STEREO 2.1W Non-Clip DIGITAL AUDIO POWER AMPLIFIER

♦ Overview

HT2144 is a digital audio power amplifier IC with maximum output of 2.1W (RL=4Ω)×2ch.

HT2144 has a "Pure Pulse Direct Speaker Drive Circuit" which directly drives speakers while reducing distortion of pulse output signal and reducing noise on the signal, and realizes the highest standard low distortion rate characteristics and low noise characteristics among digital amplifier ICs for mobile use.

In addition, circuit design with fewer external parts can be made depend on the condition of use because corresponds to filter less.

The HT2144 features Heroic original non-clip output control function which detects output signal clip due to the over level input signal and suppress the output signal clip automatically. Also the non-clip output control function can adapt the output clip caused by power supply voltage down with battery. This is the difference from the traditional AGC (Auto Gain Control) or ALC (Auto Level Control) circuit. Attack time and release time can be freely set by external resistances or capacitances.

The independent power-down function for L channel and R channel minimizes consumption current at standby. As for protection function, overcurrent protection function for speaker output terminal, overtemperatue protection function for inside of the device, and low supply voltage malfunction preventing function are prepared.

♦Electrical Characteristic

- Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit
Power supply terminal (PVDD) Voltage Range	V_{DDP}	-0.3	6.0	V
Power supply terminal (AVDD) Voltage Range	V_{DDP}	-0.3	6.0	V
Input terminal Voltage Range (Analog input terminals: INL+,INL-,INR+,INR-)	V_{IN}	Vss－0.6	V_{DDA}+0.6	V
Input terminal Voltage Range (Input terminals except the above-mentioned)	V_{IN}	Vss－0.3	V_{DDA}+0.3	V
Allowable dissipation (20QFN,Ta=25℃)	P_{D25}		1.56	W
Allowable dissipation (20QFN,Ta=85℃)	P_{D85}		0.62	W
Allowable dissipation (20QFN,Ta=25℃)	P_{D25}		3.63	W
Allowable dissipation (20QFN,Ta=85℃)	P_{D85}		1.45	W
Junction Temperature	T_{JMAX}		150	℃
Storage Temperature	T_{STG}	-50	125	℃

Note) Absolute Maximum Ratings is values which must not be exceeded to guarantee device reliability and life, and when using a device in excess even a moment, it may immediately cause damage to device or may significantly deteriorate its reliability
With a system of which a voltage at an input pin might exceed a supply voltage of VDDA/GND, use an external diode to assure that the voltage does not exceed the absolute maximum rating.
*1: θja=50.0℃/W, conditions: HT2144 evaluation board (4 layers), dead calm
*2: θja=64.0℃/W, conditions: HT2144 evaluation board (2 layers, without through-hole), dead calm
*3: θja=27.5℃/W, conditions: 4 layers, through-hole, copper foil 65μm, dead calm

- Recommended Operating Condition

Item	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage(PVDD)	V_{DDP}	3.5	5	6	V
Power Supply Voltage(AVDD)	V_{DDP}	3.5	5	6	V
Operating Ambient Temperature	Ta	-40	25	85	℃
Speaker Impedance (4.5V < PVDD)	R_L	4			Ω
Speaker Impedance (3.5V≦PVDD≦4.5V)	R_L	8			Ω

Note) Do not use under a condition other than the recommended operating conditions.
PVDD ≧ AVDD (contain power supply start up) must be met.
The rising time of PVDD and AVDD should be more than 1μ s .

- DC Characteristics (VSS=0V, VDDP= VDDA =3.5V to 5.25V, Ta=－40ºC to 85ºC, unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
AVDD power supply start-up threshold voltage	V_{UVLH}			2.2		V
AVDD power supply shut-down threshold voltage	V_{UVLL}			2.0		V
/SDL, /SDR, G0 terminal H level input voltage	V_{IH}		1.35			V
/SDL, /SDR, G0 terminal L level input voltage	V_{IL}				0.35	V
AVDD consumption current	I_{DD}	V_{DDA}=3.6v,no load		6.0		mA
PVDD consumption current	I_{DD}	V_{DDA}=3.6v,no load, no signal input		2.0		mA
Consumption current in power-down mode AVDD + PVDD	I_{PD}	/SDL=/SDR=V_{SS} T_a=25℃		0.1		uA

- AC characteristics (V_{SS}=0V, V_{DDP}= V_{DDA} =3.5V to 5.25V, Ta=-40℃ to 85℃, unless otherwise specified)

