



## PA3138

CMOS IC

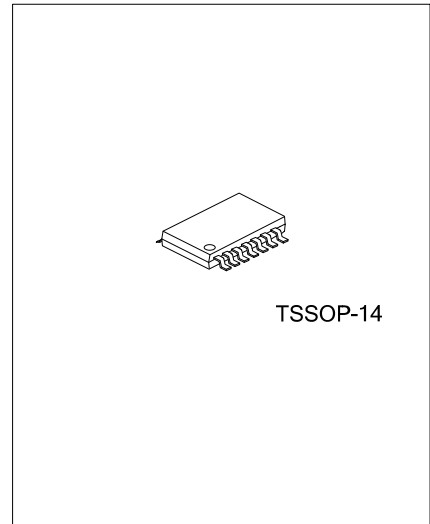
### DIRECT HEADPHONE DRIVER WITH ADJUSTABLE GAIN

#### DESCRIPTION

The UTC **PA3138** is a pop-free stereo headphone amplifier with the integrated charge pump generating the negative supply rail which allows the removal of the output DC-blocking capacitors. The UTC **PA3138** provides a clean, pop-free ground-biased audio signal. The UTC **PA3138** is capable of driving 25mW into a 32-Ω load with 3.3-V supply voltage. The device has differential inputs and uses external resistors for flexible gain setting. Gain can be configured individually for each channel. The device can also be configured as a second-order low-pass filter and is ideal for interfacing with PWM audio sources.

The UTC **PA3138** has built-in active-mute control for pop-free audio on/off control. The UTC **PA3138** has an external under-voltage detector that mutes the output when monitored voltage drop below set value.

Using the UTC **PA3138** in audio products can reduce component count considerably compared to traditional headphone amplifiers.



#### FEATURES

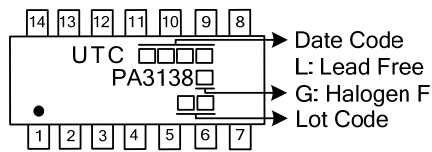
- \* Low THD+N<0.01% at 10mW Into 32Ω
- \* Stereo Direct Headphone Amplifier driver  
40 mW Into 32Ω With 3.3-V Supply
- \* Integrated charge pump Generates Negative Supply Rail
- \* High SNR, >90dB
- \* Ground-Referenced Outputs Eliminate DC-Blocking Capacitors
- \* Differential Input and Single-Ended Output
- \* Adjustable Gain by External Gain-Setting Resistors
- \* Pop-Free Under-Voltage Protection
- \* Configurable as a Second-Order Low-Pass Filter  
Ideal for PWM Audio Sources
- \* Short-Circuit Protection
- \* Click- and Pop-Reduction Circuitry
- \* Active Mute Control for Pop-Free Audio On/Off Control

#### ORDERING INFORMATION

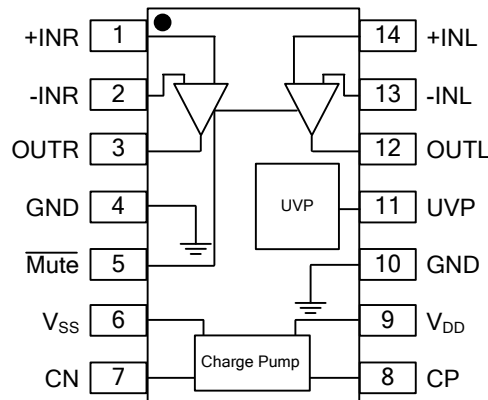
Ordering Number		Package	Packing
Lead Free	Halogen Free		
PA3138L-P14-R	PA3138G-P14-R	TSSOP-14	Tape Reel

<p>PA3138G-P14-R</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) R: Tape Reel (2) P14: TSSOP-14 (3) G: Halogen-Free and Lead Free, L: Lead Free</p>
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## MARKING



