

## Mono Low-Power CODEC with Video Buffer

### DESCRIPTION

The WM8944 is a highly integrated low power hi-fi CODEC designed for portable devices such as digital still cameras.

Up to 4 analogue inputs may be connected; a digital microphone interface is also provided. Flexible output mixing options support single-ended and differential configurations, with outputs derived from the digital audio or analogue bypass paths. Mono line and BTL headphone/speaker output can be supported.

Flexible digital mixing and powerful DSP functions are available. Programmable filters and other processes may be applied to the ADC and DAC signal paths simultaneously. The DSP functions include notch filters, 5-band EQ, dynamic range control and the Wolfson ReTune™ feature.

The ReTune™ feature is a sophisticated digital filter that can compensate for imperfect characteristics of the housing, loudspeaker or microphone components in an application. The ReTune™ algorithm can provide acoustic cancellation and selective phase (delay) control of specific frequency bands.

The WM8944 is controlled via a I2C or SPI interface. Additional functions include Auxiliary ADC, Digital beep generator, Video buffer, programmable GPIO functions, Frequency Locked Loop (FLL) for flexible clocking support and integrated LDO for low noise supply regulation.

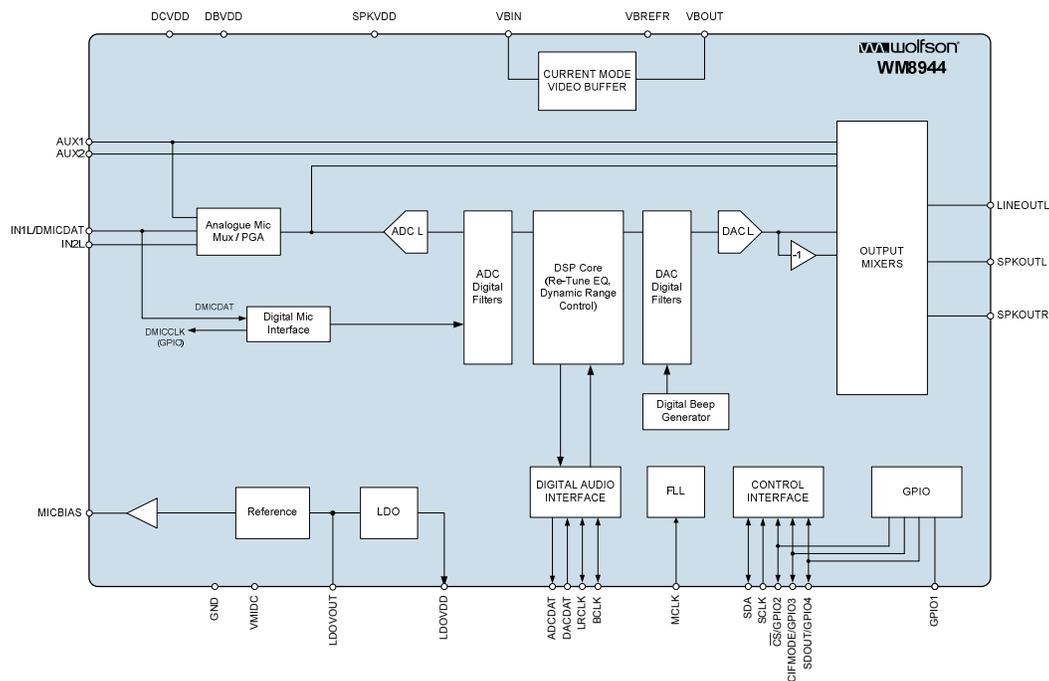
The WM8944 is supplied in 36-ball W-CSP package, ideal for portable systems.

