Low Cost 16-Bit Stereo Audio DAC

FEATURES

- Cost effective
- Low distortion
- No zero crossing distortion
- Output voltage swing is proportional to supply voltage (V_{OPP}=V_{DD}/2)
- Fast setting time permits 2*, 4*, and 8* oversampling (serial input) or double speed operation at 4* oversampling
- Audio Format：I2S(MS6309)
  Right Justified(MS6310)
- Space saving package SOP8, MSOP8,DFN8.

APPLICATIONS

- Multimedia system
- MP3, PDA, Portable Digital Audio.
- Set top box.

DESCRIPTION

The MS6309/10 is a voltage-output Digital-to-Analog Converter (DAC). The accuracy of the weight current sources, combined with the unique symmetrical decoding method, preclude zero-crossing distortion and ensures high quality audio reproduction. the initial registers of the DAC are 0000Hex, so the DAC output will be Vdd/2.

BLOCK DIAGRAM

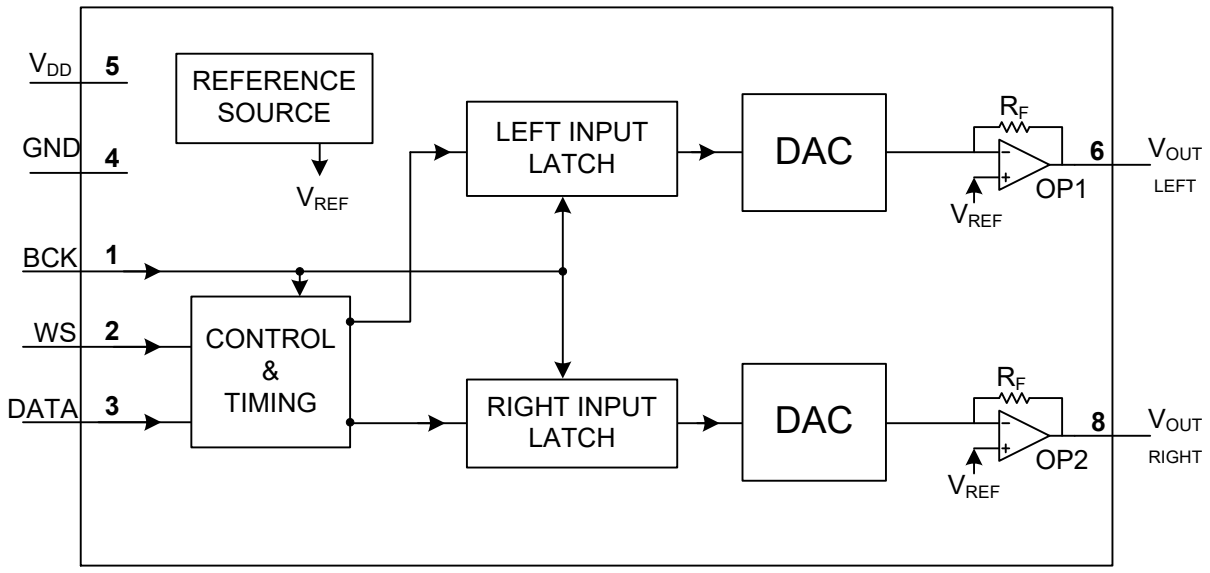
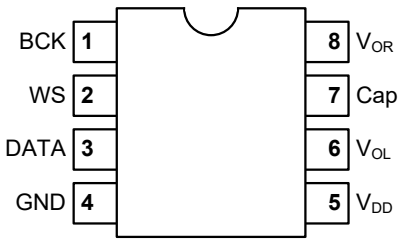


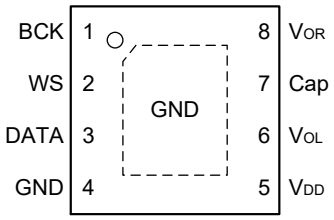
Fig.1 Block diagram.