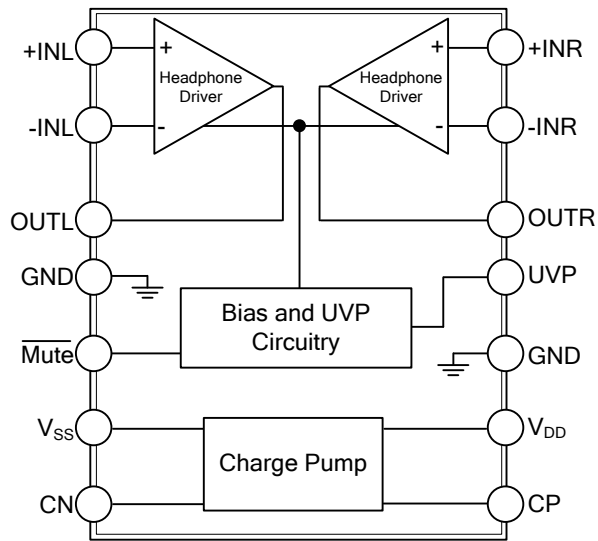
## PIN CONFIGURATION



## PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	+INR	Right-channel OPAMP positive input
2	-INR	Right-channel OPAMP negative input
3	OUTR	Right-channel OPAMP output
4, 10	GND	Ground
5	Mute	Mute, active-low
6	V <sub>SS</sub>	Supply voltage
7	CN	Charge-pump flying capacitor negative connection
8	CP	Charge-pump flying capacitor positive connection
9	V <sub>DD</sub>	Positive supply
11	UVP	Under-voltage protection; internal pull-up, unconnected if UVP function is unused.
12	OUTL	Left-channel OPAMP output
13	-INL	Left-channel OPAMP negative input
14	+INL	Left-channel OPAMP positive input

■ BLOCK DIAGRAM



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■ ABSOLUTE MAXIMUM RATING over operating free-air temperature range (unless otherwise noted)

PARAMETER	SYMBOL	RATINGS	UNIT
V <sub>DD</sub> to GND		-0.3~ 4	V
Input Voltage, V <sub>I</sub>		V <sub>SS</sub> -0.3 ~ V <sub>DD</sub> +0.3	V
Minimum Load Impedance-Line Outputs-OUTL, OUTR		12.8	Ω
Mute to GND, UVP to GND		-0.3 ~ V <sub>DD</sub> +0.3	V
Maximum Operating Junction Temperature Range	T <sub>J</sub>	-40 ~ +150	°C
Storage Temperature Range	T <sub>STG</sub>	-40 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ THERMAL INFORMATION

PARAMETER	SYMBOL	RATINGS	UNIT
Junction-to-Ambient	θ <sub>JA</sub>	130	°C/W
Junction-to-Case (top)	θ <sub>JC</sub>	49	°C/W

Note: For more information about traditional and new thermal metrics, see the IC Package Thermal Metrics application report, SPRA953.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Supply	V <sub>DD</sub>	DC supply voltage	3	3.3	3.6	V
Load Impedance	R <sub>L</sub>		16	32		Ω
Low-Level Input Voltage	V <sub>IL</sub>	$\overline{\text{Mute}}$		40		%V <sub>DD</sub>
High-Level Input Voltage	V <sub>IH</sub>	$\overline{\text{Mute}}$		60		%V <sub>DD</sub>
Ambient Temperature	T <sub>A</sub>		-40	25	85	°C

■ ELECTRICAL CHARACTERISTICS

V<sub>DD</sub>=3.3V, R<sub>DL</sub>=32Ω, R<sub>fb</sub>=30kΩ, R<sub>IN</sub>=15kΩ, T<sub>A</sub>=25°C, Charge pump: C<sub>P</sub>=1μF (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Offset Voltage	V <sub>OS</sub>	V <sub>DD</sub> =3.3V		0.5	1	mV
Power-Supply Rejection Ratio	PSRR			65		dB
High-Level Output Voltage	V <sub>OH</sub>	V <sub>DD</sub> =3.3V	3.1			V
Low-Level Output Voltage	V <sub>OL</sub>	V <sub>DD</sub> =3.3V			-3.05	V
External UVP Detect Voltage	V <sub>UVP_EX</sub>			1.25		V
External UVP Detect Hysteresis Current	V <sub>UVP_EX_HYSTE</sub> RESIS			5		μA
Charge-pump Switching Frequency	f <sub>CP</sub>		200	300	400	kHz
High-Level Input Current, $\overline{\text{Mute}}$	I <sub>IH</sub>	V <sub>DD</sub> =3.3V, V <sub>IH</sub> =V <sub>DD</sub>			1	μA
Low-Level Input Current, $\overline{\text{Mute}}$	I <sub>IL</sub>	V <sub>DD</sub> =3.3V, V <sub>IL</sub> =0V			1	μA
Supply Current	I <sub>DD</sub>	V <sub>DD</sub> =3.3V, no load, $\overline{\text{Mute}}$ = V <sub>DD</sub> , no load	5	14	25	mA
		V <sub>DD</sub> =3.3V, no load, $\overline{\text{Mute}}$ = GND, disabled		14		mA