Item	Symbol	Conditions	Min	Typ	Max	Unit
Start-up time	T_{STUP}			3.5		ms
Input cut-off frequency	fc	C_{IN}=0.1uF,Av=18dB		57		Hz
Attack time	T_{AT}	V_{DDA}=3.6v,g=10dB,Cex=1uF,Rex=1MΩ		10		ms
Release time	T_{RL}	V_{DDA}=3.6v,g=10dB,Cex=1uF,Rex=1MΩ		0.8		S
Carrier clock frequency	f_{PWM}			1.0		MHz

- Analog Characteristics

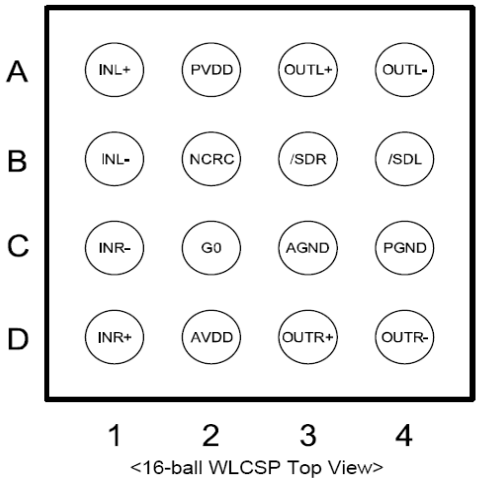
(VSS=0V, VDDP= VDDA =3.6V, RL=8Ω, Ta=25ºC, Non-Clip function=OFF, no snubber circuit, no schottky barrier diode,unless otherwise specified)

Item	Symbol	Conditions	Min	Typ	Max	Unit
Maximum output	Po	R_L=4Ω, f=1kHz,THD+N=10%, V_{DDP}=V_{DDA}=5V		2.1		W
		R_L=8Ω, f=1kHz,THD+N=10%		0.75		W
Voltage Gain	Av	G0=L		12		dB
		G0=H		18		dB
Total Harmonic Distortion Rate (BW:20kHz)	THD+N	R_L=8Ω, Po=0.4W, f=1kHz		0.03		%
Residual Noise (A-Filter)	N	Av=12dB		40		uV_{rms}
Signal /Noise Ratio (BW:20kHz A-Filter)	SNR	Av=12dB		95		dB
Channel Separation Ratio	CS	1kHz		95		dB
Power supply rejection ratio	PSRR	217Hz (to P_{VDD})		-85		dB
Maximum Efficiency	η	R_L=8Ω, Po=600mW		84		%
		R_L=8Ω, Po=100mW		78		%

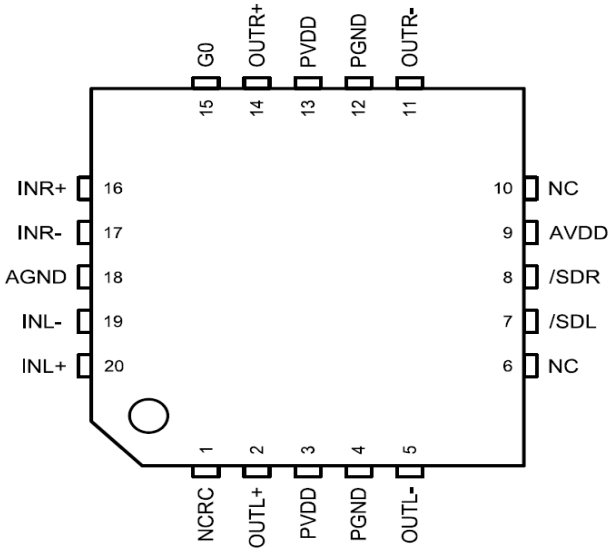
Output offset voltage	Vo			±20		mV
Frequency characteristics	f_{RES}	C_{IN} =0.1μF, f=100Hz to 20kHz	-3	-	1	dB
Non-Clip maximum attenuation gain	Aa			-10		dB

Note) All the values of analog characteristics were obtained by using our evaluation circumstance.
Depending upon parts and pattern layout to use, characteristics may be changed.
8Ω or 4Ω resistor and 30μH coil are used as an output load in order to obtain various digital amplifier characteristics.

