2.5W STEREO CLASS-D AUDIO POWER AMPLIFIER WITH VOLUME CONTROL

GENERAL DESCRIPTION

The TMPA208DS is a stereo class-D audio power amplifier with volume control. It delivers up to 2.5W/ch(5W in all) into a 3 ohm load or 2W/ch(4W in all) into a 4 ohm load or 1.25W/ch(2.5W in all) into an 8 ohm load.

With differential input structure, TMPA208DS features high Common Mode Rejection Ratio and Power Supply Rejection Ratio.

Analog input signal is converted into digital output which drives directly to the speaker. High power efficiency is achieved due to digital output at the load. The audio information is embedded in PWM（Pulse Width Modulation）.

DC volume control is convenient for LCD projectors, LCD monitors, powered speakers, and other consumer products especially when using remote control.

APPLICATIONS

Multimedia application includes Cellular Phones, PDAs, DVD/CD players, TFT LCD TVs/Monitors, LCD Projectors, 2.1 channel audio systems, Powered Speakers, USB audio. It is also ideal for other portable devices like Wireless Radios.

FEATURES

- **2.5V to 6V Single Supply**
- **Up to 5Wrms Max. Power or 2.5Wrms/ch.**
- **Up to 86% Power Efficiency**
- **3mA /Ch Quiescent Current**
- **Less Than 0.2uA /Ch Shutdown Current**
- **Pop-less Power-Up, Shutdown and Recovery**
- **Differential 230 KHz PWM Allows Bridge-Tied Load to Increase Output Power**
- **DC Volume Control**
- **BTL Output Requires No Output Capacitors**
- **Thermal Shutoff and Automatic Recovery**
- **Output Pin Short-Circuit Protection (Short to Other Outputs, Short to VCC, Short to Ground)**
- **Compatible with earphone application**
- **Differential Signal Processing Improves CMRR & Eliminates Power Regulation**
- **Package：TSSOP20 Available**

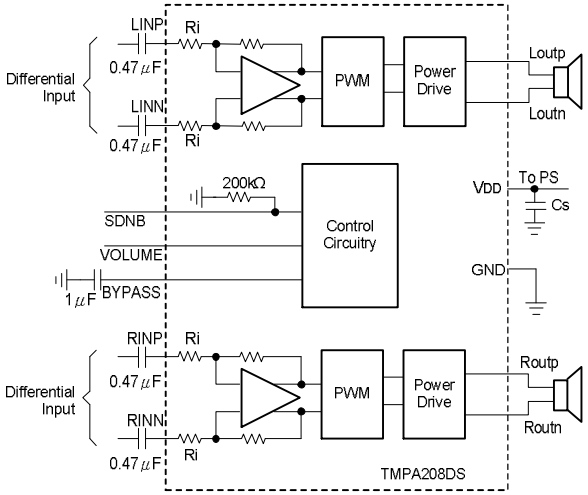
For best performance, please refer to
http://www.taimec.com.tw/English/EVM.htm
http://www.class-d.com.tw/English/EVM.htm
for PCB layout.

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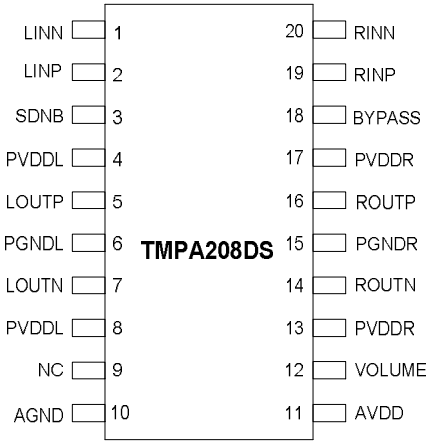
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REFERENCE CIRCUIT（Please refer to TMPA002.APP for application）



