Lyontek Inc.

Rev. 1.4

LY8892

2.0Watt Audio Power Amplifier

FEATURES

- 2.5V~5.5V Power supply.
- Thermal shutdown Protection.
- Low current shutdown mode
- No output capacitors and networks or bootstrap capacitors required
- Low noise during turn-on and turn-off transitions
- User selectable shutdown logic level. (High or Low) (MSOP10 & DFN10 only)
- Lead free and green package available. (RoHS Compliant)
- Space Saving Package
  - -- 8-pin MSOP package.
  - -- 8-pin DFN Package
  - -- 10-pin MSOP package.
  - -- 10-pin DFN Package

APPLICATION

- Portable electronic devices
- Mobile Phones
- PDAs

GENERAL DESCRIPTION

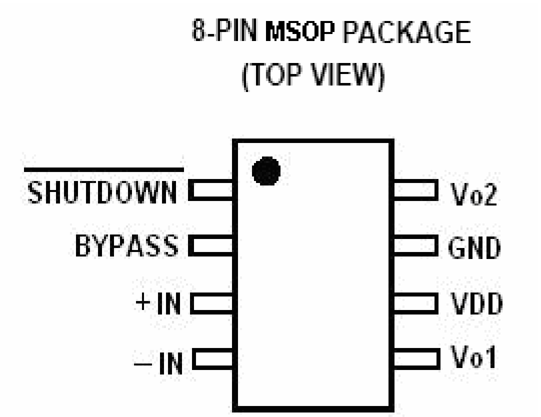
The LY8892 is a 2.0W audio power amplifier. It is capable of driving 4Ω speaker load at a continuous average output of 2.0W with less than 10% distortion (THD+N) from a 5.5V power supply and 8Ω speaker load at a continuous average output of 1.5W with less than 10% distortion (THD+N) from a 5.5V power supply.

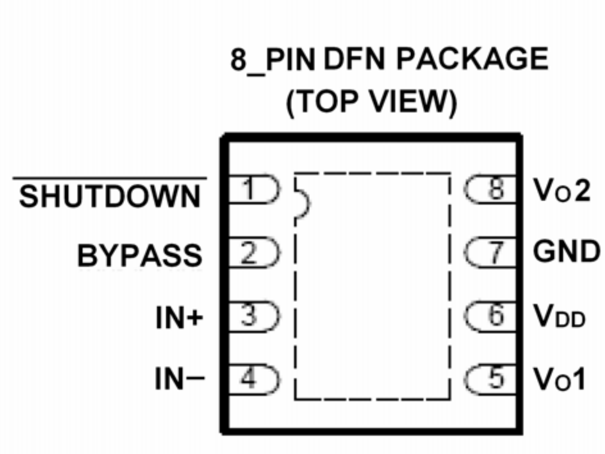
The LY8892 primarily designed for high quality application in other portable communication device. And the LY8892 audio amplifier features low power consumption shutdown mode. To facilitate this, The shutdown function may be enabled by either logic high or low depending on mode selection. Driving the shutdown mode pin either high or low enables the shutdown pin to be driven in a likewise manner to enable shutdown.

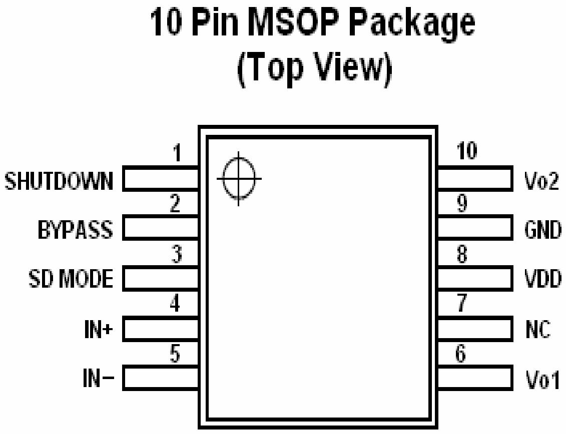
And the LY8892 has an internal thermal shutdown protection feature.

