

16-Bit Stereo Audio DAC & Headphone Driver Power Down Function, Component Less

FEATURES

- Operation range: 2.5V~5.5V
- Excellent Power Supply Rejection Ratio(PSRR)
- Power Down function
- Pop noise free control (PDPR)
- No zero crossing distortion
- Component less
- Fast setting time permits 2*, 4*, and 8* oversampling (serial input) or double speed operation at 4* oversampling
- Compatible with most of the Japanese input formats; time multiplexed, two's complement, TTL input level. (Right-justified format)
- Housed in 10 pin MSOP package

APPLICATIONS

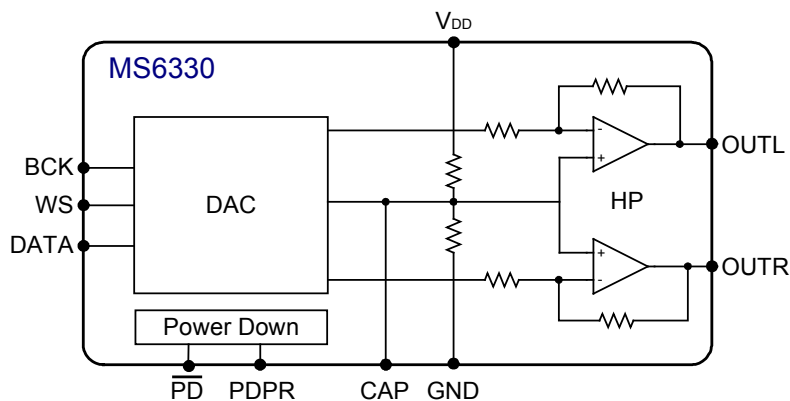
- Multimedia system, PDA, Portable Digital Audio, GPS Navigator, Cellular phone.

DESCRIPTION

The MS6330 is an integrated 16-bits voltage-output Digital-to-Analog Converter (DAC) and class AB stereo headphone driver. The MS6330 is with the excellent Power Supply Rejection Ratio(PSRR). It is fabricated in a CMOS process and features extremely low power dissipation, small package size and easy application. The accuracy of the matched coarse current sources, combined with the unique symmetrical decoding method, precluded zero-crossing distortion and ensures high quality audio reproduction.

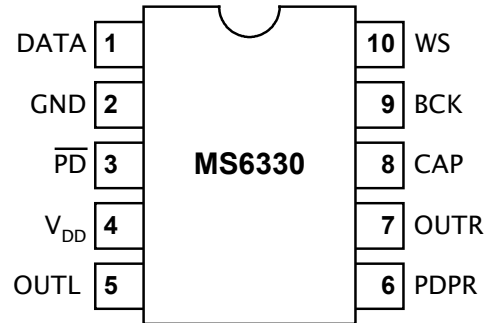
These unique features, combined with its exceptional performance, make the MS6330 ideally suited for use in digital audio equipment.

BLOCK DIAGRAM



PIN CONFIGURATION

Symbol	Pin	Description
DATA	1	Data input
GND	2	Ground
/PD	3	Power down
V _{DD}	4	Positive supply voltage
OUTL	5	Left channel output
PDPR	6	Power down preparation
OUTR	7	Right channel output
CAP	8	Capacitor
BCK	10	Bit clock input
WS	9	Word select input



Pin 8 : Capacitor = 1uF~10uF

ORDERING INFORMATION

Package	Part number	Packaging Marking	Transport Media
10-Pin MSOP (lead free)	MS6330GTR	MS6330G	3.5k Units Tape and Reel
10-Pin MSOP (lead free)	MS6330GU	MS6330G	80 Units Tube

RoHS Compliance

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
V _{DD}	Positive Supply Voltage	6	V
V _{ESD}	Electrostatic Handling	-3000 to 3000	V
T _{STG}	Storage Temperature Range	-65 to 150	°C
T _A	Operating Ambient Temperature Range	-40 to 85	°C
T _J	Maximum Junction Temperature	150	°C
T _S	Soldering Temperature, 10 seconds	260	°C
R _{THJA}	Thermal Resistance from Junction to Ambient in Free Air MSOP10	194	°C/W

