenuation and Registers sections are changed.

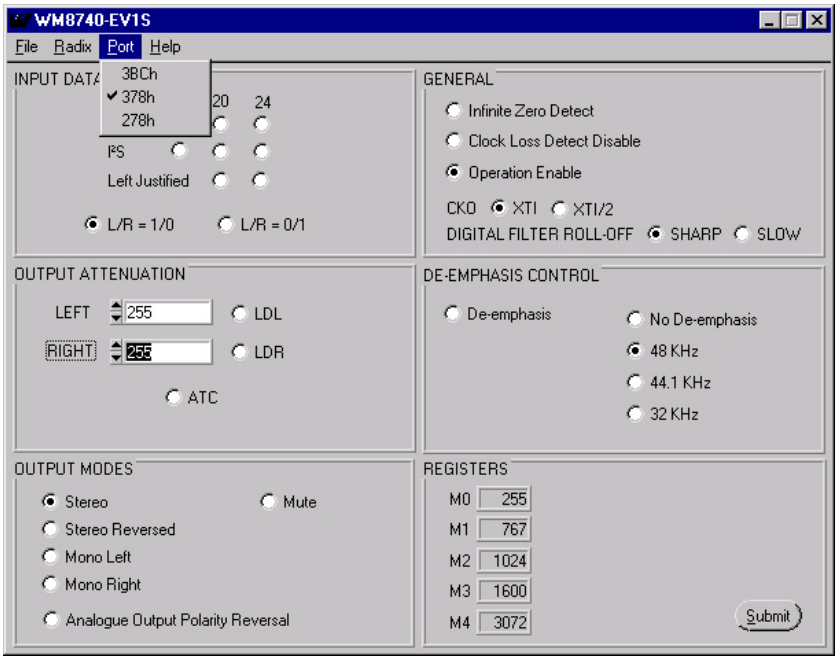


Figure 7 Port Menu

Figure 7 shows the 'Port' menu. This gives the user full control over which of the PCs parallel ports is used.

SOFTWARE INSTALLATION

There are 2 floppy disks supplied with this evaluation kit. To install the software:

- Insert disk 1
- Select the 'Start' button on the Windows task bar and the 'Run…' option.
- Type "A:\setup" and then press OK
- Follow the on-screen instructions

SOFTWARE OPERATION

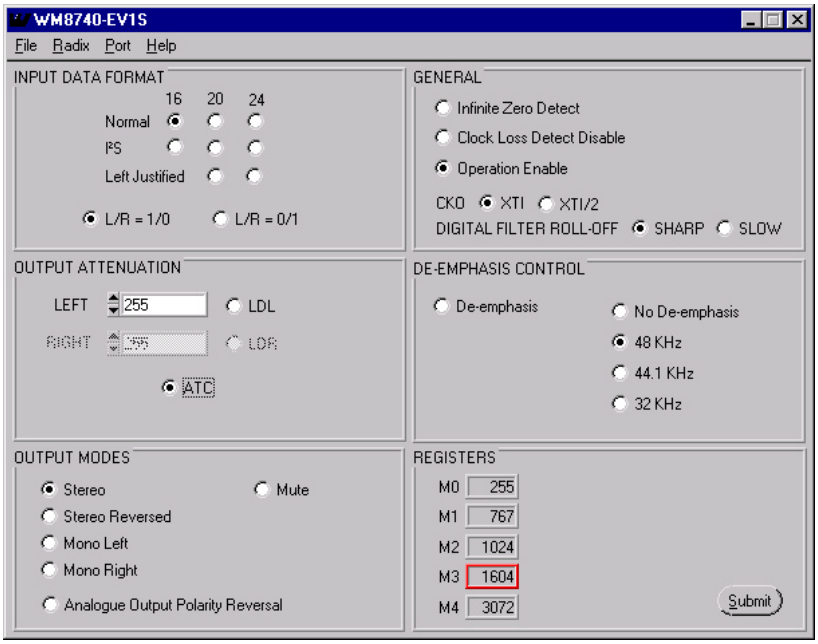


Figure 8 Changing Default Settings

Once any of the default settings are changed on the control panel, the relevant register is highlighted (see Figure 8) to show the bit selected has changed. For example if the ATC mode is selected as above, then register M3 will be highlighted and the value will change from 1600 (dec) default to 1604 (dec) as bit B2 is set to a 1. When the ATC bit is set, access to the right attenuation register value is denied (when the ATC bit is set the right channel is locked to the value set in the left).