### FEATURES

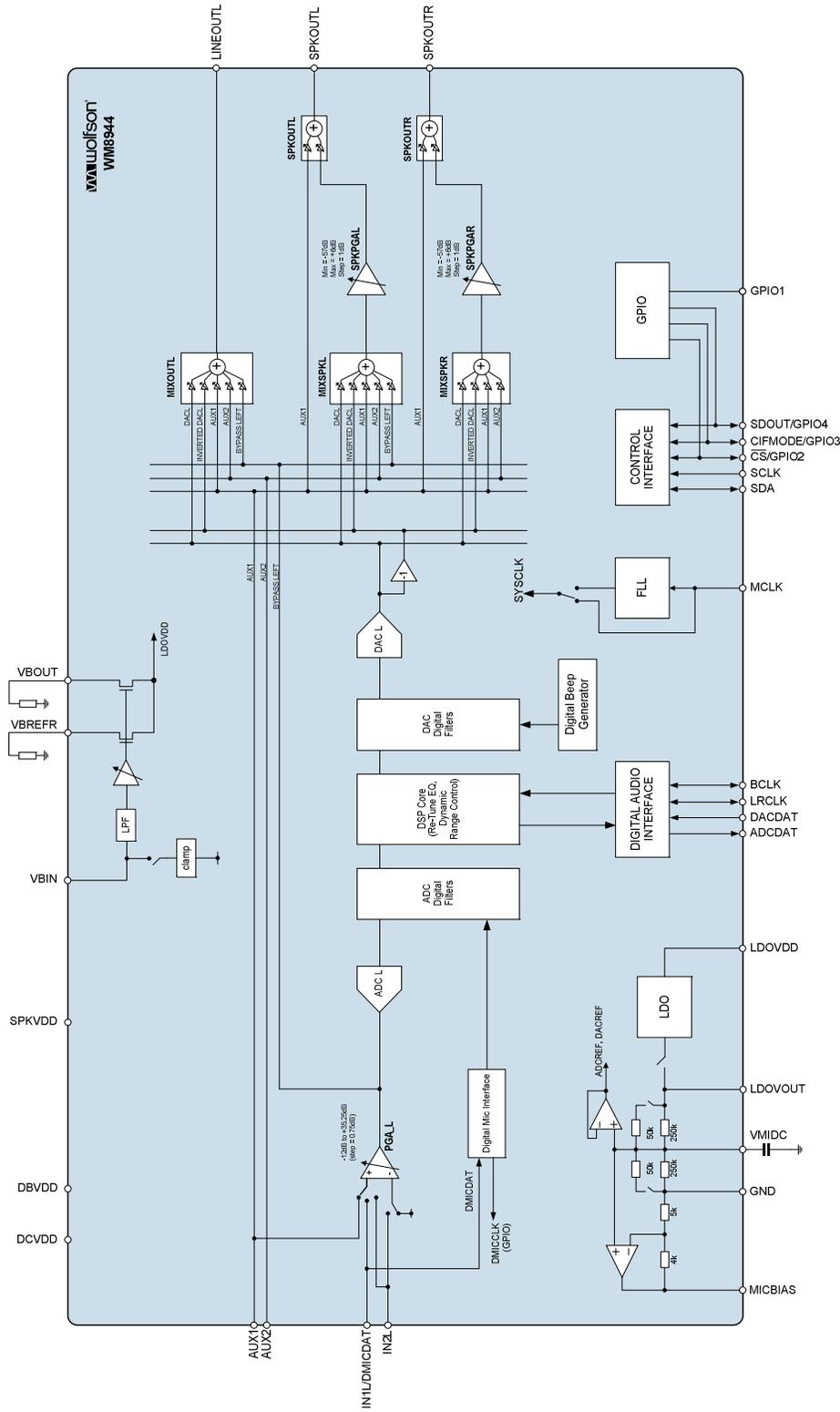
- Hi-fi audio CODEC
  - 94dB SNR during ADC recording ('A' weighted)
  - 98dB SNR during DAC playback ('A' weighted)
- 4 analogue audio inputs
- Integrated bias reference for electret microphones
- Digital microphone interface
- Powerful digital mixing / DSP functions:
  - 5-notch filters
  - 5-band equalizer (EQ)
  - ReTune™ parametric filter
  - Dynamic range control and noise gate
  - Low-pass/High-pass filters
  - Direct Form 1 (DF1) programmable digital filter
- Digital beep generator
- 3 analogue audio outputs
- Mono line output
- Mono BTL headphone/speaker output driver
- I2S digital audio interface - sample rates 8kHz to 48kHz
- Frequency Locked Loop (FLL) frequency conversion / filter
- Video buffer function
- Integrated LDO low-noise voltage regulator
- 36-ball W-CSP package (2.96 x 3.06 x 0.7mm, 0.5mm pitch)