PIN CONFIGURATION

Symbol	Pin	Description
BCK	1	Bit clock input
WS	2	Word select input
DATA	3	Data input
GND	4	Ground
V_{DD}	5	Positive supply voltage
V_{OL}	6	Left channel output
n.c.	7	not connected
V_{OR}	8	Right channel output



SOP8/MSOP8



DFN8

ORDERING INFORMATION

Package	Part number	Packaging Marking	Transport Media
8-Pin SOP (lead free)	MS6309GTR	MS6309G	2.5k Units Tape and Reel
8-Pin SOP (lead free)	MS6309GU	MS6309G	100 Units Tube
8-Pin MSOP (lead free)	MS6309MGTR	6309G	3.5k Units Tape and Reel
8-Pin MSOP (lead free)	MS6309MGU	6309G	80 Units Tube
8-Pin DFN (lead free)	MS6309DGTR	MS6309	5k Units Tape and Reel
8-Pin SOP (lead free)	MS6310GTR	MS6310G	2.5k Units Tape and Reel
8-Pin SOP (lead free)	MS6310GU	MS6310G	100 Units Tube
8-Pin MSOP (lead free)	MS6310MGTR	6310G	3.5k Units Tape and Reel
8-Pin MSOP (lead free)	MS6310MGU	6310G	80 Units Tube
8-Pin DFN (lead free)	MS6310DGTR	MS6310	5k Units Tape and Reel

RoHS Compliance

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
VDD	Positive Supply Voltage	6	V
V_{ESD}	Electrostatic Handling	-2000 to 2000	V
T_{STG}	Storage Temperature Range	-65 to 150	℃
T_A	Operating Ambient Temperature Range	-40 to 85	℃
T_J	Maximum Junction Temperature	150	℃
T_S	Soldering Temperature, 10 seconds	260	℃
R_{THJA}	Thermal Resistance from Junction to Ambient in Free Air SOP8 MSOP8 DFN8	 175 235 120	℃/W

OPERATING RATINGS

Symbol	Parameter	Min	Typ	Max	Unit
V_{DD}	Supply Voltage	2.5	-	6	V

6V ELECTRICAL CHARACTERISTICS

(Ta=25℃, V_{DD}=6V, f=1kHz ; unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Characteristics						
V_{DC}	Output DC level		2.9	3	3.1	V
V_{FS}	Full scale output voltage	V_{FS}=0.5V_{DD}	2.8	3	3.2	Vpp
I_Q	Quiescent current	At code 0000H	-	3	-	mA
CS	Channel separation		85	90	-	dB
AC Characteristics						
Res	Resolution		-	-	16	bits
THD+N	Total harmonic distortion plus noise		-	-60	-54	dB
			-	0.1	0.2	%
S/N	Signal-to-noise ratio		87	93	-	dB

5V ELECTRICAL CHARACTERISTICS

(Ta=25℃, V_{DD}=5V, f=1kHz ; unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Characteristics						
V_{DC}	Output DC level		2.4	2.5	2.6	V
V_{FS}	Full scale output voltage	V_{FS}=0.5V_{DD}	2.3	2.5	2.7	Vpp
I_Q	Quiescent current	At code 0000H	-	2.7	-	mA
CS	Channel separation		83	89	-	dB
AC Characteristics						
Res	Resolution		-	-	16	bits
THD+N	Total harmonic distortion plus noise		-	-60	-54	dB
			-	0.1	0.2	%
S/N	Signal-to-noise ratio		86	92	-	dB

3.3V ELECTRICAL CHARACTERISTICS

(Ta=25℃, V_{DD}=3.3V, f=1kHz ; unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Characteristics						
V_{DC}	Output DC level		1.6	1.65	1.7	V
V_{FS}	Full scale output voltage	V_{FS}=0.5V_{DD}	1.5	1.65	1.8	Vpp
I_Q	Quiescent current	At code 0000H	-	2.3	-	mA
CS	Channel separation		82	88	-	dB
AC Characteristics						
THD+N	Total harmonic distortion plus noise		-	-59	-53	dB
			-	0.112	0.223	%
S/N	Signal-to-noise ratio		86	92	-	dB