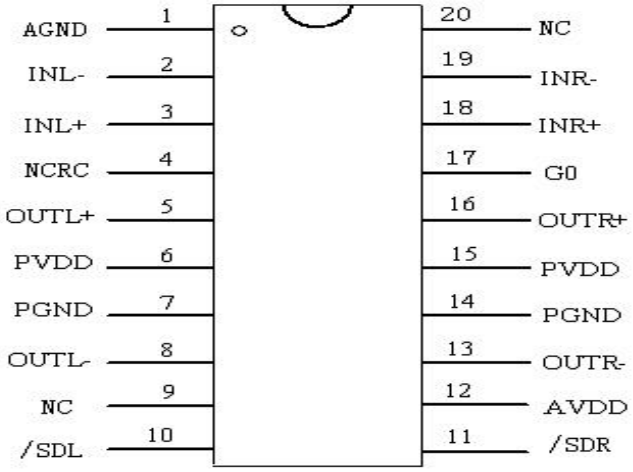
♦ Terminal configuration



<16-ball WLCSP Top View>



<20-pin QFN Top View>

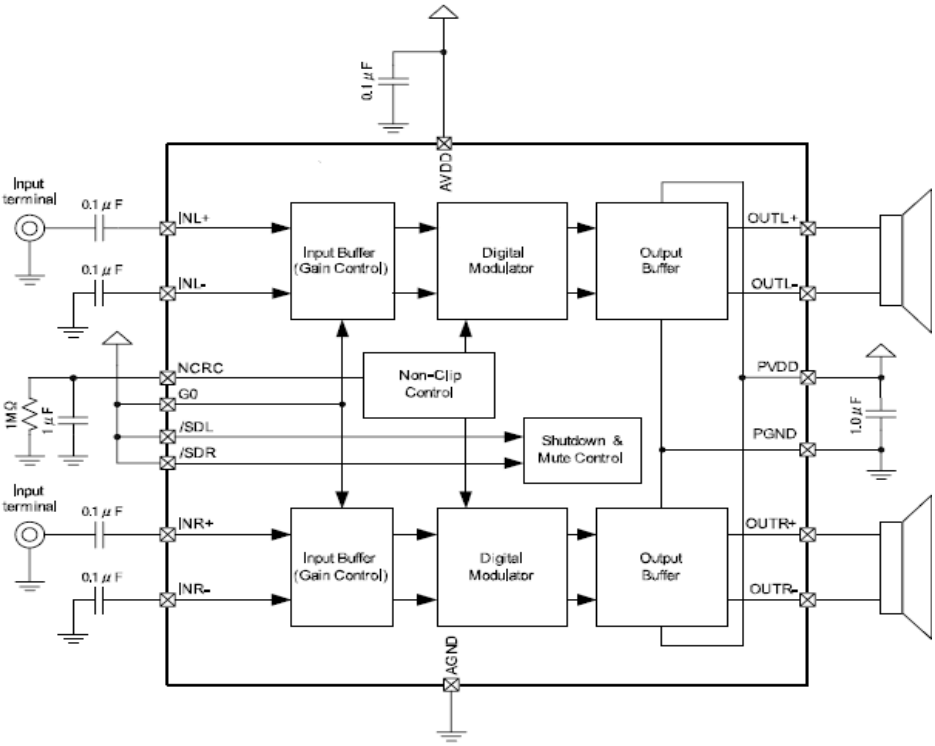


<20-pin TSSOP Top View>

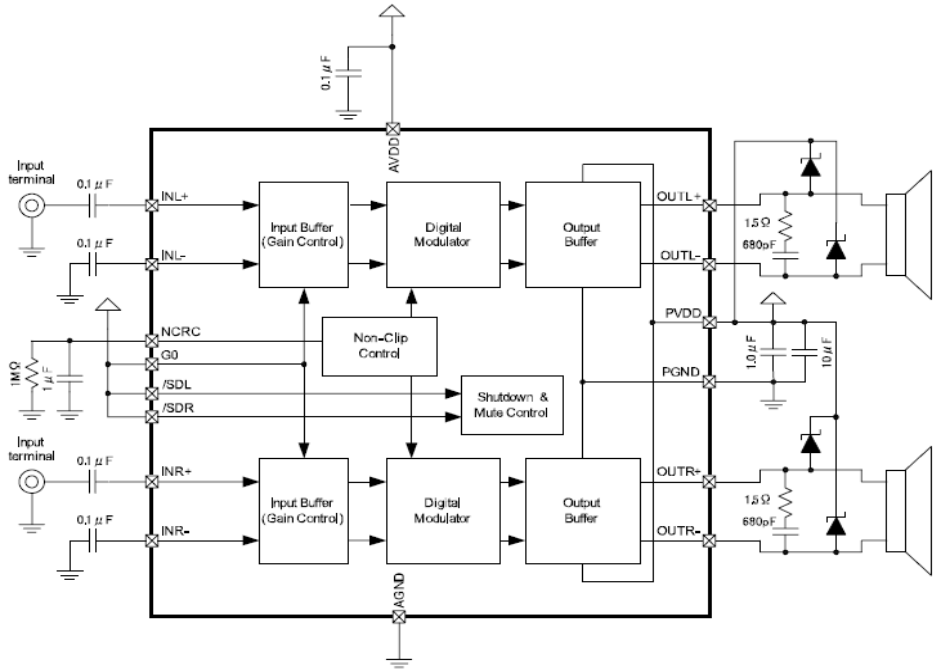
♦ Application circuit examples

- WLCSP16

・Snubber circuit and schottky barrier diode are unnecessary (3.5V≦PVDD≦4.5V)