After a value has been updated in the Output Attenuation section, 'RETURN' must be pressed to send the value to the Registers section. If a value is changed with no 'RETURN' press then the value will not be updated and return to its previous setting.

When all register updates are complete on the software user interface, the values are not sent to the WM8740 until the 'Submit' button is pressed. Only then does the WM8740 change existing settings.

WM8740-EV1B SCHEMATIC

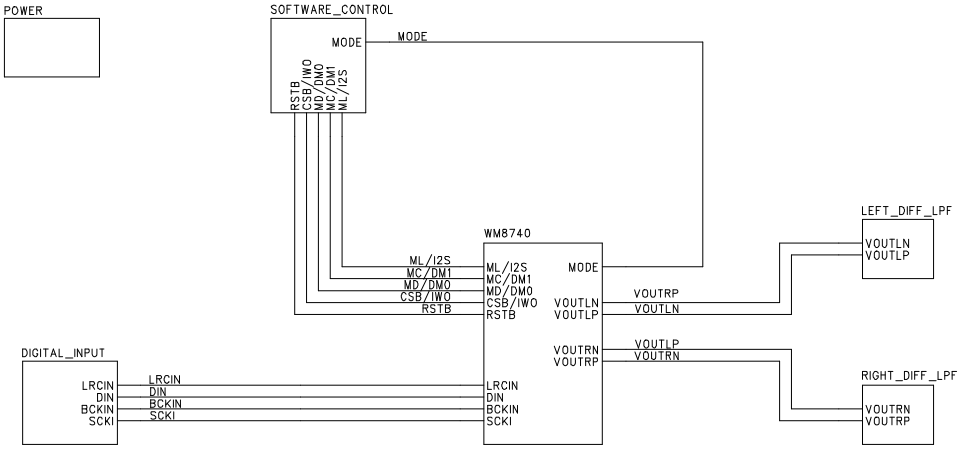