OPERATING RATINGS

Symbol	Parameter	Min	Typ	Max	Unit
V _{DD}	Supply Voltage	2.5	-	5.5	V

5V ELECTRICAL CHARACTERISTICS

($T_a=25^{\circ}\text{C}$, $V_{DD}=5\text{V}$, $f=1\text{kHz}$, $R_L=32\Omega$; unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Characteristics						
V_{CAP}	Voltage at CAP		2.45	2.5	2.55	V
V_{DC}	Output DC level		2.45	2.5	2.55	V
I_Q	Quiescent current		-	4.4	4.8	mA
I_{PD}	Power down current	No digital input signal	-	0.5	1	uA
PSRR	Power supply rejection ratio	CAP=2.2uF (100Hz)	50	55	-	dB
		CAP=10uF (100Hz)	62	67	-	dB
CS	Channel separation		70	75	-	dB
V_{PDH}	Power down high level		$0.7V_{DD}$	-	-	V
V_{PDL}	Power down low level		-	-	$0.3V_{DD}$	V
V_{PDPRH}	Power down preparation high level		$0.7V_{DD}$	-	-	V
V_{PDPRL}	Power down preparation low level		-	-	$0.3V_{DD}$	V
AC Characteristics						
Res	Resolution		-	-	16	bits
V_{FS}	Full scale output voltage	$V_{FS}=0.568 * V_{DD}$	-	2.84	-	Vpp
THD+N	Total harmonic distortion plus noise		-	-60	-56	dB
			-	0.1	0.158	%
S/N	Signal-to-noise ratio		89	95	-	dB
Po	Maximum output power	(THD+N)/S < 0.16%, 2ch	-	63	-	mW

3.3V ELECTRICAL CHARACTERISTICS

(Ta=25°C, V_{DD}=3.3V, f=1kHz, R_L=32Ω; unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Characteristics						
V _{CAP}	Voltage at CAP		1.60	1.65	1.70	V
V _{DC}	Output DC level		1.60	1.65	1.70	V
I _Q	Quiescent current		-	3.6	4	mA
I _{PD}	Power down current	No digital input signal	-	0.35	1	uA
PSRR	Power supply rejection ratio	CAP=2.2uF (100Hz)	50	55	-	dB
		CAP=10uF (100Hz)	61	66	-	dB
CS	Channel separation		70	75	-	dB
AC Characteristics						
V _{FS}	Full scale output voltage	V _{FS} =0.568 * V _{DD}	-	1.87	-	V _{pp}
THD+N	Total harmonic distortion plus noise		-	-60	-56	dB
			-	0.1	0.158	%
S/N	Signal-to-noise ratio		86	92	-	dB
P _o	Maximum output power	(THD+N)/S < 0.16%,2ch	-	27	-	mW

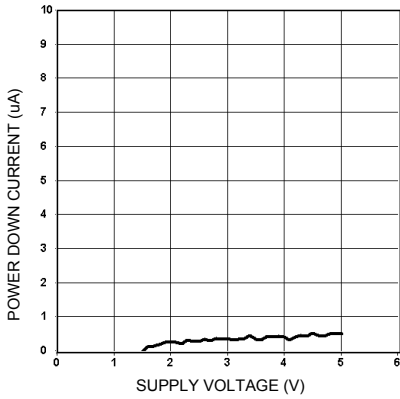
2.7V ELECTRICAL CHARACTERISTICS

(Ta=25°C, V_{DD}=2.7V, f=1kHz, R_L=32Ω; unless otherwise specified)

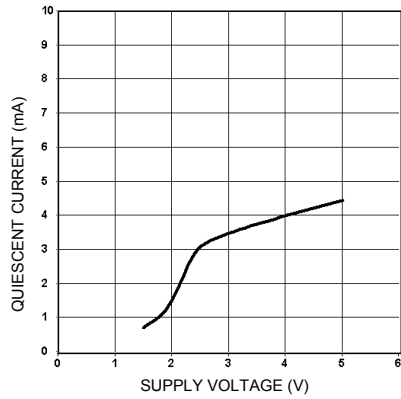
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Characteristics						
V _{CAP}	Voltage at CAP		1.3	1.35	1.4	V
V _{DC}	Output DC level		1.3	1.35	1.4	V
I _Q	Quiescent current		-	3.3	3.7	mA
I _{PD}	Power down current	No digital input signal	-	0.28	1	uA
PSRR	Power supply rejection ratio	CAP=2.2uF (100Hz)	50	55	-	dB
		CAP=10uF (100Hz)	61	66	-	dB
CS	Channel separation		70	75	-	dB
AC Characteristics						
V _{FS}	Full scale output voltage	V _{FS} =0.568 * V _{DD}	-	1.53	-	V _{pp}
THD+N	Total harmonic distortion plus noise		-	-59	-55	dB
			-	0.112	0.178	%
S/N	Signal-to-noise ratio		84	90	-	dB
P _o	Maximum output power	(THD+N)/S < 0.18%		18.3	-	mW