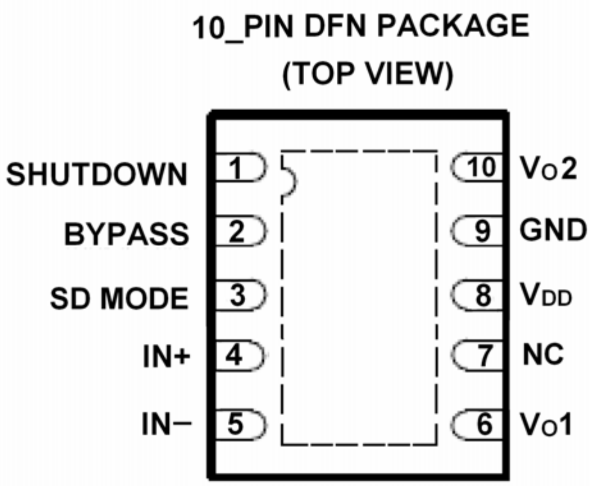
The LY8892 audio amplifier was designed specifically to provide high quality output power with a minimal amount of external components. The LY8892 does not require output capacitors, and the LY8892 is ideally suited for other low voltage applications or portable electronic devices where minimal power consumption is a primary requirement.

PIN CONFIGURATION









PIN DESCRIPTION

SYMBOL	Pin No.				DESCRIPTION
	MSOP8	DFN8	MSOP10	DFN10	
SHUTDOWN	1	1	1	1	Shutdown the device
BYPASS	2	2	2	2	Bypass pin
SD MODE	--	--	3	3	Shutdown Mode Selectable
+IN	3	3	4	4	Positive Input
-IN	4	4	5	5	Negative Input
Vo1	5	5	6	6	Negative output
NC	--	--	7	7	No Connection
V_{DD}	6	6	8	8	Power Supply
GND	7	7	9	9	Ground
Vo2	8	8	10	10	Positive Output

APPLICATION CIRCUIT

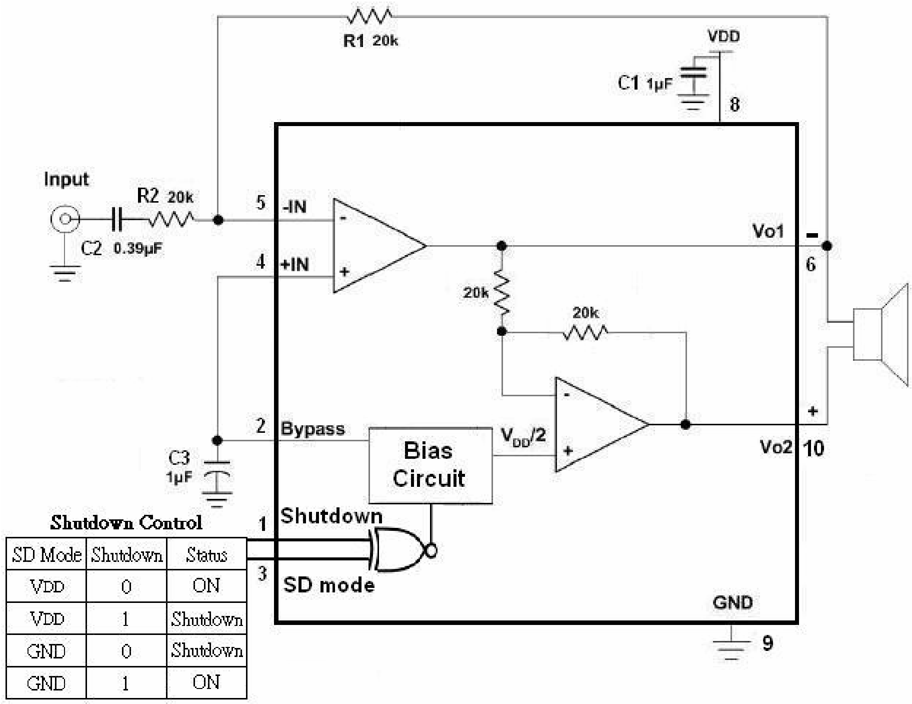


Figure 1. **Application Schematic with Single –Ended Input (DFN10 and MSOP10 package)**