### APPLICATIONS

- Digital Still Cameras (DSC)
- Multimedia phones

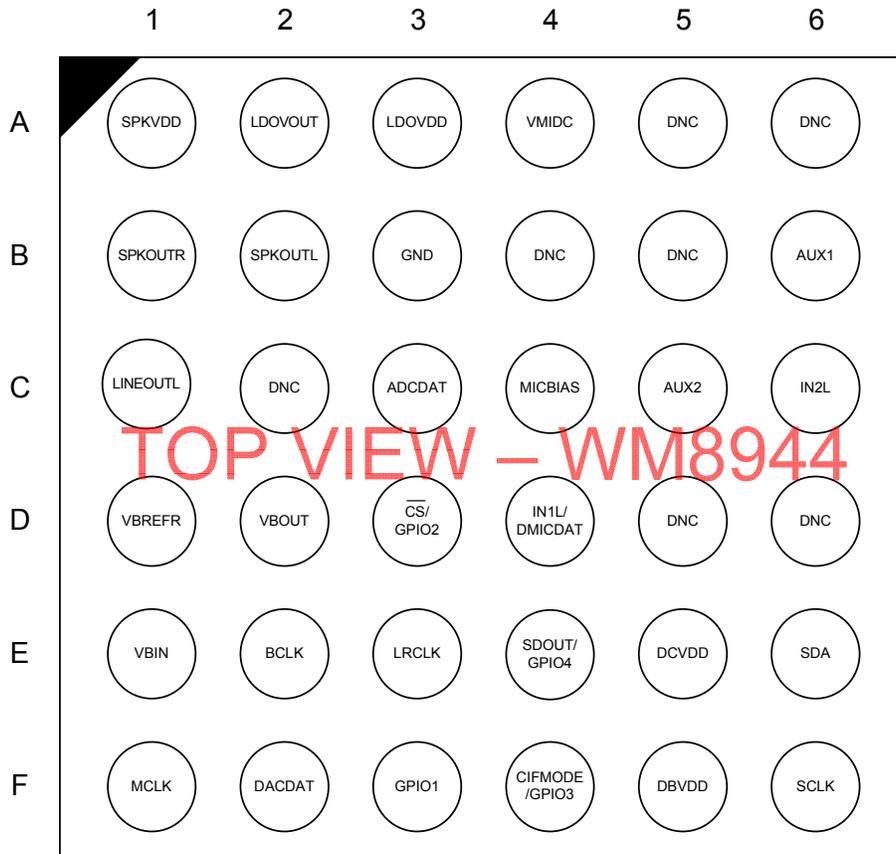


BLOCK DIAGRAM



## PIN CONFIGURATION

The WM8944 is supplied in a 36-pin CSP format. The pin configuration is illustrated below, showing the top-down view from above the chip.