TYPICAL PERFORMANCE CHARACTERISTICS

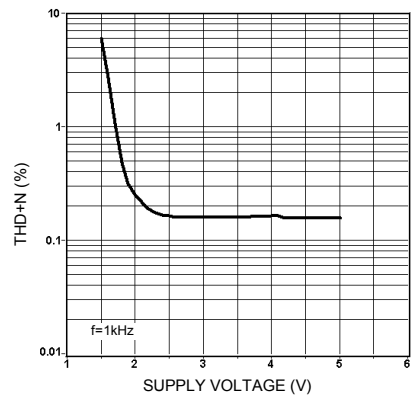
($T_a=25^\circ\text{C}$, $R_L=32\Omega$, sampling rate=4fs; unless otherwise specified)



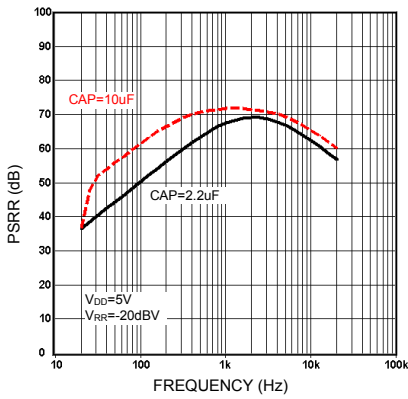
Power down current vs. supply voltage



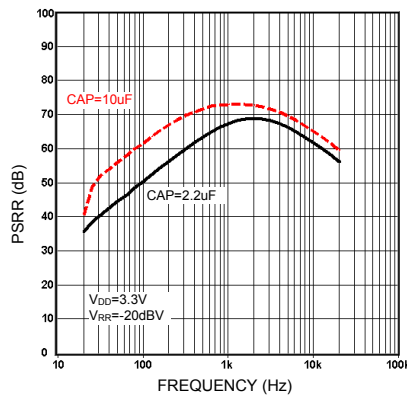
Quiescent current vs. supply voltage



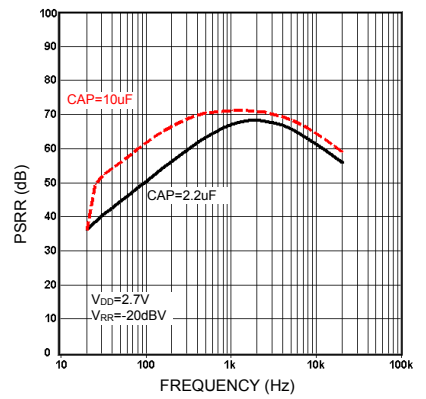
THD+N vs. supply voltage



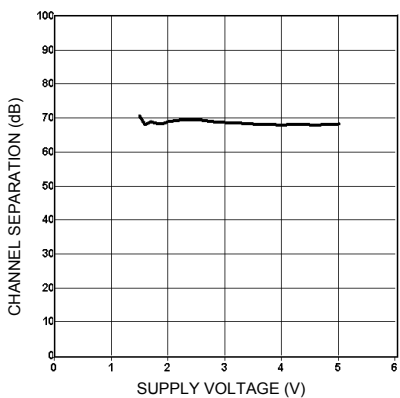
PSRR vs. frequency



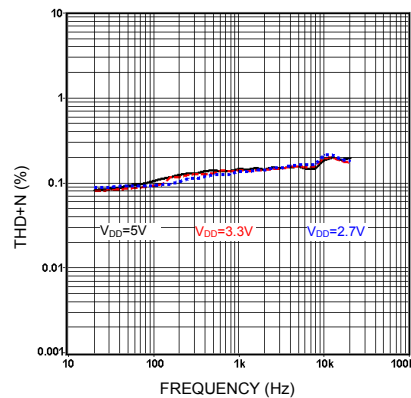
PSRR vs. frequency



PSRR vs. frequency



Channel separation vs. supply voltage



THD+N vs. frequency

TIMING AND DATA FORMAT

The MS6330 accepts input serial data formats of 16-bit word length. Left and right data words are time multiplexed. The MSB must always be first. The format of data input is shown in Figs. 1 and 2.