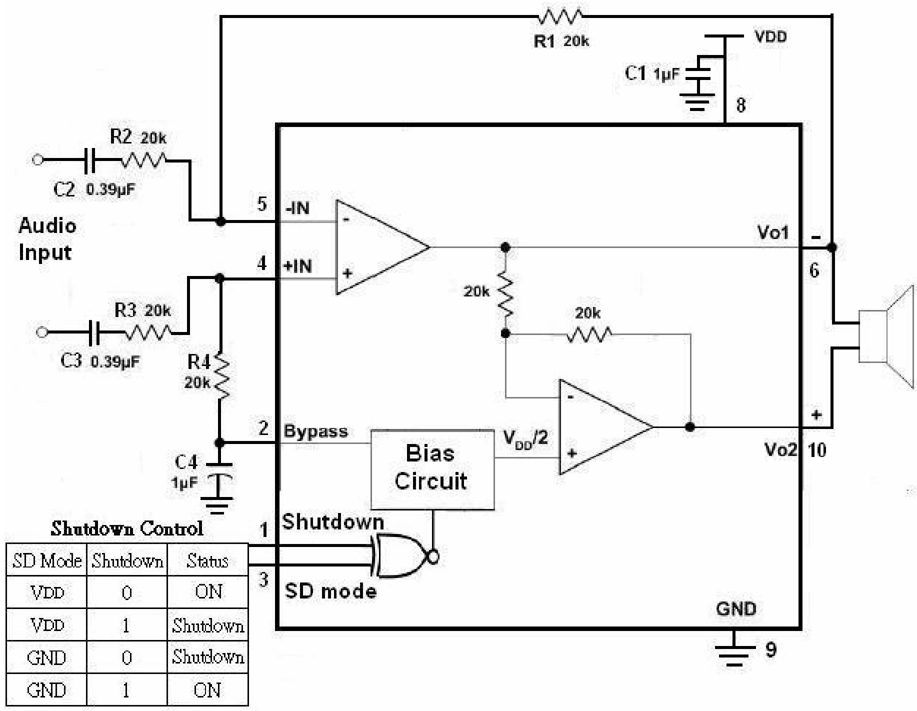


Figure 2. **Application Schematic with Differential Input (DFN10 and MSOP10 package)**

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ABSOLUTE MAXIMUN RATINGS*

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	6.0	V
Operating Temperature	T_A	-40 to 85 (I grade)	℃
Input Voltage	V_I	-0.3V to V_{DD} +0.3V	V
Storage Temperature	T_{STG}	-65 to 150	℃
Power Dissipation	P_D	Internally Limited	W
ESD Susceptibility	V_{ESD}	2000	V
Junction Temperature	T_{JMAX}	150	℃
Soldering Temperature (under 10 sec)	T_{SOLDER}	260	℃

DC ELECTRICAL CHARACTERISTICS (V_{DD}=5V, T_A=25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Current	I_{DD}	V_{IN} = 0V, I_O = 0A, 8Ω Load	-	5.0	15.0	mA
Shutdown Current	I_{SD}	$V_{SHUTDOWN}$ = $V_{SD\ Mode}$	-	0.1	2.0	μA
Shutdown Voltage Input High	V_{SDIH}	$V_{SD\ Mode}$ = V_{DD}	-	1.5	-	V
Shutdown Voltage Input Low	V_{SDIL}	$V_{SD\ Mode}$ = V_{DD}	-	1.3	-	
Shutdown Voltage Input High	V_{SDIH}	$V_{SD\ Mode}$ = GND	-	1.5	-	
Shutdown Voltage Input Low	V_{SDIL}	$V_{SD\ Mode}$ = GND	-	1.3	-	
Output Offset Voltage	V_{OS}		-	7.0	50.0	mV
Resistor Output to GND	$R_{OUT-GND}$		7.0	8.5	9.7	kΩ
Output Power	Po	**THD = 1%** , f = 1 kHz **R_L=8Ω**	-	1.0	-	W
		THD = 10% , f = 1 kHz **R_L=8Ω**	-	1.4	-	
		THD = 1% , f = 1 kHz **R_L=4Ω**	-	1.4	-	
		THD = 10% , f = 1 kHz **R_L=4Ω**	-	1.8	-	
		THD = 10% , f = 1 kHz **R_L=4Ω (at 5.5V)**	-	2.0	-	
Total Harmonic Distortion+ Noise	THD+N	Po = 0.4 Wrms; f = 1kHz	-	0.13		%
Power Supply Rejection Ratio	PSRR	Vripple = 200mV sine p-p Input terminated with 10Ω to GND	-	62 (f = 217Hz) 66 (f = 1kHz)	-	dB
Wake-up time	T_{WU}	Bypass Cap.=1.0uF, 5.0V	-	145		ms
Thermal Shutdown Temperature	T_{SD}		150	170	190	℃
Shut Down Time	T_{SDT}	8 Ω load		1.0		ms