## ORDERING INFORMATION

ORDER CODE	TEMPERATURE RANGE	PACKAGE	MOISTURE SENSITIVITY LEVEL	PEAK SOLDERING TEMPERATURE
WM8944ECS/R	-40°C to +85°C	36-ball W-CSP (Pb-free, tape and reel)	MSL1	260°C

**Note:**

Reel quantity = 3500

**PIN DESCRIPTION**

PIN NO	NAME	TYPE	DESCRIPTION
A1	SPKVDD	Supply	Supply for speaker driver
A2	LDOVOUT	Supply	LDO output
A3	LDOVDD	Supply	LDO supply input
A4	VMIDC	Analogue Output	Midrail voltage decoupling capacitor
A5	DNC	N/A	Do Not Connect
A6	DNC	N/A	Do Not Connect
B1	SPKOUTR	Analogue Output	Right speaker mixer output
B2	SPKOUTL	Analogue Output	Left speaker mixer output
B3	GND	Supply	Ground
B4	DNC	N/A	Do Not Connect
B5	DNC	N/A	Do Not Connect
B6	AUX1	Analogue Input	Aux input (audio or AUXADC input)
C1	LINEOUTL	Analogue Output	Left line mixer output
C2	DNC	N/A	Do Not Connect
C3	ADCDAT	Digital Output	ADC / Digital Microphone digital audio data
C4	MICBIAS	Analogue Output	Microphone bias
C5	AUX2	Analogue Input	Aux input (audio or AUXADC input)
C6	IN2L	Analogue Input	Left input 2
D1	VBREFR	Analogue Output	Video buffer current reference resistor connection
D2	VBOUT	Analogue Output	Video buffer output
D3	CS/GPIO2	Digital Input / Output	Chip Select / GPIO2
D4	IN1L/DMICDAT	Analogue Input / Digital Input	Left input 1 / Digital Microphone data input
D5	DNC	N/A	Do Not Connect
D6	DNC	N/A	Do Not Connect
E1	VBIN	Analogue Input	Video buffer input
E2	BCLK	Digital Input / Output	Audio interface bit clock
E3	LRCLK	Digital Input / Output	Audio interface left / right clock
E4	SDOUT/GPIO4	Digital Input / Output	Control interface data output / GPIO4
E5	DCVDD	Supply	Digital core supply
E6	SDA	Digital Input / Output	Control interface data input / output
F1	MCLK	Digital Input	Master clock
F2	DACDAT	Digital Input	DAC digital audio data
F3	GPIO1	Digital Input / Output	GPIO1
F4	CIFMODE/GPIO3	Digital Input / Output	Control interface mode select / GPIO3
F5	DBVDD	Supply	Digital buffer (I/O) supply
F6	SCLK	Digital Input	Control interface clock input

## ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings are stress ratings only. Permanent damage to the device may be caused by continuously operating at or beyond these limits. Device functional operating limits and guaranteed performance specifications are given under Electrical Characteristics at the test conditions specified.



ESD Sensitive Device. This device is manufactured on a CMOS process. It is therefore generically susceptible to damage from excessive static voltages. Proper ESD precautions must be taken during handling and storage of this device.

Wolfson tests its package types according to IPC/JEDEC J-STD-020B for Moisture Sensitivity to determine acceptable storage conditions prior to surface mount assembly. These levels are:

MSL1 = unlimited floor life at <30°C / 85% Relative Humidity. Not normally stored in moisture barrier bag.

MSL2 = out of bag storage for 1 year at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.

MSL3 = out of bag storage for 168 hours at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.