2.5V ELECTRICAL CHARACTERISTICS

(Ta=25℃, V_{DD}=2.5V, f=1kHz ; unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Characteristics						
V_{DC}	Output DC level		1.2	1.25	1.3	V
V_{FS}	Full scale output voltage	V_{FS}=0.5V_{DD}	1.2	1.25	1.5	Vpp
I_Q	Quiescent current	At code 0000H	-	2.0	-	mA
CS	Channel separation		80	87	-	dB
AC Characteristics						
THD+N	Total harmonic distortion plus noise		-	-58	-52	dB
			-	0.125	0.25	%
S/N	Signal-to-noise ratio		83	89	-	dB

TIMING AND DATA FORMAT

The MS6309/10 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. 2 and 3. With a HIGH level on the word select input (WS), data is placed in the left input register and with LOW level on the WS input, data is placed in the right register (Fig. 1). The data in the input registers are simultaneously latched in the output registers which control the bit switches.

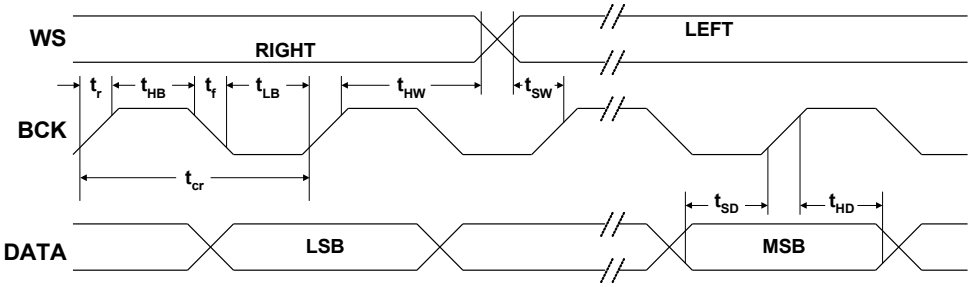


Fig.2 Timing and input signals.

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
$\lvert I_{IL} \rvert$	Input Leakage Current LOW		-	-	10	μA
$\lvert I_{IH} \rvert$	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

I2S format

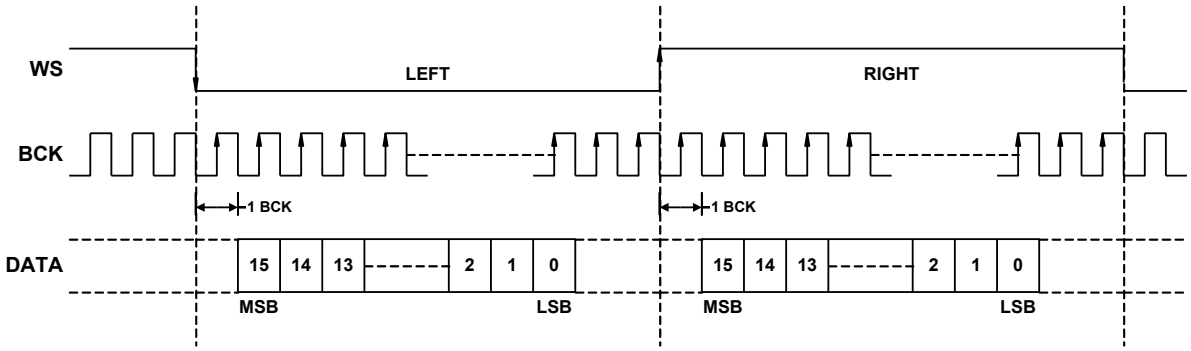


Fig.3 I2S format(MS6309)