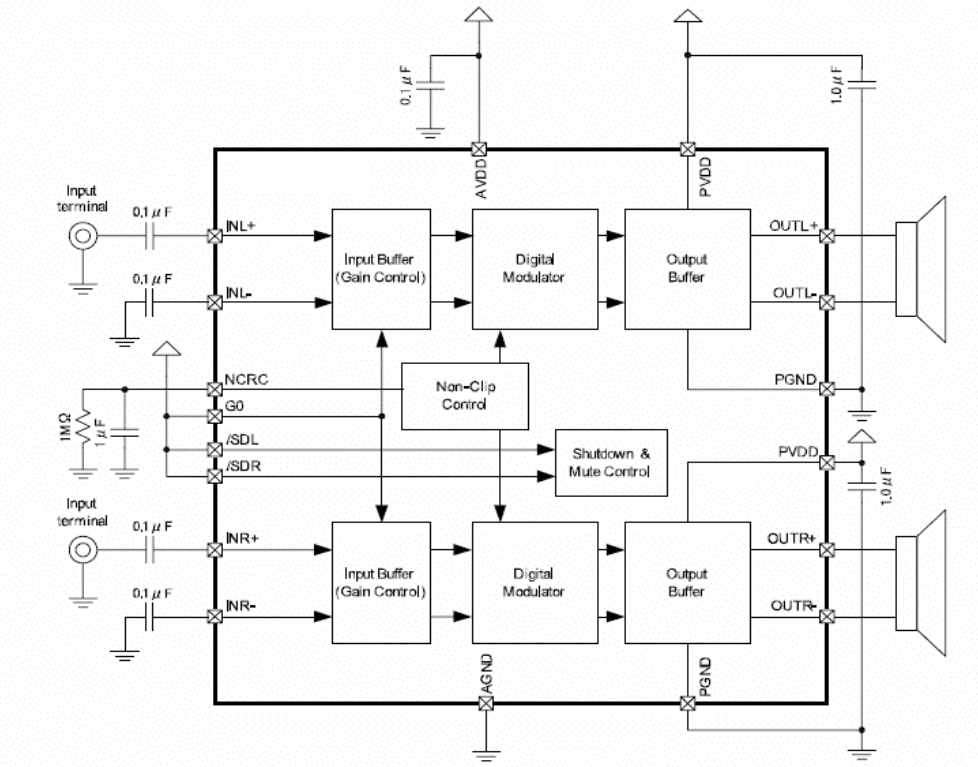
・Snubber circuit and schottky barrier diode are necessary (4.5V＜PVDD)



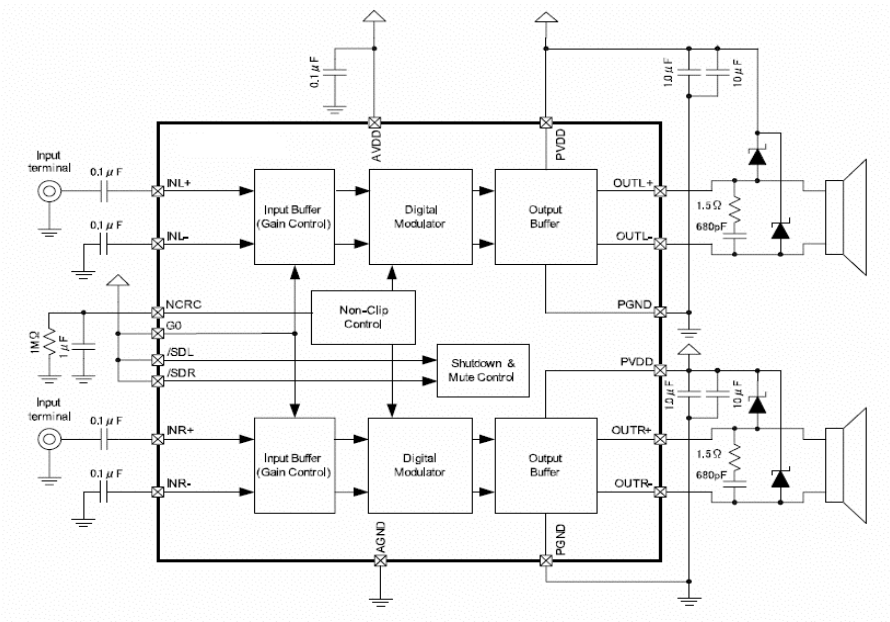
When the IC is used at more than 4.5V power supply, use it with an additional capacitor of 10μF or over between PVDD and GND.
Place a bypass capacitor as close as possible to each power supply pin of the IC.