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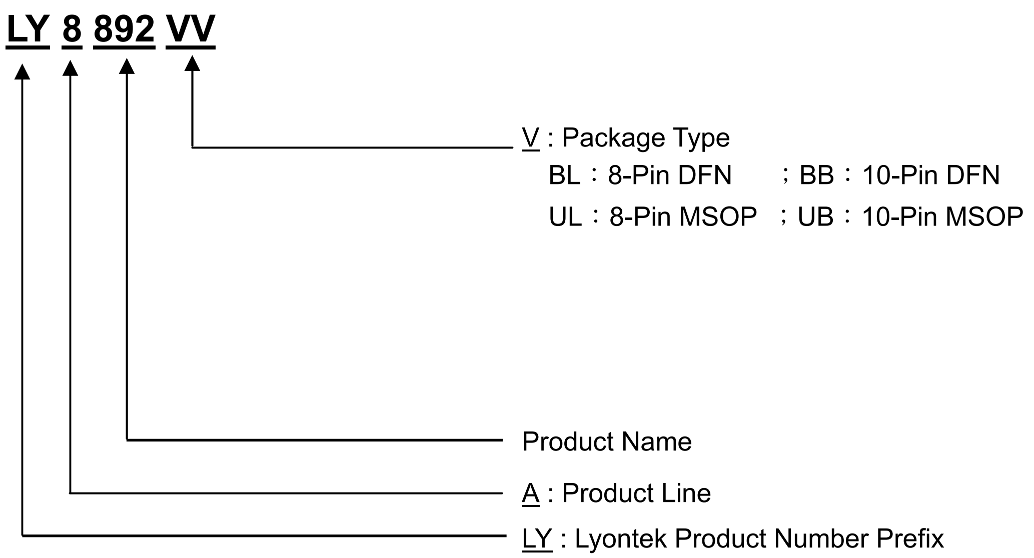
DC ELECTRICAL CHARACTERISTICS (V_{DD}=3V, T_A=25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Current	I_{DD}	V_{IN} = 0V, I_O = 0A, 8Ω Load	-	4.5	14.0	mA
Shutdown Current	I_{SD}	$V_{SHUTDOWN}$ = = $V_{SD\ Mode}$	-	0.1	2.0	μA
Shutdown Voltage Input High	V_{SDIH}	$V_{SD\ Mode}$ = V_{DD}	-	1.2	-	V
Shutdown Voltage Input Low	V_{SDIL}	$V_{SD\ Mode}$ = V_{DD}	-	1.0	-	
Shutdown Voltage Input High	V_{SDIH}	$V_{SD\ Mode}$ = GND	-	1.2	-	
Shutdown Voltage Input Low	V_{SDIL}	$V_{SD\ Mode}$ = GND	-	1.0	-	
Output Offset Voltage	V_{OS}		-	7.0	50.0	mV
Resistor Output to GND	$R_{OUT\text{-}GND}$		7.0	8.5	9.7	kΩ
Output Power	Po	THD = 1% , f = 1 kHz R_L=8Ω	-	375	-	mW
		THD = 10% , f = 1 kHz R_L=8Ω	-	460	-	
		THD = 1% , f = 1 kHz R_L=4Ω	-	460	-	
		THD = 10% , f = 1 kHz R_L=4Ω	-	600	-	
Total Harmonic Distortion+ Noise	THD+N	Po = 0.25 W_{rms} , f = 1kHz	-	0.13	-	%
Power Supply Rejection Ratio	PSRR	V_{ripple} = 200mV sine p-p Input terminated with 10Ω to GND	-	56 (f = 217Hz) 62 (f = 1kHz)	-	dB
Wake-up time	T_{WU}		-	82		ms
Thermal Shutdown Temperature	T_{SD}		150	170	190	℃