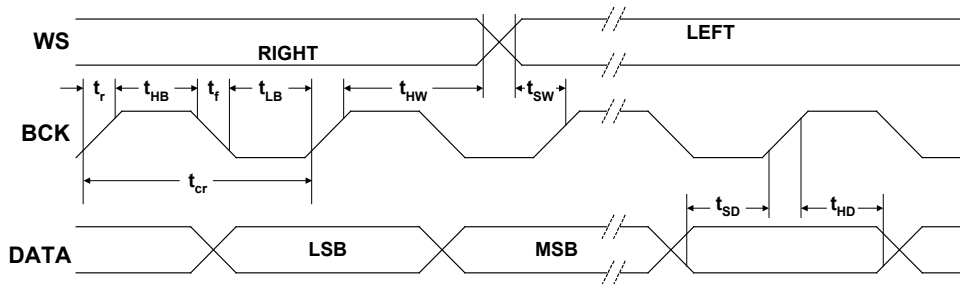


Fig.1 Timing and input signals.

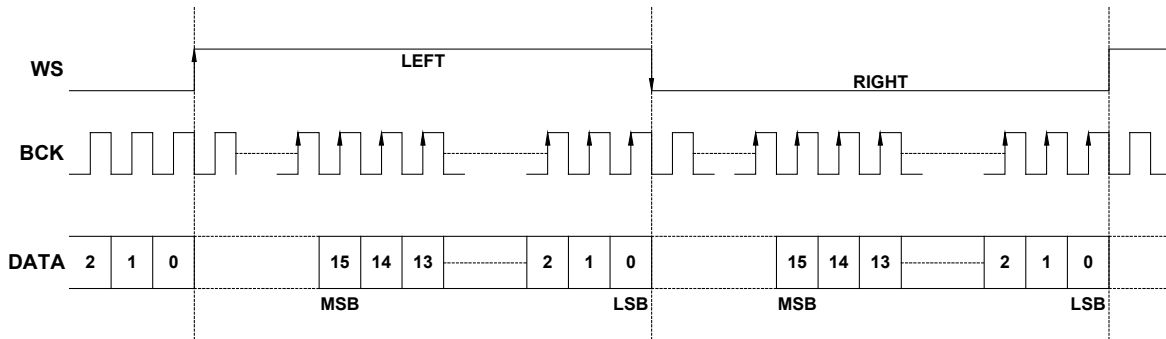


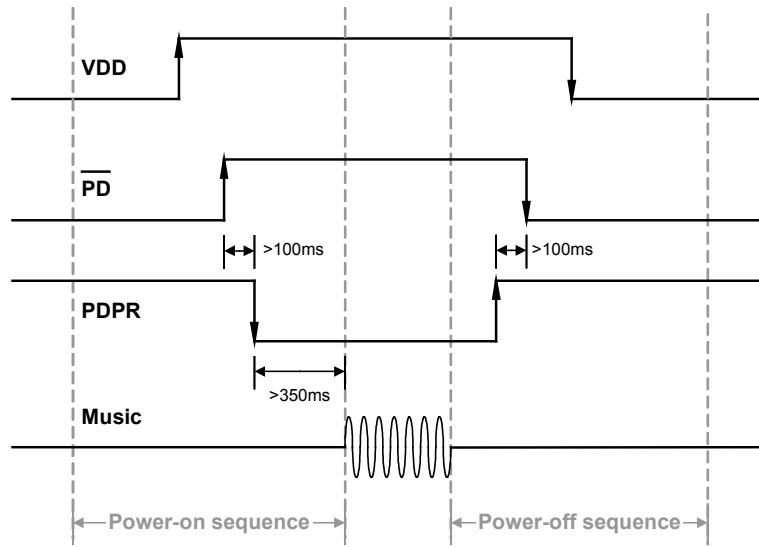
Fig.2 Format of input signals.