Figure 9 Functional Diagram

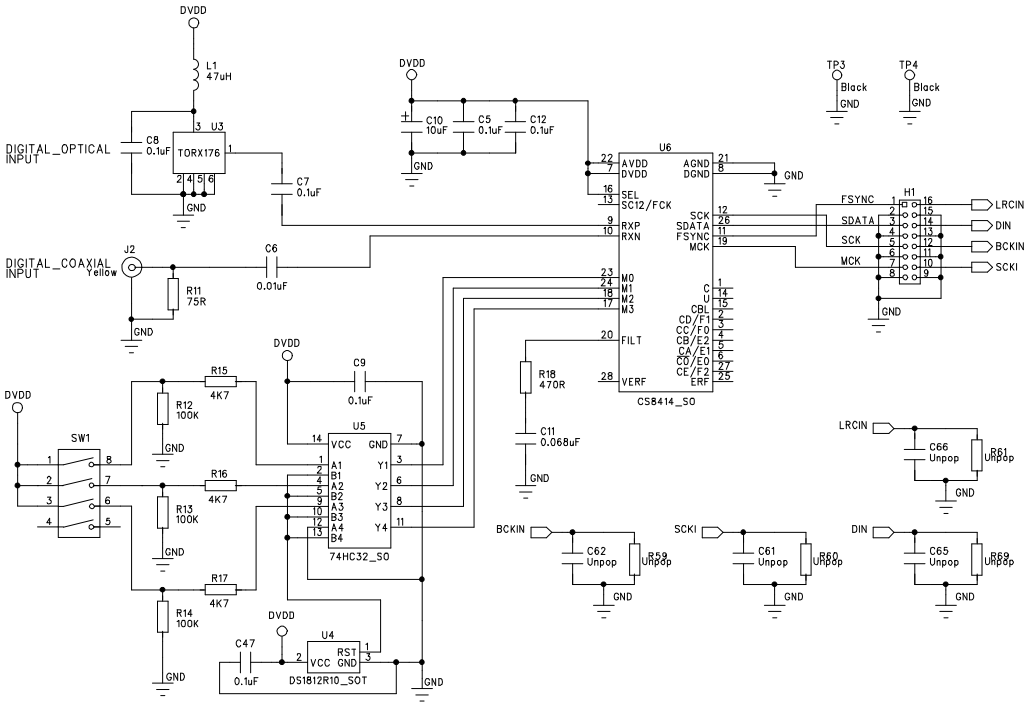


Figure 10 Digital Input

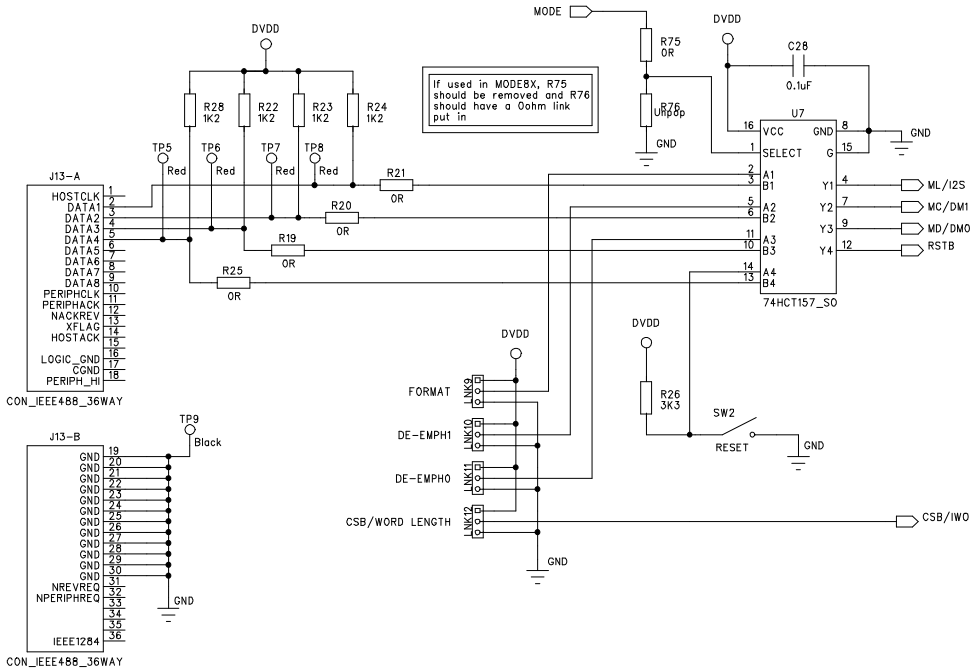


Figure 11 Software Control Interface

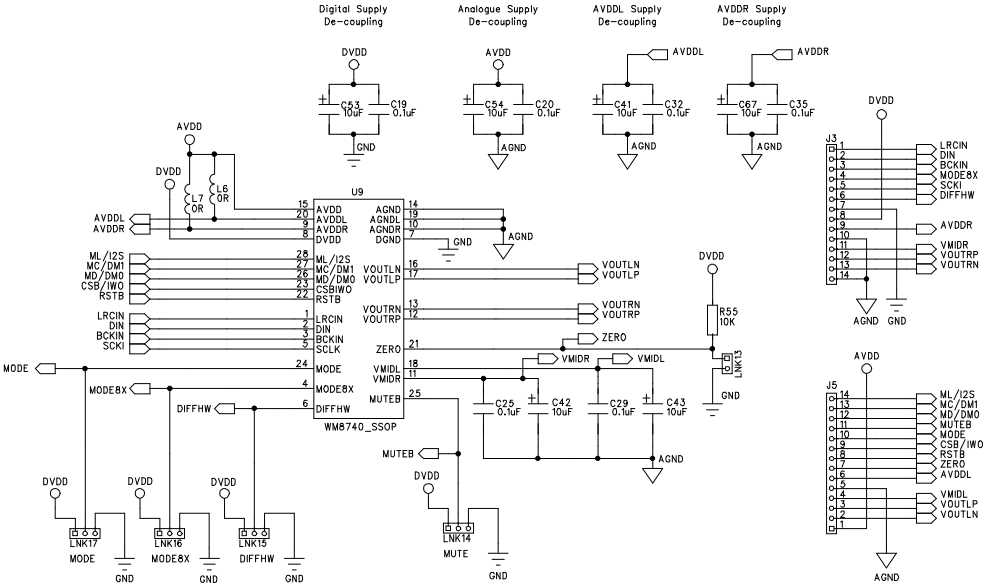


Figure 12 WM8740