Right justified format

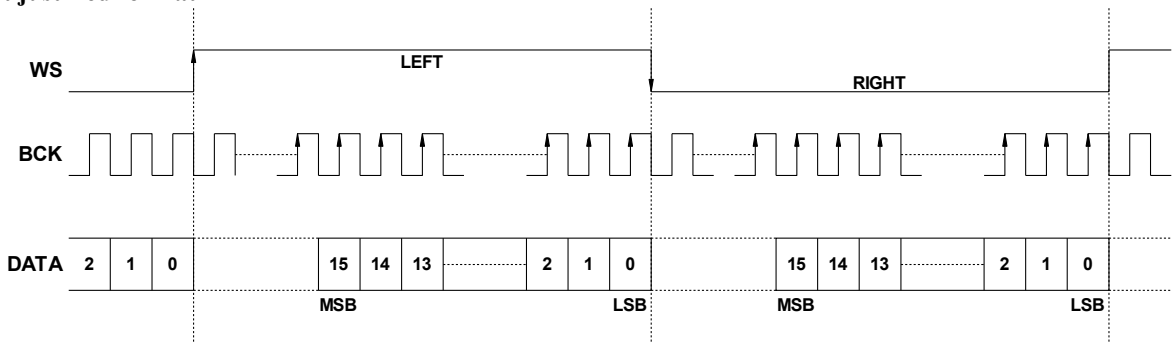


Fig.4 Right justified format(MS6310)

APPLICATION INFORMATION

Basic application example

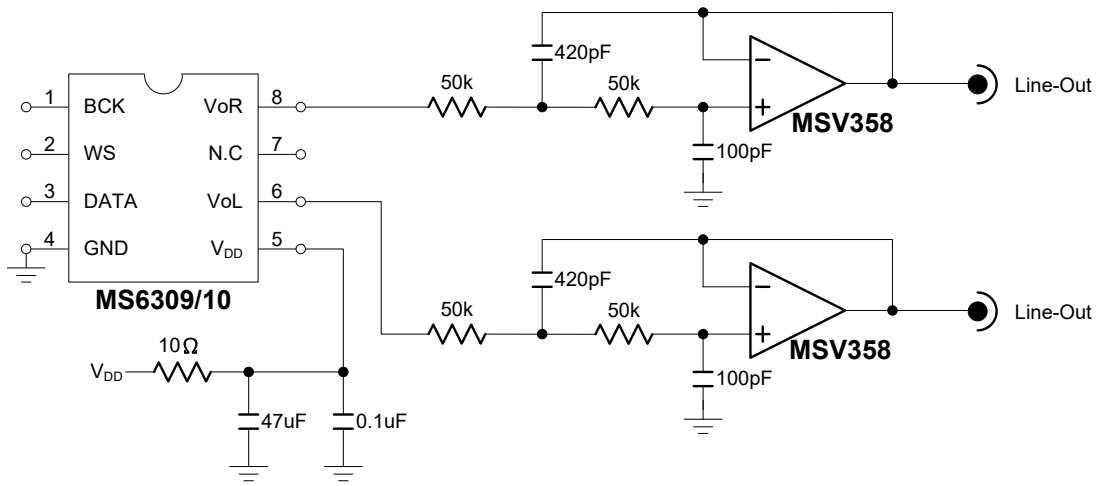
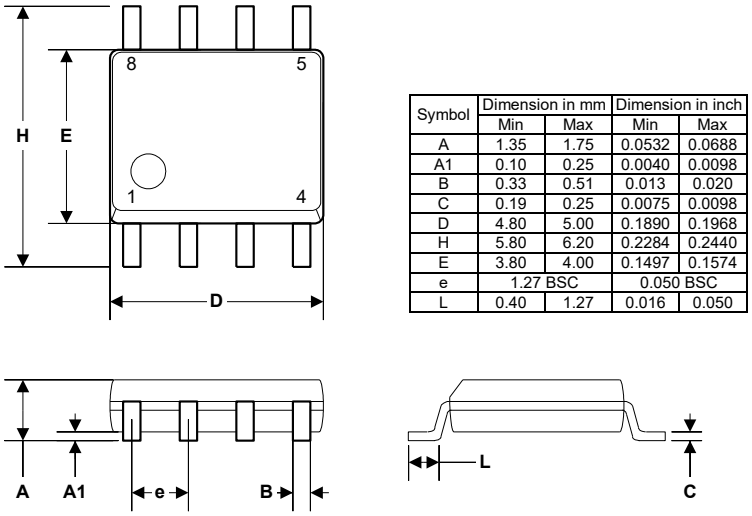