Data format (BCK, WS, DATA)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IL}	Input LOW level		-	-	0.8	V
V_{IH}	Input HIGH level		2	-	-	V
I_{IL}	Input Leakage Current LOW		-	-	10	μA
I_{IH}	Input Leakage Current HIGH		-	-	10	μA
f_{BCK}	Input Clock Frequency		-	-	18.4	MHz
BR	Bit Rate Data Input		-	-	18.4	Mbits/s
f_{WS}	Word Select Input		-	-	384	kHz
t_r	Rise Time		-	-	12	ns
t_f	Fall Time		-	-	12	ns
t_{Cr}	Bit Clock Cycle Time		54	-	-	ns
t_{HB}	Bit Clock High Time		15	-	-	ns
t_{LB}	Bit Clock Low Time		15	-	-	ns
t_{SD}	Data Set-up Time		12	-	-	ns
t_{HD}	Data Hold Time to Bit Clock		2	-	-	ns
t_{HW}	Word Select Hold Time		2	-	-	ns
t_{SW}	Word Select Set-up Time		12	-	-	ns

POP NOISE REDUCTION AS POWER-ON-OFF

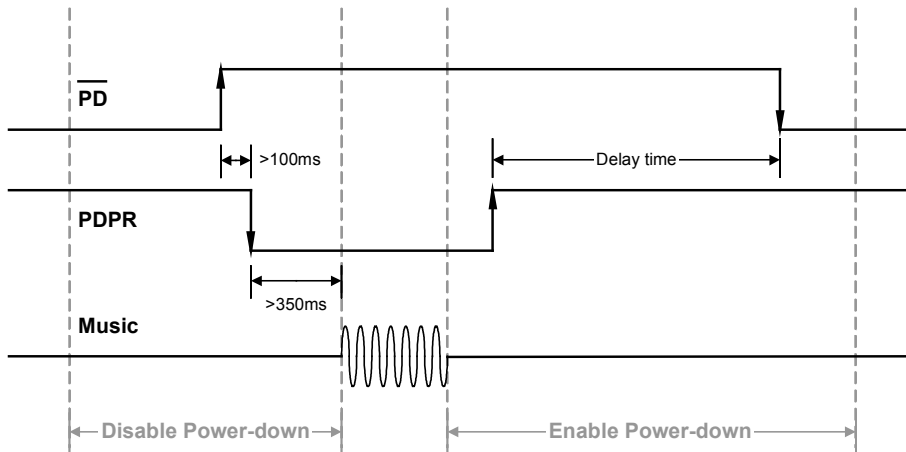
It is effective to prevent the power-on-off pop noise by controlling /PD and PDPR pins. The better control timing is as below. Please refer to the circuit diagram in the page 8.



In power-on sequence, the initial state of /PD is low and PDPR is high, and then PDPR sets low after the /PD sets high at least 100ms. In power-off sequence, enable PDPR function and delay 100ms, and then sets low to /PD.

POWER DOWN SEQUENCE

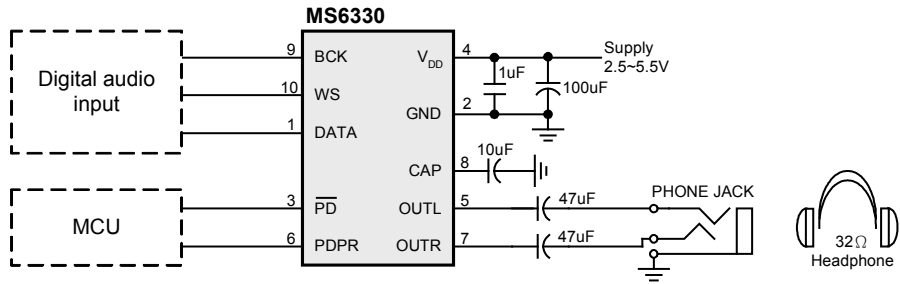
The power down sequence is a power-save mode (V_{DD} is on), the power down current of MS6330 is less than 1uA. The control timing is as below.



The delay time is decided by the value of the bypass capacitor. It is 5second for 10uF bypass capacitance.