TOP VIEW



（Please email david@taimec.com.tw for complete datasheet.）

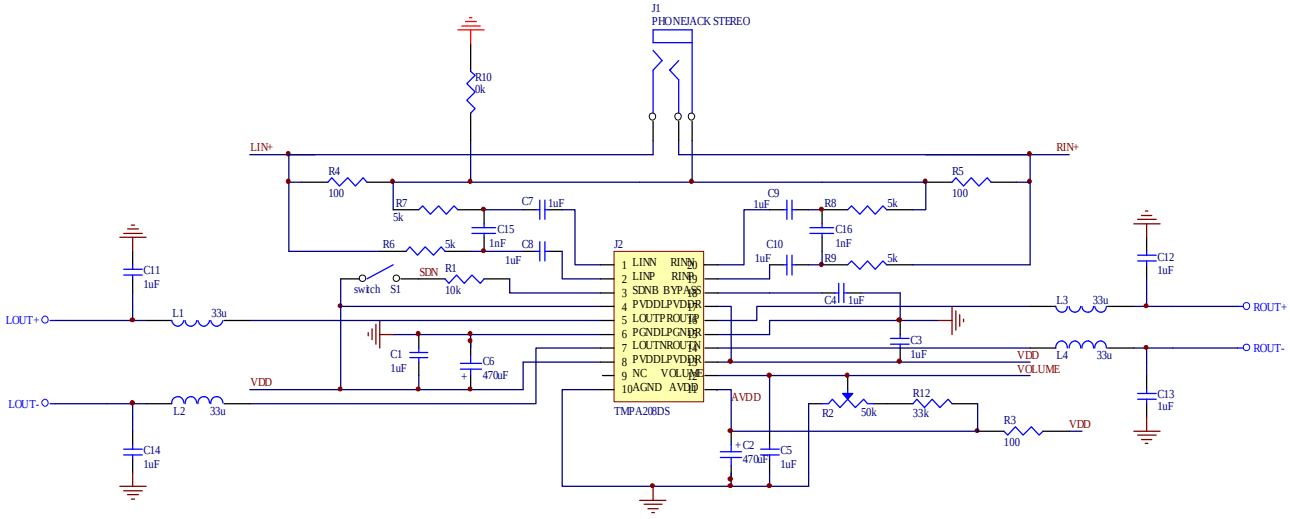
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Note that the external components or PCB layout should be designed not to generate abnormal voltages to the chip to prevent from latch up which may cause damage to the device.

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Typical Application



TERMINAL FUNCTIONS

TERMINAL		I/O	DESCRIPTION
NAME	PIN NO		
AGND	10	—	Analog ground
BYPASS	18	O	Bypass
LINN	1	I	Negative differential input for left channel
LINP	2	I	Positive differential input for left channel
LOUTN	7	O	Negative output for left channel
LOUTP	5	O	Positive output for left channel
NC	9	—	No connection
PGNDL	6	—	Ground for left channel H-bridge
PGNDR	15	—	Ground for right channel H-bridge
PVDDL	4,8	—	Power supply for left channel H-bridge
PVDDR	13,17	—	Power supply for right channel H-bridge
RINN	20	I	Negative differential input for right channel
RINP	19	I	Positive differential input for right channel
ROUTN	14	O	Negative output for right channel
ROUTP	16	O	Positive output for right channel
SDNB	3	I	Places the amplifier in shutdown mode if a TTL logic low is placed on this terminal; normal operation if a TTL logic high is placed on this terminal
AVDD	11	—	Analog power supply
VOLUME	12	I	DC Volume control

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ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range unless otherwise noted (1)

Supply voltage range, V_{DD}, PV_{DD}	0.3V to 6V
Input voltage range, V_I	0V to 5.5V
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature, T_A	-20 °C to 85 °C
Operating junction temperature range, T_J	-20 °C to 150 °C
Storage temperature range, T_{stg}	-65 °C to 150 °C

(1)Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

DISSIPATION RATINGS TABLE

PACKAGE	$T_A \leq 25$ °C	DERATING FACTOR	T_A=70 °C	T_A=85 °C
TSSOP20(FD)	2.18W	21.8mW/°C	1.2W	872mW

RECOMMENDED OPERATING CONDITIONS

		MIN	TYP	MAX	UNIT
Supply voltage, V_{DD}		2.5		6	V
High-level input voltage, V_{IH}	SDNB	2			V
Low-level input voltage, V_{IL}	SDNB			0.8	V
PWM frequency		200		300	KHz
Operating free-air temperature, T_A		-20		85	°C
Operating junction temperature, T_J		-20		125	°C

ELECTRICAL CHARACTERISTICS

T_A=25 °C, V_{DD}=PV_{DD}=5V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$\lvert V_{OS} \rvert$	Output offset voltage (measured differentially)	V_I=0V, A_V=20dB, R_L=8Ω			25	50	mV
PSSR	Power supply rejection ratio	V_{DD}=PV_{DD}=3.5V to 5.5V			-70		dB
$\lvert I_{IH} \rvert$	High-level input current	V_{DD}=AV_{DD}=5.5V, V_I=5.8V (SDNB)			30		μA
$\lvert I_{IL} \rvert$	Low-level input current	V_{DD}=AV_{DD}=5.5V, V_I=-0.3V (SDNB)				1	μA
I_{DD}	Supply current	No load			6	10	mA
I_{DD} (SD)	Supply current in shutdown mode	SDNB=0V			50	1000	nA
r_{ds} (on)	Drain-source on-state resistance	V_{DD}=5V, I_O=500mA, T_J=25 °C	High side		450	600	mΩ
			Low side		450	600	
Av	Voltage gain	R_L=8Ω, VOLUME=2.8V			18		dB
Ri	Input resistance	VOLUME=2.8V~0V		24		200	kΩ