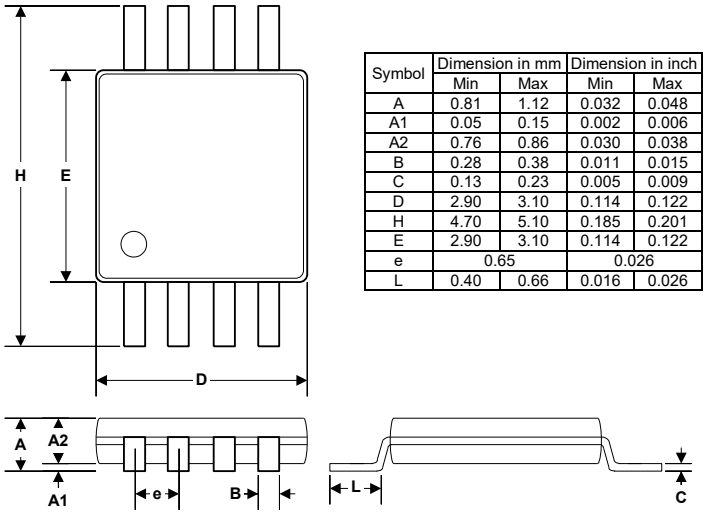
Fig.4 Example of a 2nd order filter application.

EXTERNAL DIMENSIONS



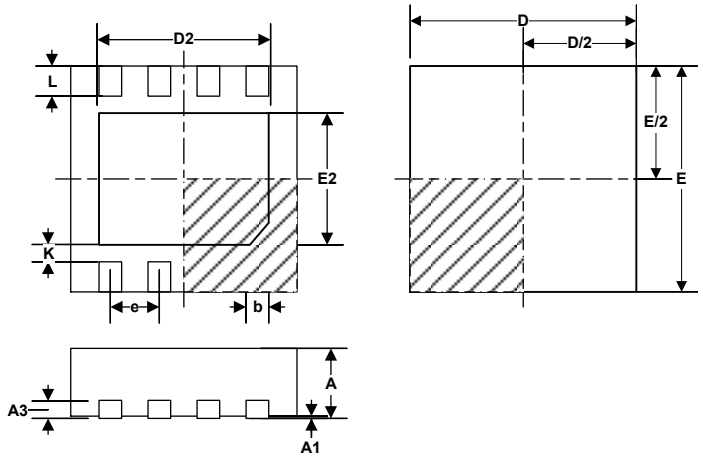
Symbol	Dimension in mm		Dimension in inch	
	Min	Max	Min	Max
A	1.35	1.75	0.0532	0.0688
A1	0.10	0.25	0.0040	0.0098
B	0.33	0.51	0.013	0.020
C	0.19	0.25	0.0075	0.0098
D	4.80	5.00	0.1890	0.1968
H	5.80	6.20	0.2284	0.2440
E	3.80	4.00	0.1497	0.1574
e	1.27 BSC		0.050 BSC	
L	0.40	1.27	0.016	0.050

SOP8



Symbol	Dimension in mm		Dimension in inch	
	Min	Max	Min	Max
A	0.81	1.12	0.032	0.048
A1	0.05	0.15	0.002	0.006
A2	0.76	0.86	0.030	0.038
B	0.28	0.38	0.011	0.015
C	0.13	0.23	0.005	0.009
D	2.90	3.10	0.114	0.122
H	4.70	5.10	0.185	0.201
E	2.90	3.10	0.114	0.122
e	0.65		0.026	
L	0.40	0.66	0.016	0.026