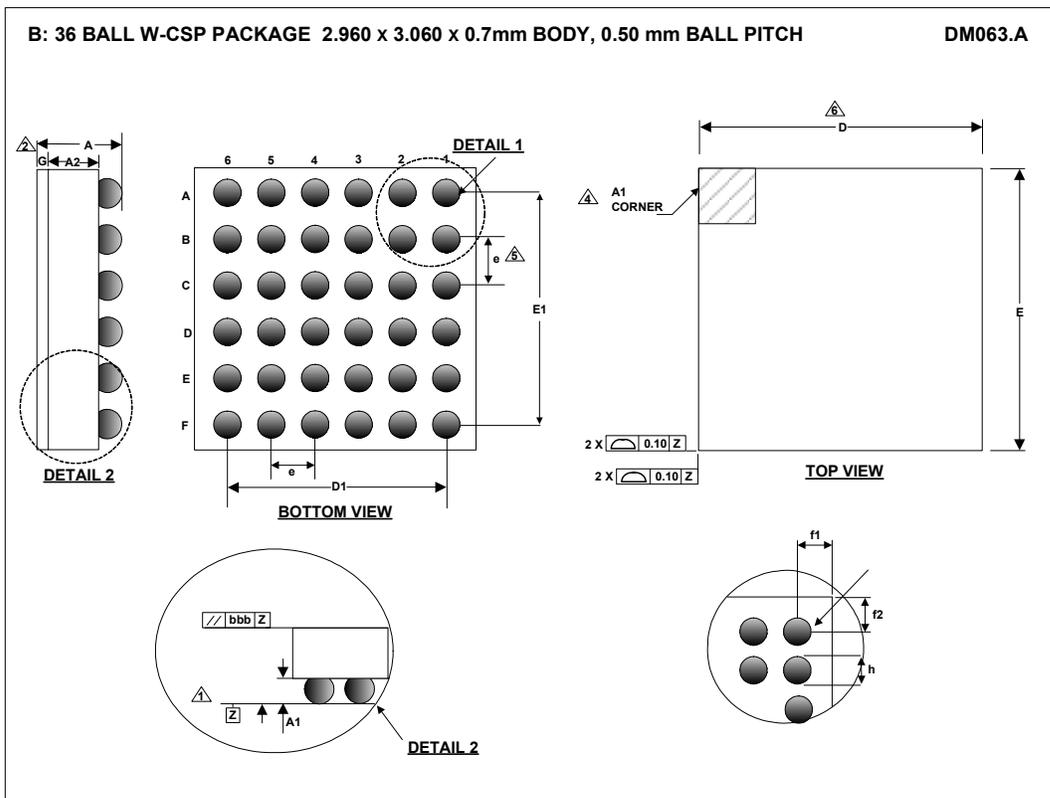
The Moisture Sensitivity Level for each package type is specified in Ordering Information.

CONDITION	MIN	MAX
Supply voltages (DCVDD)	-0.3V	2.5V
Supply voltages (LDOVDD, DBVDD, SPKVDD)	-0.3V	4.5V
Voltage range digital inputs	-0.3V	DBVDD +0.7V
Voltage range analogue inputs	-0.3V	LDOVDD +0.7V
Operating temperature range, T <sub>A</sub>	-40°C	+85°C
Junction temperature, T <sub>JMAX</sub>	-40°C	+150°C
Storage temperature after soldering	-65°C	+150°C

## RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Digital supply range (Core)	DCVDD	1.71	1.8	1.98	V
Digital supply range (I/O)	DBVDD	1.71	3.3	3.6	V
Analogue supply	LDOVDD	2.4	3.3	3.6	V
Speaker supply range	SPKVDD	1.71	3.3	3.6	V
Ground	GND		0		V

**PACKAGE DIMENSIONS**



Symbols	Dimensions (mm)			NOTE
	MIN	NOM	MAX	
A	0.615	0.7	0.785	
A1	0.219	0.244	0.269	
A2	0.361	0.386	0.411	
D		2.960 BSC		
D1		2.500 BSC		
E		3.060 BSC		
E1		2.500 BSC		
e		0.500 BSC		5
f1	0.220			
f2	0.270			
g	0.035	0.070	0.105	
h		0.314 BSC		

- NOTES:
1. PRIMARY DATUM -Z- AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
  2. THIS DIMENSION INCLUDES STAND-OFF HEIGHT 'A1' AND BACKSIDE COATING.
  3. A1 CORNER IS IDENTIFIED BY INK/LASER MARK ON TOP PACKAGE.
  4. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
  5. 'e' REPRESENTS THE BASIC SOLDER BALL GRID PITCH.
  6. THIS DRAWING IS SUBJECT TO CHANGE WITHOUT NOTICE.
  7. FOLLOWS JEDEC DESIGN GUIDE MO-211-C.

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