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OPERATING CHARACTERISTICS

T_A=25 °C, V_{DD}=PV_{DD}=5V, R_L=8Ω speaker, Gain=18dB (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
P_O	Output power per channel (Limited by thermal condition)	f=1kHz, R_L=3Ω, stereo operation		2.5		W
		f=1kHz, R_L=4Ω, stereo operation		2		W
		f=1kHz, R_L=8Ω, stereo operation		1.25		W
THD+N	Total harmonic distortion plus noise	R_L =8Ω, P_O=1.2W, f=1kHz		0.4%		
	Thermal trip point			150		°C
	Thermal hysteresis			20		°C
Vn	Integrated noise floor	20 Hz to 20 kHz, inputs ac grounded		85		μVrms
SNR	Signal-to-noise ratio	V_{DD}=AV_{DD}=5V, P_O=1W, R_L=8Ω		95		dB
Crosstalk	Crosstalk between outputs	V_{DD}=AV_{DD}=5V, P_O=1W R_L=8Ω		-68		dB

VOLTAGE RANGE OF "VOLUME" AT DIFFERENT VDD

VDD	MAX	MIN
5V	2.8V	0V
3.6V	1.9V	0V
3V	1.3V	0V

VOLTAGE GAIN AT T_A=25 °C, R_L=8Ω

V_{DD}=PV_{DD}=5V	VOLTAGE GAIN	VOLTAGE of VOLUME
5V	18dB/-27dB	2.8V/0V
3.6V	18dB/-27dB	1.9V/0V
3V	16dB/-27dB	1.4V/0V

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Table 1. TYPICAL DC VOLUME CONTROL

VOLTAGE ON VOLUME PIN (V)	TYPICAL GAIN OF AMPLIFIER (dB)
0-0.1	-38
0.1-0.19	-36
0.19-0.29	-34
0.29-0.39	-32
0.39-0.48	-30
0.48-0.58	-28
0.58-0.68	-26
0.68-0.77	-24
0.77-0.87	-22
0.87-0.97	-20
0.97-1.06	-18
1.06-1.16	-16
1.16-1.26	-14
1.26-1.35	-12
1.35-1.45	-10
1.45-1.55	-8
1.55-1.64	-6
1.64-1.74	-4
1.74-1.84	-2
1.84-1.93	0
1.93-2.03	2
2.03-2.13	4
2.13-2.22	6
2.22-2.32	8
2.32-2.42	10
2.42-2.51	12
2.51-2.61	14
2.61-2.71	16
2.71-2.8	18
2.8-2.9	20
2.9-VDD	—

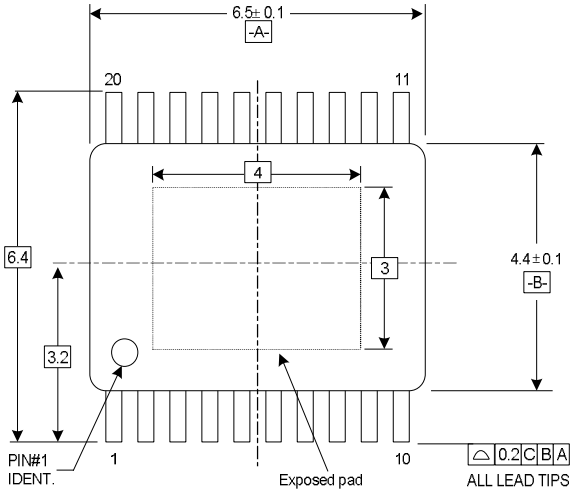
*Not fully tested but guaranteed by design.

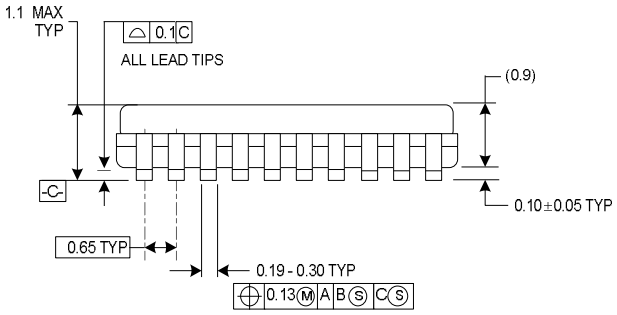
**This table is only for VDD=5V

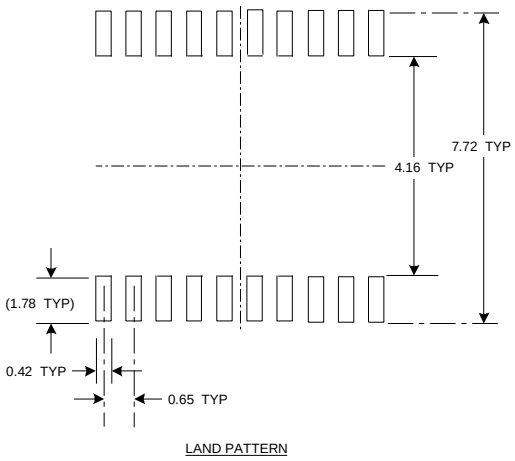
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Physical Dimensions (IN MILLIMETERS)







TSSOP20

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