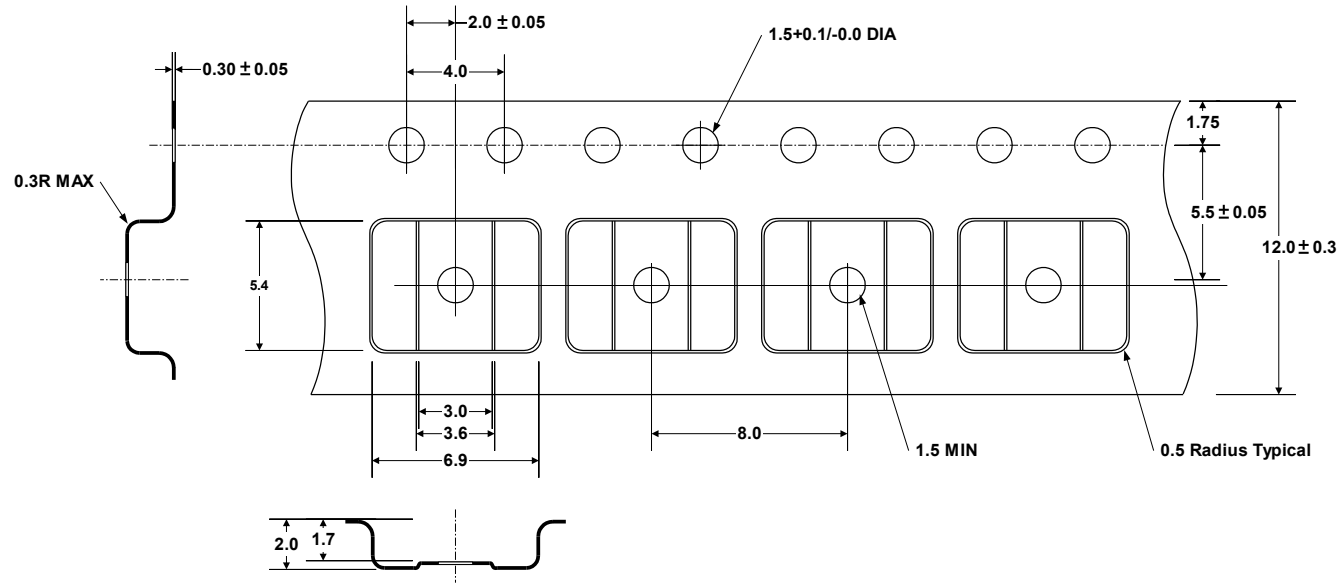
MSOP8



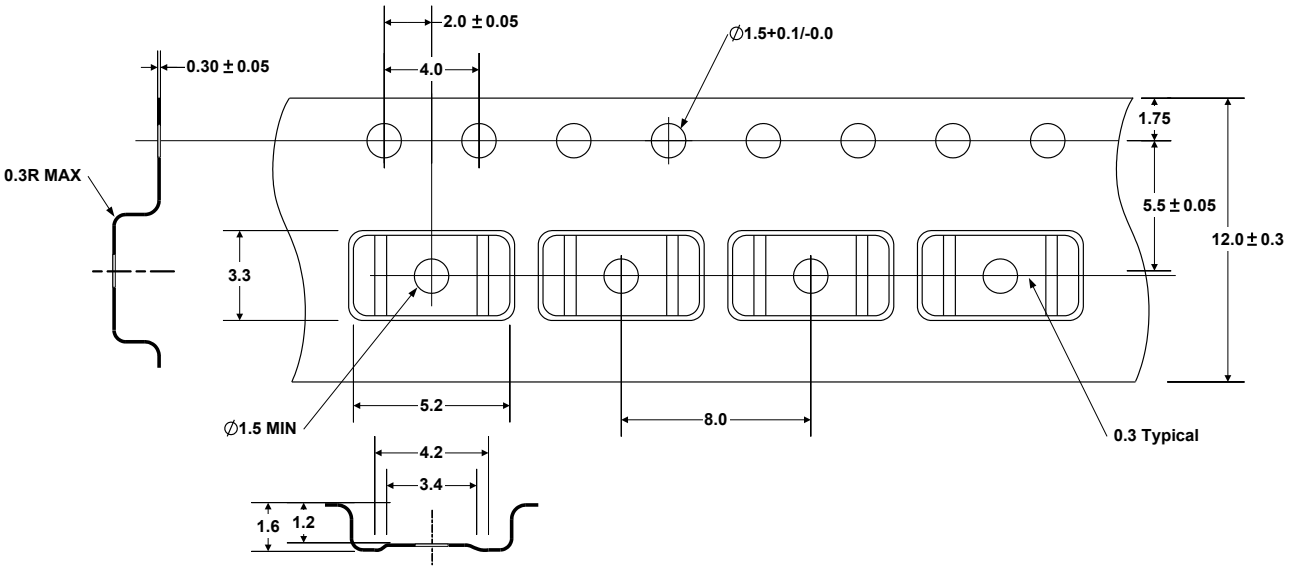
Symbol	Dimension in mm		
	Min	Nom	Max
A	0.80	0.90	1.00
A1	0	0.02	0.05
A3	0.20 REF.		
D	3.00 BASIC		
D2	1.60		2.50
E	3.00 BASIC		
E2	1.35		1.75
e	0.65 BASIC		
b	0.25	0.30	0.35
L	0.30	0.40	0.50
K	0.20		
JEDEC	MO-229(Variation V3030C-2)		