APPLICATION INFORMATION

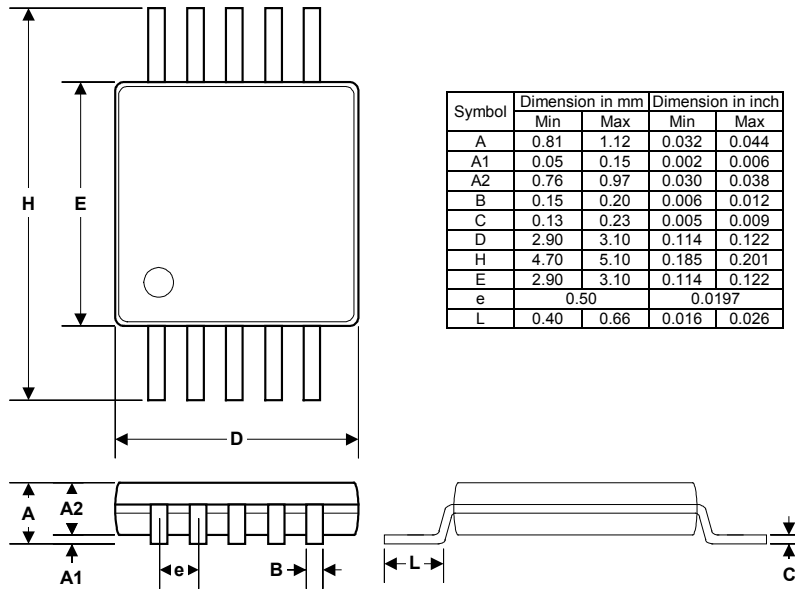
Basic application example



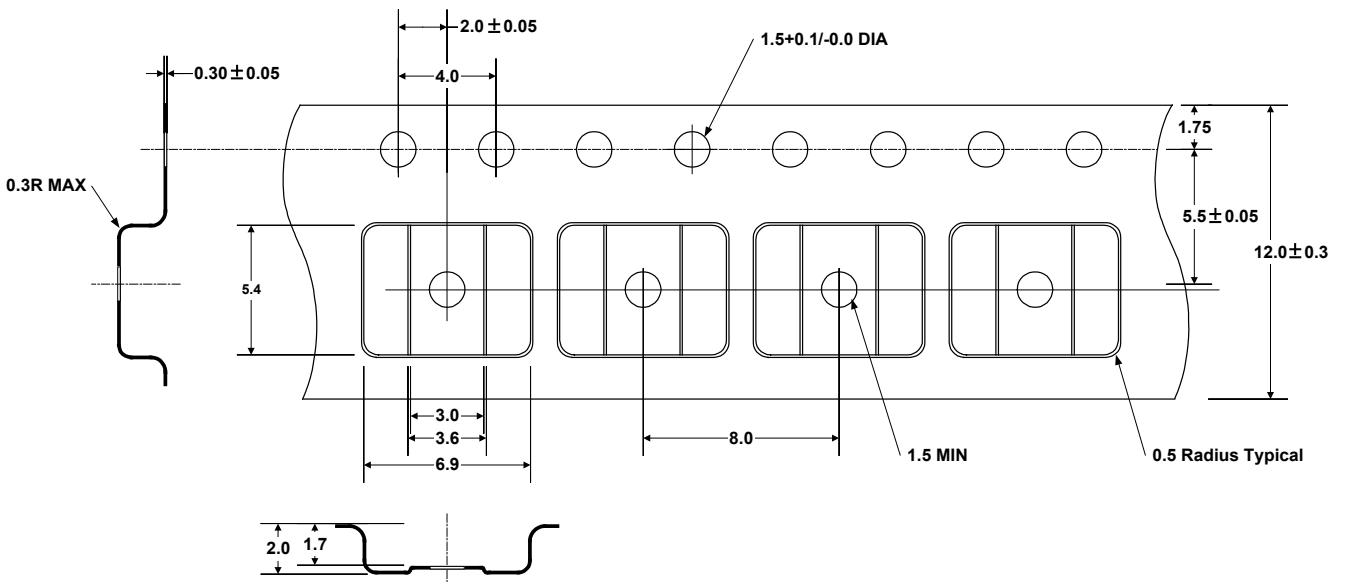
Note : $V_o=1.87V_{pp}$ at $V_{DD}=3.3V$