ORDERING INFORMATION



APPLICATION INFORMATION

BRIDGED CONFIGURATION EXPLANATION

As shown in Figure 1, the LY8892 has two operational amplifiers internally, allowing for a few different amplifier configurations. The first amplifier's gain is externally configurable, while the second amplifier is internally fixed in a unity-gain, inverting configuration. The closed-loop gain of the first amplifier is set by selecting the ratio of Rf to RIN while the second amplifier's gain is fixed by the two internal 20kΩ resistors. *Figure 1* shows that the output of amplifier one serves as the input to amplifier two which results in both amplifiers producing signals identical in magnitude, but out of phase by 180°. Consequently, the differential gain for the IC is

$$AVD = 2 \times (R_f / R_{IN})$$

By driving the load differentially through outputs Vo1 and Vo2, an amplifier configuration commonly referred to as "bridged mode" is established. Bridged mode operation is different from the classical single-ended amplifier configuration where one side of the load is connected to ground.

A bridge amplifier design has a few distinct advantages over the single-ended configuration, as it provides differential drive to the load, thus doubling output swing for a specified supply voltage. Four times the output power is possible as compared to a single-ended amplifier under the same conditions.

This increase in attainable output power assumes that the amplifier is not current limited or clipped. In order to choose an amplifier's closed-loop gain without causing excessive clipping, please refer to the Audio Power Amplifier Design section.

A bridge configuration, such as the one used in the LY8892, also creates a second advantage over single -ended amplifiers. Since the differential outputs, Vo1 and Vo2, are biased at half-supply, no net DC voltage exists across the load. This eliminates the need for an output coupling capacitor which is required in a single supply, single-ended amplifier configuration. Without an output coupling capacitor, the half-supply bias across the load would result in both increased internal IC power dissipation and also possible loudspeaker damage.

Power Dissipation

Power dissipation is a major concern when designing a successful amplifier, whether the amplifier is bridged or single-ended. A direct consequence of the increased power delivered to the load by a bridge amplifier is an increase in internal power dissipation. Since the LY8892 has two operational amplifiers in one package, the maximum internal power dissipation is 4 times that of a single-ended amplifier. The maximum power dissipation for a given application can be derived from the power dissipation graphs of from equation 1.

$$P_{DMAX} = 4 \times (V_{DD})^2 / (2 \pi^2 R_L) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

It is critical that the maximum junction temperature TJMAX of 150°C is not exceeded. TJMAX can be determine from the power derating curves by using P_{DMAX} and the PC board foil area. By adding additional copper foil, the thermal resistance of the application can be reduced, resulting in higher P_{DMAX}. Additional copper foil can be added to any of the leads connected to the LY8892.If TJMAX still exceeds 150°C, then additional changes must be made. These changes can include reduced supply voltage, higher load impedance, or reduced ambient temperature. Internal power dissipation is a function of output power.

POWER SUPPLY BYPASSING

As with any amplifier, proper supply bypassing is critical for low noise performance and high power supply rejection. The capacitor location on both the bypass and power supply pins should be as close to the device as possible.

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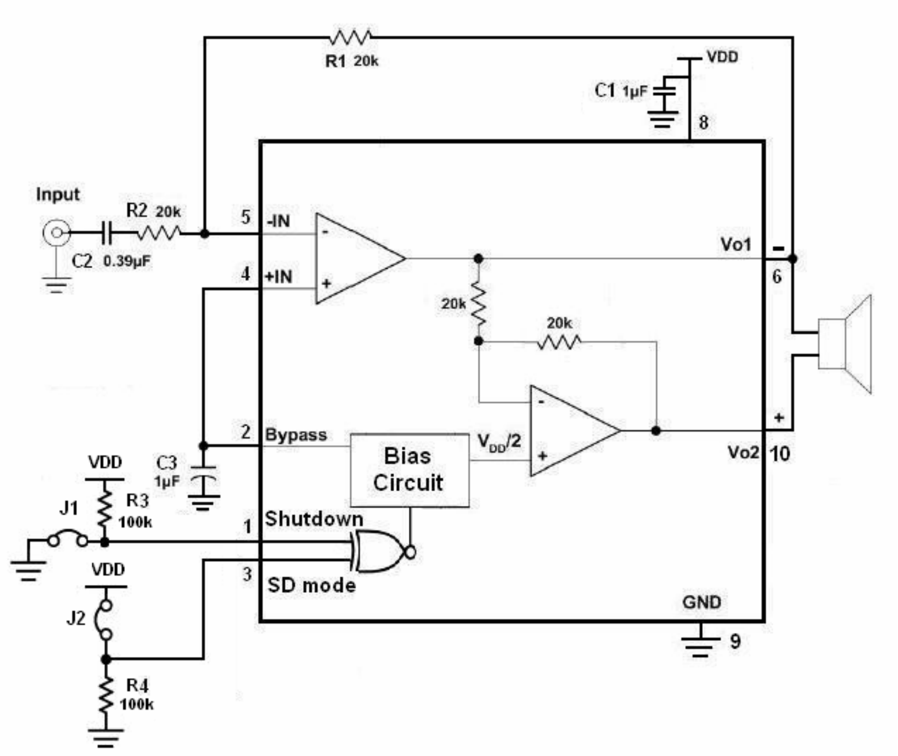