### ■ OPERATING CHARACTERISTICS

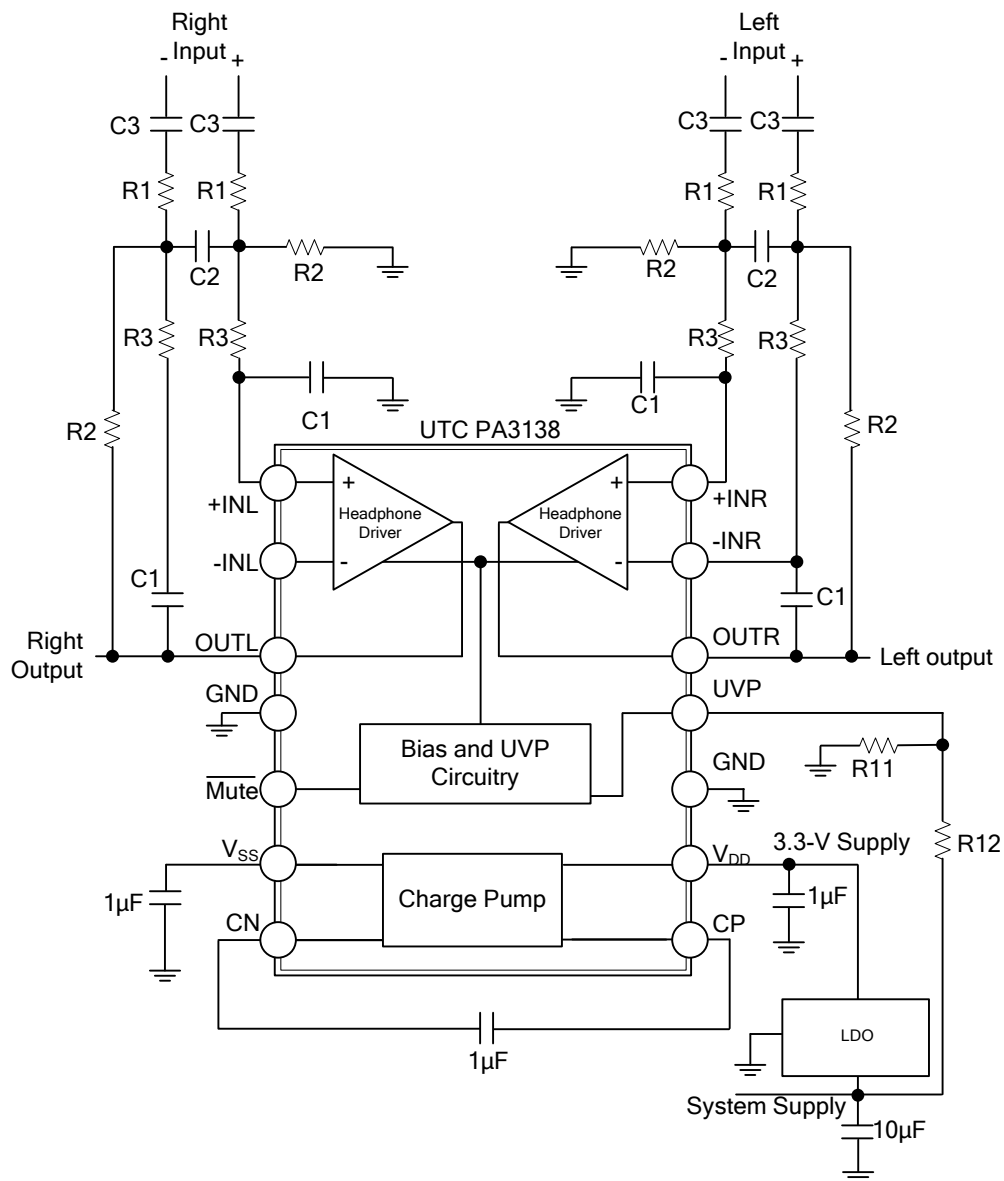
$V_{DD}=3.3V$ ,  $R_{DL}=32\Omega$ ,  $R_{fb}=30k\Omega$ ,  $R_{IN}=15k\Omega$ ,  $T_A=25^\circ C$ , Charge pump:  $C_P=1\mu F$  (unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Power, Outputs in Phase	$P_O$	THD+N=1%, $V_{DD}=3.3V$ , $f=1kHz$ , $R_L=32\Omega$		30		mW
Total Harmonic Distortion Plus Noise	THD+N	$V_{DD}=3.3V$ , $f=1kHz$ , $R_{LD}=32\Omega$ , $P_O=10mW$		0.01%		
Signal-to-Noise Ratio (Note 1)	SNR	A-weighted		96		dB
Dynamic Range (Note 2)	DNR	A-weighted	90	100		dB
Noise Voltage	$V_N$	A-weighted		13		$\mu V$
Output Impedance When Muted	$Z_O$	Mute =GND		110		$\Omega$
Input-to-Output Attenuation When Muted		Mute =GND		80		dB
Crosstalk-L to R, R to L		$P_O=20mW$		-65		dB
Current Limit	$I_{LIMIT}$	$PV_{DD}=3.3V$		50		mA