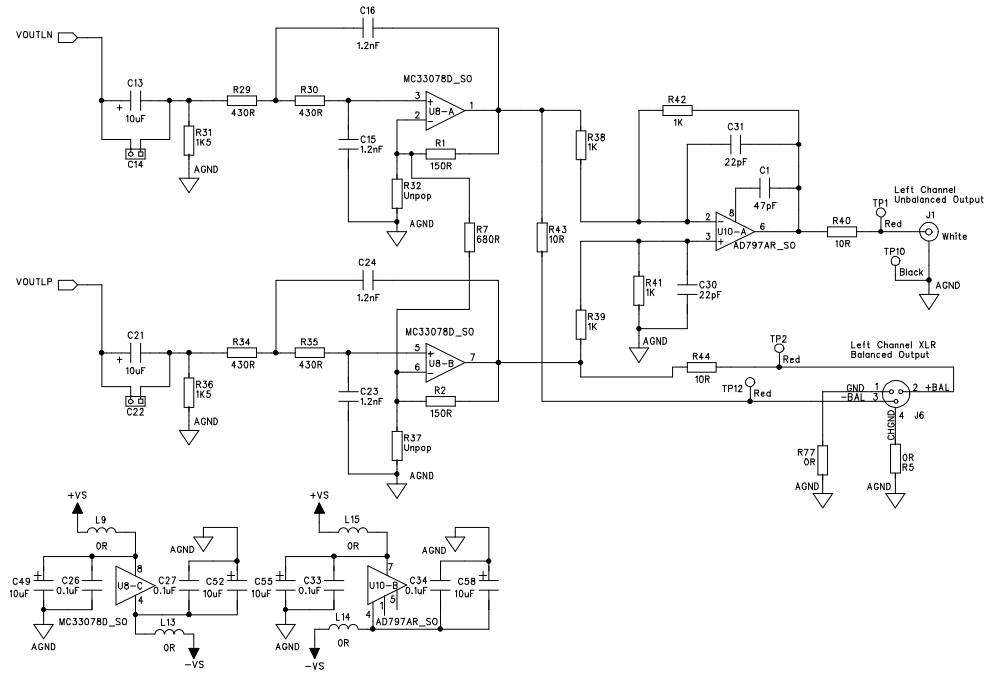


Figure 13 Left Differential LPF Output

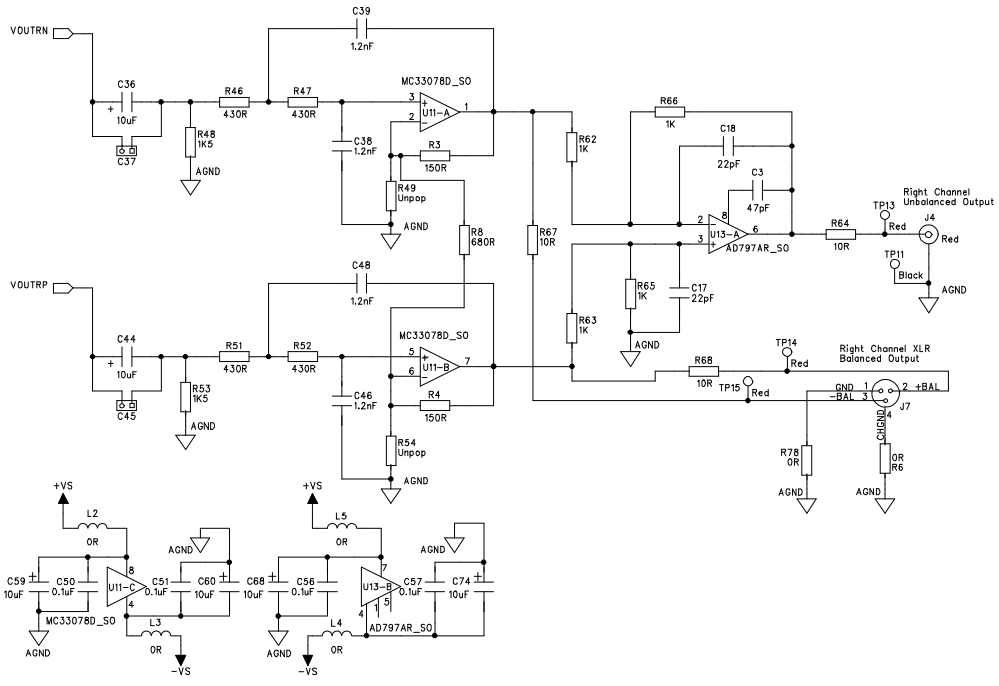


Figure 14 Right Differential LPF Output

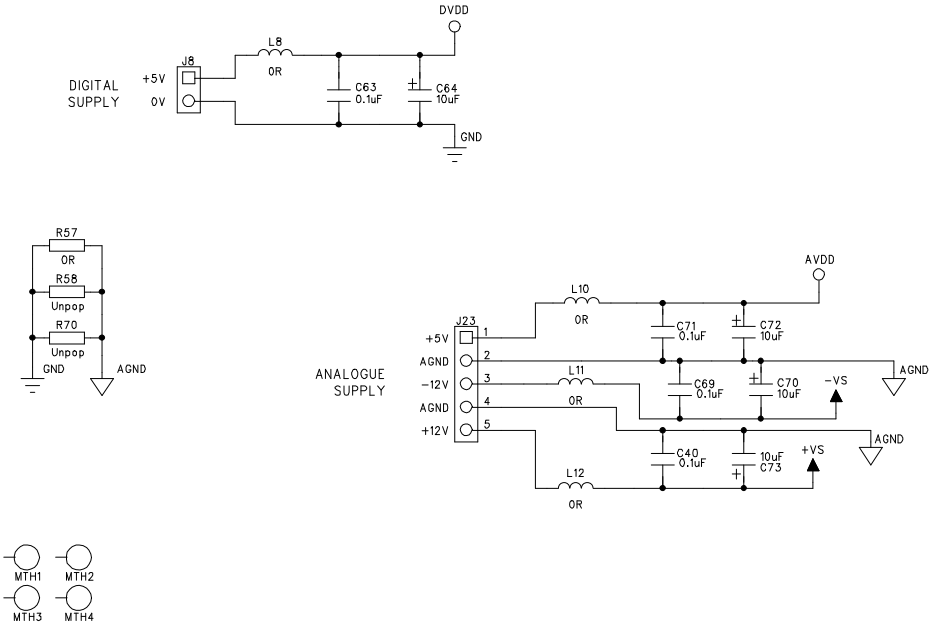
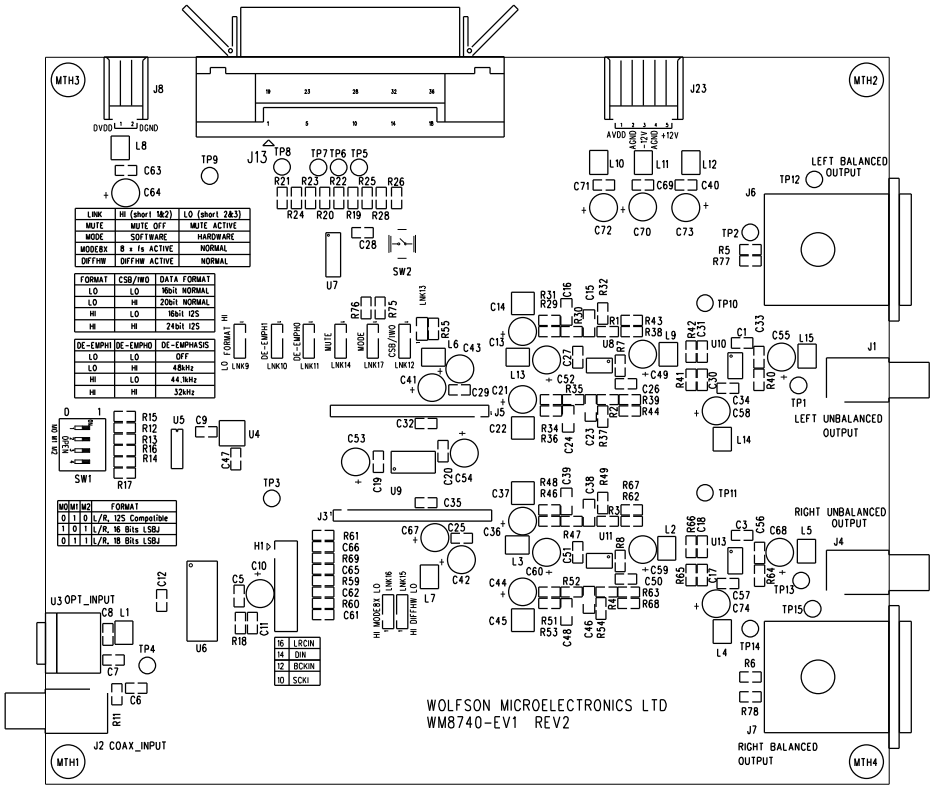