Figure 3. Audio Amplifier with Single –Ended Input Application Schematic (DFN10 & MSOP10 package)

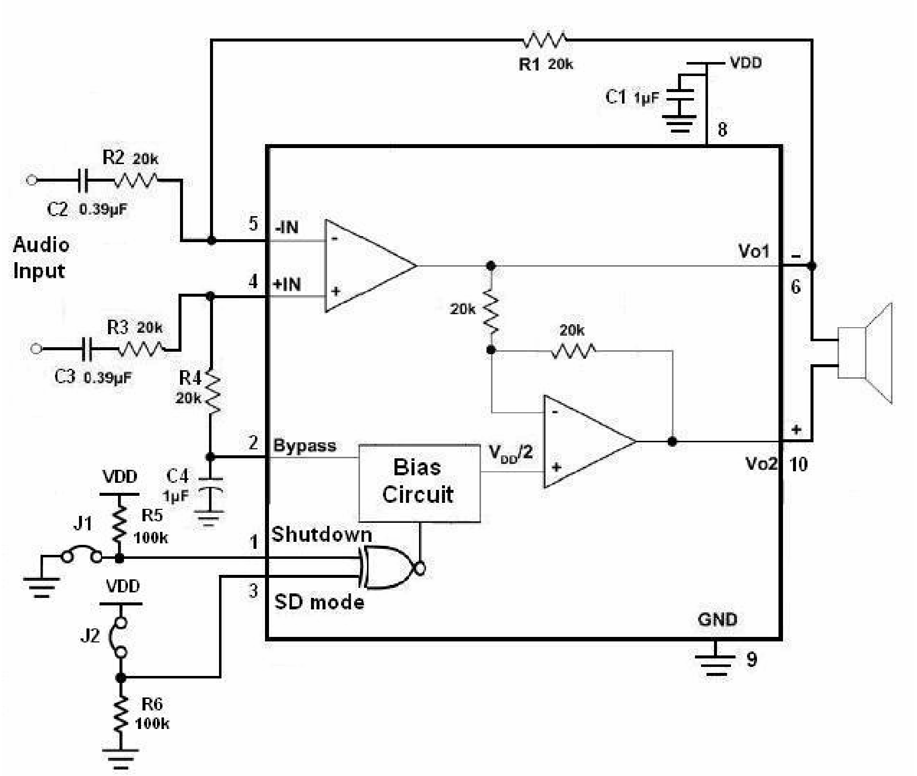
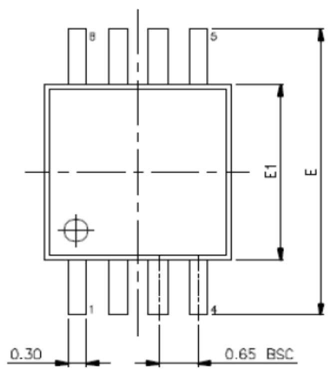
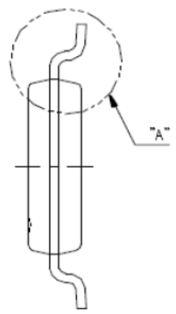


Figure 4. Audio Amplifier with Differential Input Application Schematic (DFN10 & MSOP10 package)