EXTERNAL DIMENSIONS

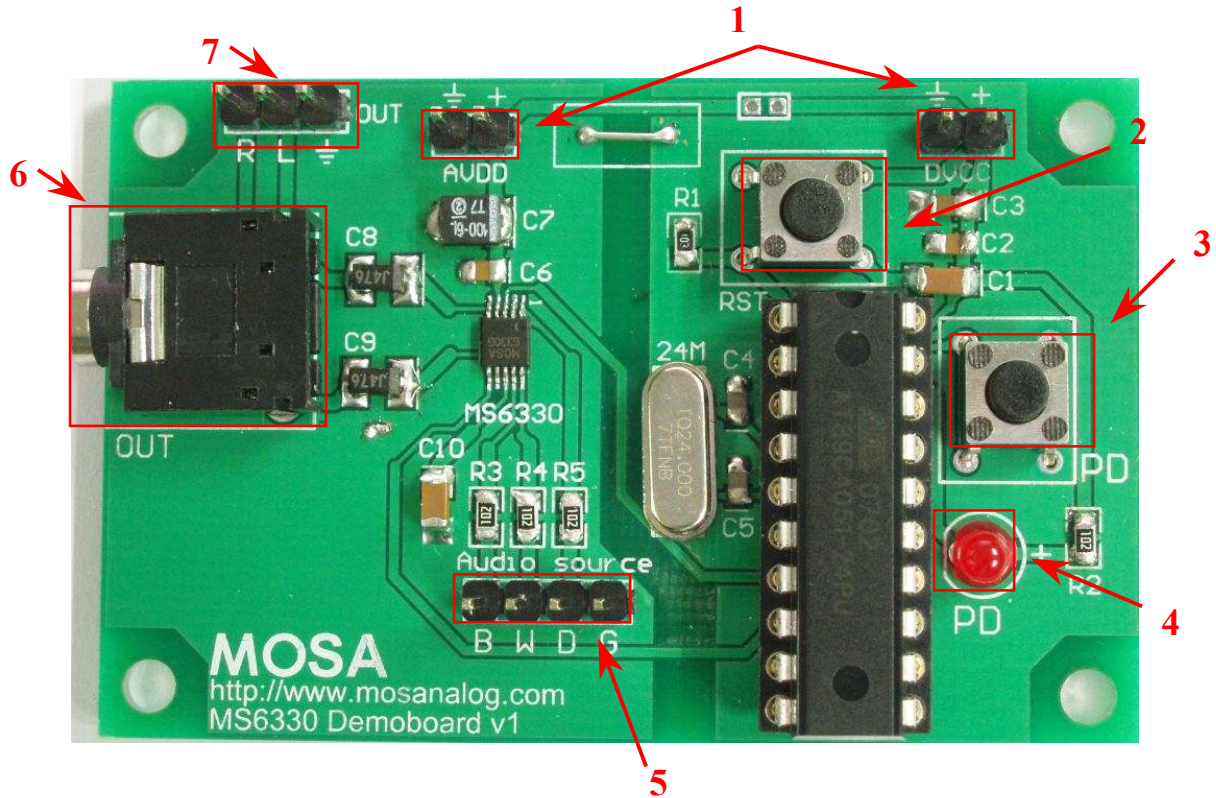
MSOP10 package



TAPE AND REEL (Unit : mm)



DEMO BOARD



Function description

Label 1: Supply Input

The AVDD and DVDD should be the same supply voltage, the supply range is 2.5~5.5 VDC.

Label 2: Reset MCU Switch

As pressed the button once, the system will be loaded default value. The MS6330 is power-down mode.

Label 3: Power-down Switch (shutdown MS6330)

As pressed the button once, the chip status will be switched to power-down mode or active mode (disable power-down mode). The default status is power down mode initially.

Label 4: Power-down LED (shutdown MS6330)

The MS6330 is power-down mode as the LED is brightness. On the other hand, darkness is active-mode.

Label 5: Digital Audio Input

Connected to digital audio signals and used right-justified format.

Label 6: Headphone Jack

Used 3.5mm diameter of headphone with 32ohm.

Circuit