Figure 15 Power

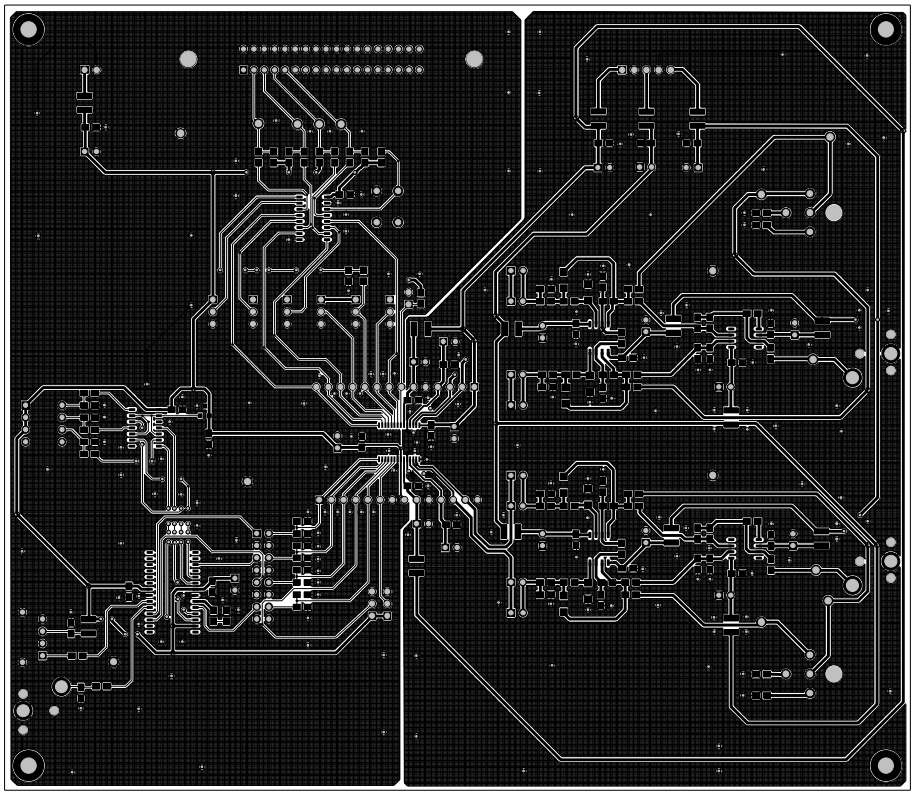
WM8740-EV1B PCB LAYOUT

TOP LAYER SILKSCREEN

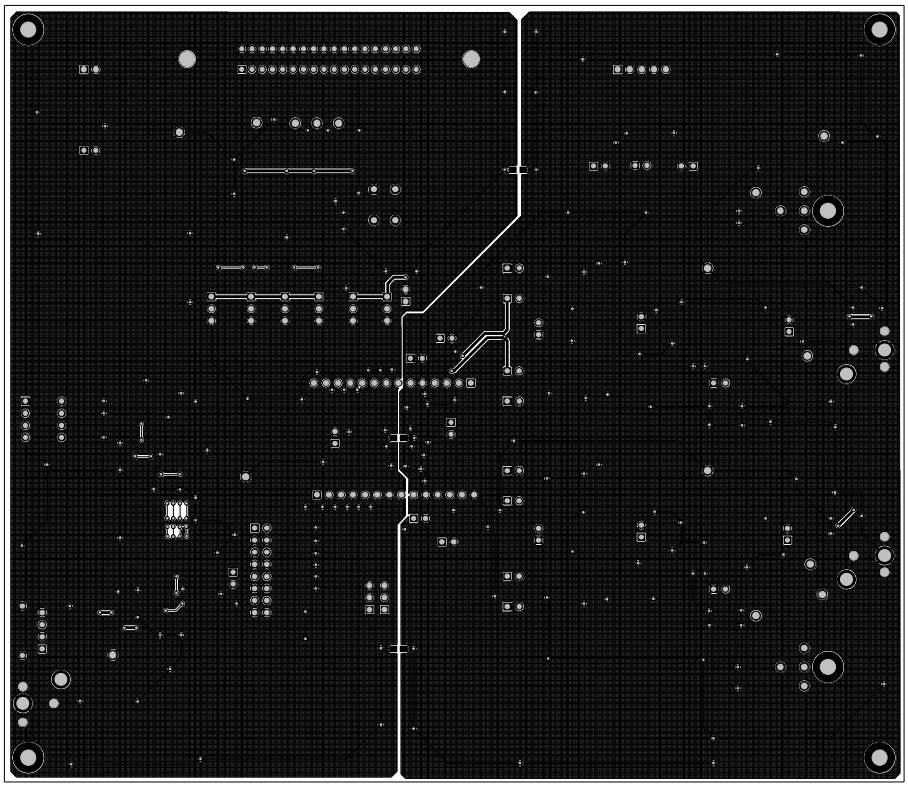


BOTTOM LAYER SILKSCREEN

TOP LAYER



BOTTOM LAYER



WM8740-EV1B BILL OF MATERIAL

Description	Reference	Qty
47pF 0805 SMD Ceramic Capacitor 100V NPO	C1 C3	2
10uF 6.3 Dia 2.5 pitch Oscon Through Hole Cap. 16V 20%	C10 C13 C21 C36 C41-43 C49 C52-55 C58-60 C64 C67-68 C70 C72-74	23
0.068uF 0805 SMD Ceramic Capacitor 25V X7R	C11	1
1x2 PCB Pin Header 0.1" VERTICAL	C14 C22 C37 C45 LNK13	5
1.2nF 1206 SMD Ceramic Capacitor 50V NPO	C15-16 C23-24 C38-39 C46 C48	8
22pF 0805 SMD Ceramic Capacitor 100V NPO	C17-18 C30-31	4
0.1uF 0805 SMD Ceramic Capacitor 50V X7R	C5 C7-9 C12 C19-20 C25-29 C32-35 C40 C47 C50-51 C56-57 C63 C69 C71	25
0.01uF 0805 SMD Ceramic Capacitor 50V X7R	C6	1
2x8 PCB Pin Header 0.1" VERTICAL	H1	1
Phono Socket PCB mount WHITE	J1	1
36-way Centronics/IEE488 PCB mountable Connector	J13	1
Phono Socket PCB mount YELLOW	J2	1
5-Way 2.54mm Pitch Molex Square Pin Header HORIZONTAL	J23	1
1x14 2.54mm pitch PCB Pin Header VERTICAL	J3 J5	2