PACKAGE OUTLINE DIMENSION

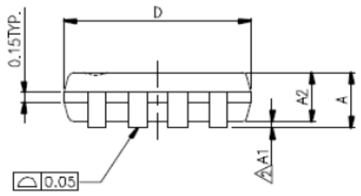
8 Pin MSOP Package Outline Dimension

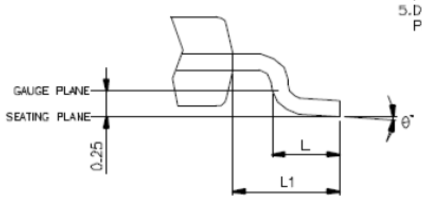




SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.10
A1	0.00	–	0.15
A2	0.75	0.85	0.95
D	3.00 BSC		
E	4.90 BSC		
E1	3.00 BSC		
L	0.40	0.60	0.80
L1	0.95 REF		
θ°	0	–	8

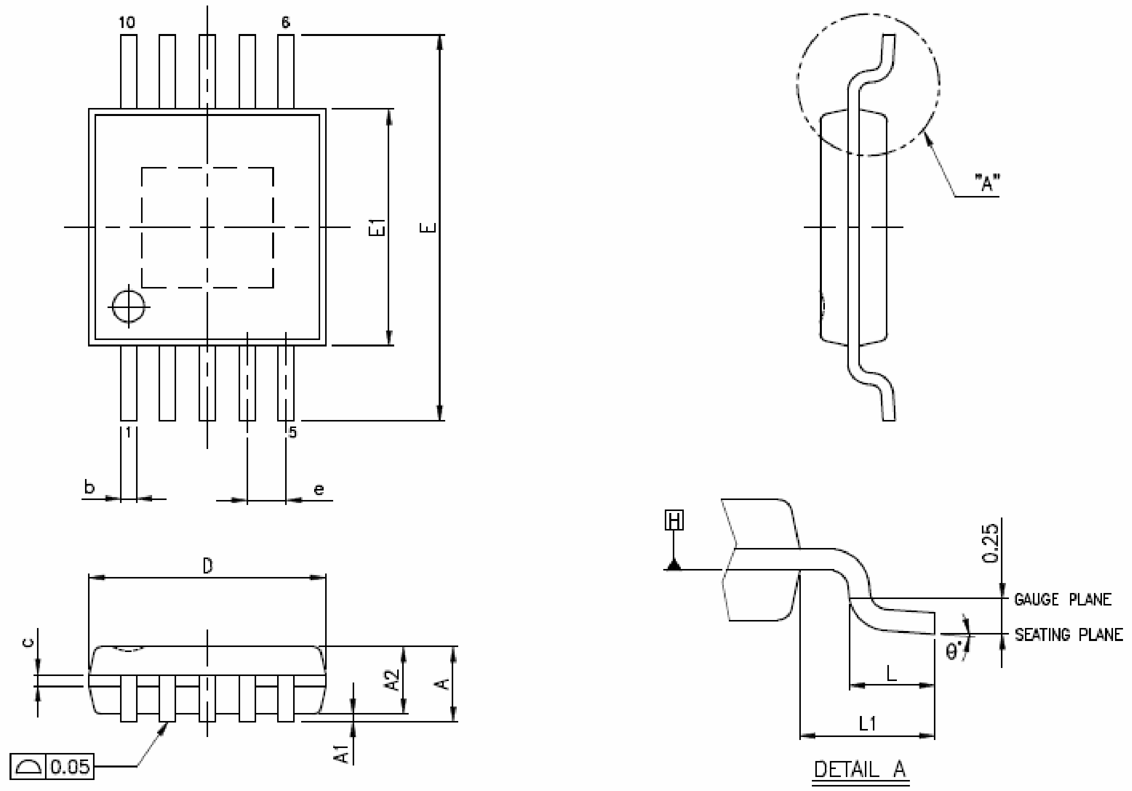
UNIT : MM





NOTES:
1.JEDEC OUTLINE : MO-187 AA
2.DIMENSION 'D' DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.
3.DIMENSION 'E1' DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 PER SIDE.
4.DIMENSION '0.22' DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 MM TOTAL IN EXCESS OF THE '0.22' DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT. MINIMUM SPAC BETWEEN PROTRUSION AND ADJACENT LEAD IS 0.07 MM.
5.DIMENSIONS 'D' AND 'E1' TO BE DETERMINED AT DATUM PLANE H .