- QFN20/TSSOP20

・Snubber circuit and schottky barrier diode are unnecessary (3.5V≦PVDD≦4.5V)



・Snubber circuit and schottky barrier diode are necessary (4.5V＜PVDD)

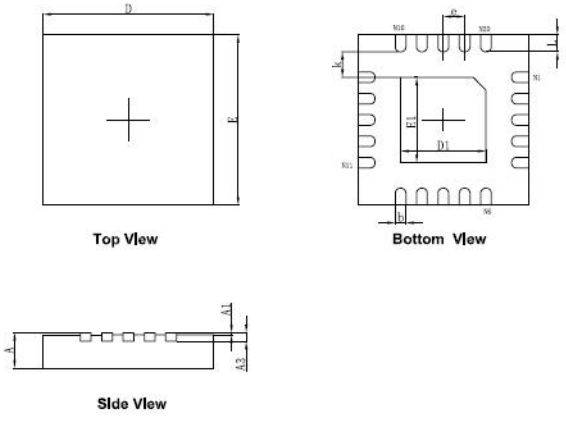


When the IC is used at more than 4.5V power supply, use it with an additional capacitor of 10μF or over between PVDD and GND.

Place a bypass capacitor as close as possible to each power supply pin of the IC.

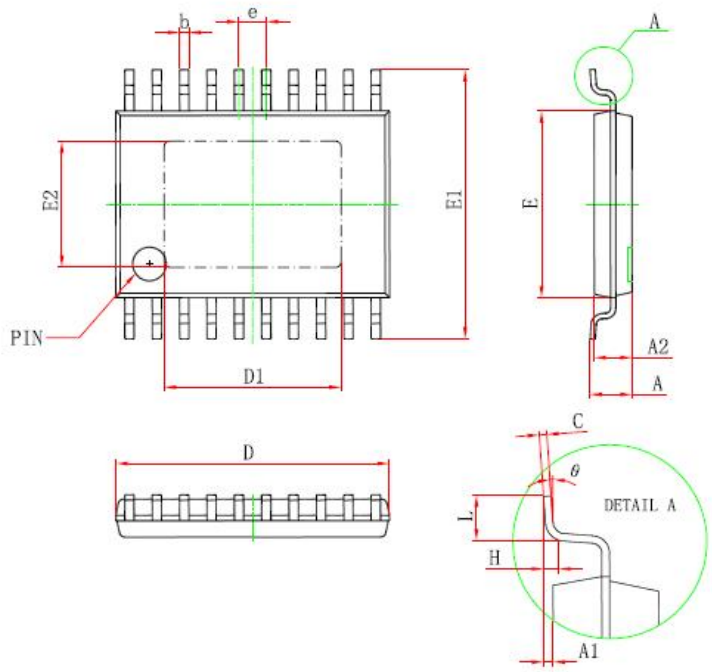
♦ Physical Dimensions

QFNWB4×4-20L(P0.50T0.75/0.85) PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	3.900	4.100	0.154	0.161
E	3.900	4.100	0.154	0.161
D1	1.900	2.100	0.075	0.083
E1	1.900	2.100	0.075	0.083
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.020TYP.	
L	0.300	0.500	0.012	0.020

TSSOP20/PP PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	6.400	6.600	0.252	0.259
D1	4.100	4.300	0.165	0.169
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
E2	2.900	3.100	0.114	0.122
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.65 (BSC)		0.026 (BSC)	
L	0.500	0.700	0.02	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°

嘉兴禾润电子科技有限公司
Jiaxing Heroic Technology Co.,Ltd.
Add： 浙江省嘉兴市亚太路 JRC 大厦三楼 A 座 314 室
Tel: 0573-82583866
Fax：0573-82585078
E-mail：sales@heroic.com.cn
Web: www.heroic.com.cn