Phono Socket PCB mount RED	J4	1
XLR 3-pole PCB mounting male connector HORIZONTAL	J6-7	2
2-Way 2.54mm Pitch Molex Square Pin Header HORIZONTAL	J8	1
47uH 1210 Surface Mount Inductor 'PA series'	L1	1
0R 1206 Resistor on 1210 Inductor site	L2-15	14
1x3 PCB Pin Header 0.1" VERTICAL	LNK9-12 LNK14-17	8
75R 0805 SMD chip resistor 1% 0.125W	R11	1
100K 0805 SMD chip resistor 1% 0.1W	R12-14	3
150R 0805 SMD chip resistor 1% 0.1W	R1-4	4
4K7 0805 SMD chip resistor 1% 0.1W	R15-17	3
470R 0805 SMD chip resistor 1% 0.1W	R18	1
1K2 0805 SMD chip resistor 1% 0.1W	R22-24 R28	4
3K3 0805 SMD chip resistor 1% 0.1W	R26	1
430R 0805 SMD chip resistor 1% 0.1W	R29-30 R34-35 R46-47 R51-52	8
1K5 0805 SMD chip resistor 1% 0.1W	R31 R36 R48 R53	4
1K 0805 SMD chip resistor 1% 0.1W	R38-39 R41-42 R62-63 R65-66	8
10R 0805 SMD chip resistor 1% 0.1W	R40 R43-44 R64 R67-68	6
10K 0805 SMD chip resistor 1% 0.1W	R55	1
0R 0805 SMD chip resistor 1% 0.1W	R5-6 R19-21 R25 R57 R75 R77-78	10
680R 0805 SMD chip resistor 1% 0.1W	R7-8	2
DIL Switch 4-Way Rocker	SW1	1
B3F1000 SPNO PCB mount switch	SW2	1
1.32mm PCB Test Terminal RED	TP1-2 TP5-8 TP12-15	10