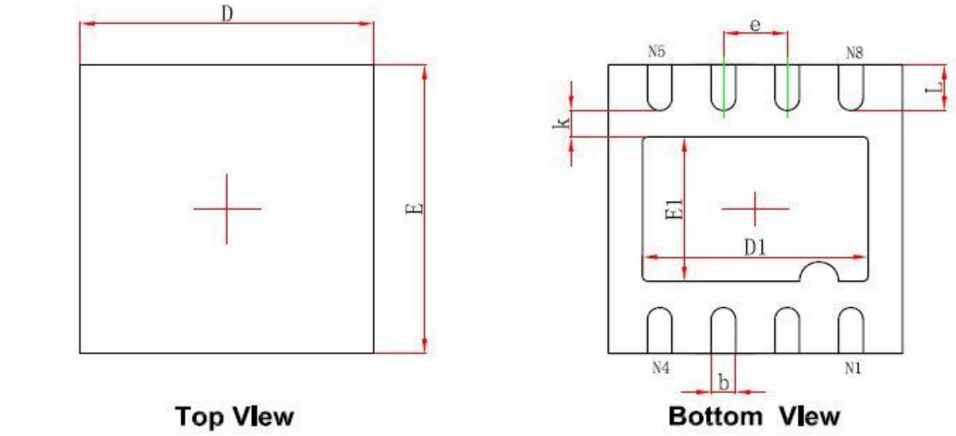
10-Pin MSOP Package Outline Dimension

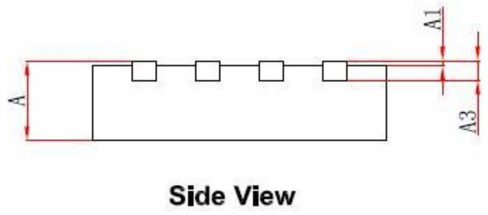


SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.10
A1	0.00	–	0.15
A2	0.75	0.85	0.95
b	0.17	–	0.27
c	0.08	–	0.23
D		3.00 BSC	
E		4.90 BSC	
E1		3.00 BSC	
e		0.50 BSC	
L	0.40	0.60	0.80
L1		0.95 REF	
θ°	0	–	8

UNIT : MM

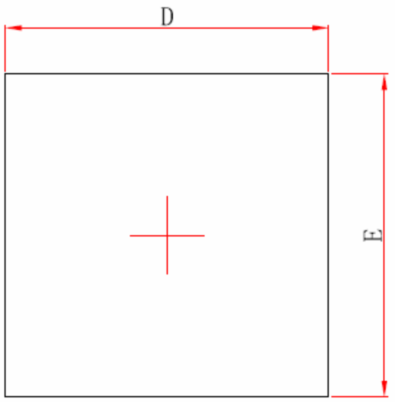
8-Pin DFN Package Outline Dimension



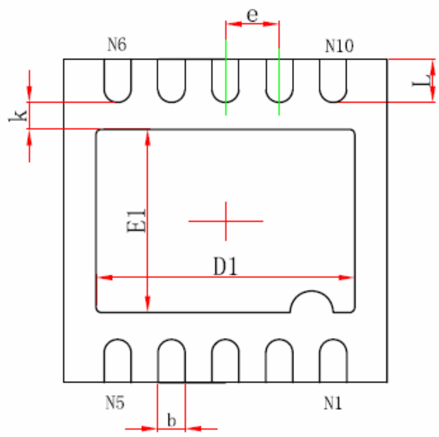


Symbol	Dimensions In Millimeters	
	Min.	Max.
A	0.700/0.800	0.800/0.900
A1	0.000	0.050
A3	0.203REF.	
D	2.900	3.100
E	2.900	3.100
D1	2.200	2.400
E1	1.400	1.600
k	0.200MIN.	
b	0.180	0.300
e	0.650TYP.	
L	0.375	0.575

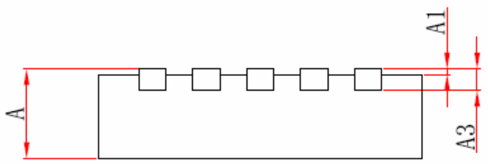
10-Pin DFN Package Outline Dimension



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters	
	Min.	Max.
A	0.700/0.800	0.800/0.900
A1	0.000	0.050
A3	0.203REF.	
D	2.900	3.100
E	2.900	3.100
D1	2.300	2.500
E1	1.600	1.800
k	0.200MIN.	
b	0.180	0.300
e	0.500TYP.	
L	0.300	0.500

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