DFN8

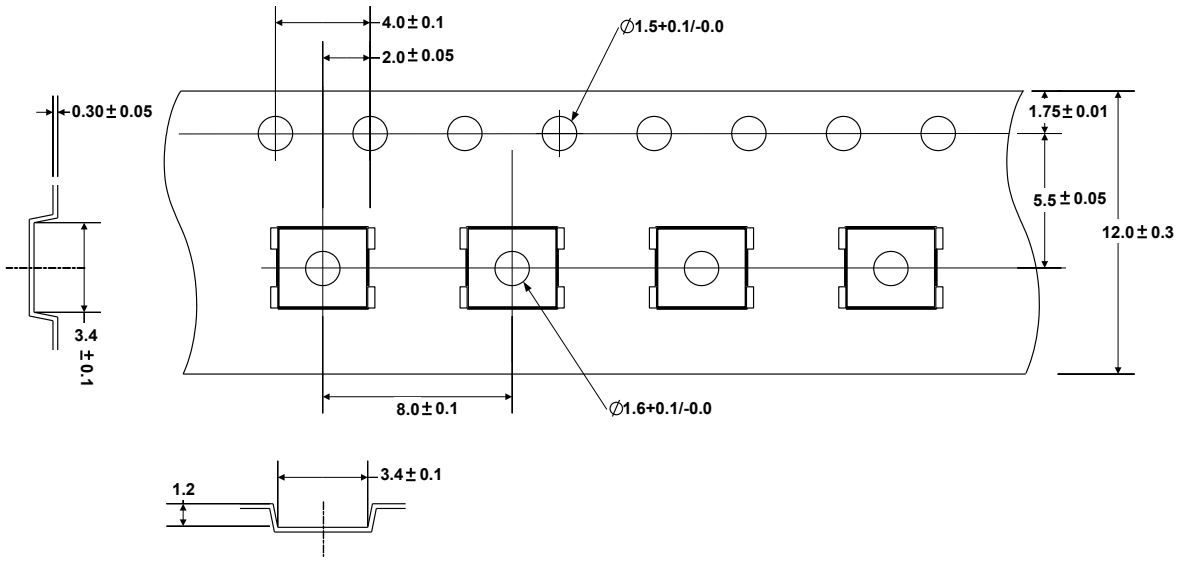
TAPE AND REEL (Unit : mm)



SOP8



MSOP8


4.0±0.1
2.0±0.05
∅1.5+0.1/-0.0
0.30±0.05
1.75±0.01
5.5±0.05
12.0±0.3
3.4±0.1
8.0±0.1
∅1.6+0.1/-0.0
1.2
3.4±0.1

DFN8 (3x3mm)