1.32mm PCB Test Terminal BLACK	TP3-4 TP9-11	5

AD797 Ultra Low Distortion, Ultra Low Noise Op-Amp SO	U10 U13	2
TORX176 Digirtal Audio Optical Receiver	U3	1
DS1812 5V Power-On-Reset chip SOT	U4	1
MM74HC32 Quad 2-input OR gate SO	U5	1
CS8414 96kHz Digital Audio Receiver SO	U6	1
74HCT157 Quad 2-Input Mux SO	U7	1
MC33078 Low Noise Dual Op-Amp SO	U8 U11	2
WM8740 Wolfson DAC SSOP	U9	1
Unpop 0805 SMD Ceramic Capacitor site	C61-62 C65-66	4
Unpopulated 0805 resistor site	R32 R37 R49 R54 R58-61 R69-70 R76	11

EVALUATION SUPPORT

The aim of this evaluation kit is to help you to become familiar with the functionality and performance of the WM8740, stereo DAC.

If you require further information or require technical support please contact Wolfson Microelectronics **Applications** group through the following channels:

Email: apps@wolfson.co.uk
Telephone: (+44) 131 667 9386
Fax: (+44) 131 667 5176
Mail: **Applications** at the address on page 1.

or contact your local Wolfson representative.

Additional information may be made available from time to time on our web site at http://www.wolfson.co.uk