Notes: 1. SNR is calculated relative to 25-mW output.

2. DNR is calculated relative to output at 1% THD+N.

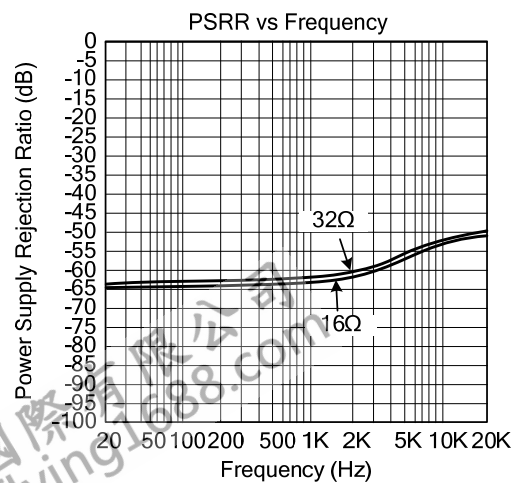
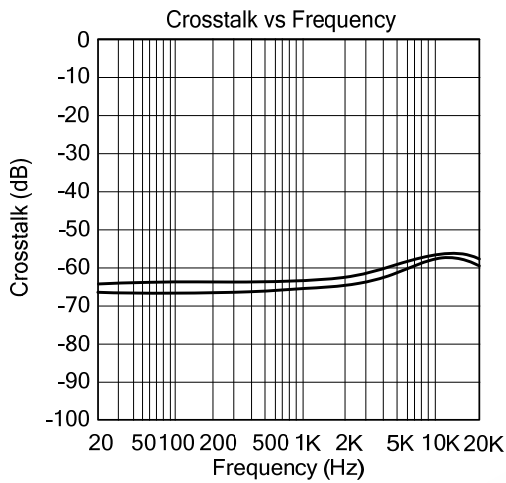
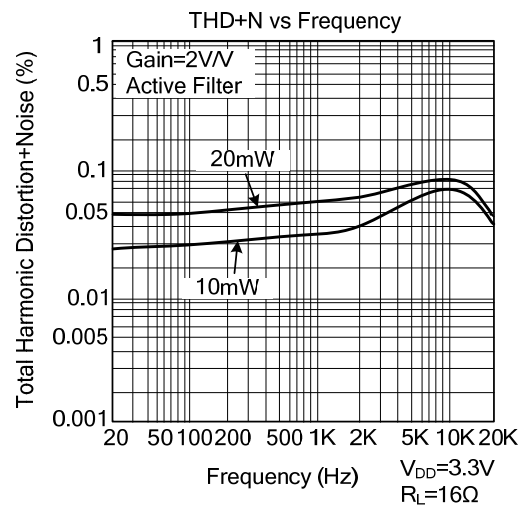
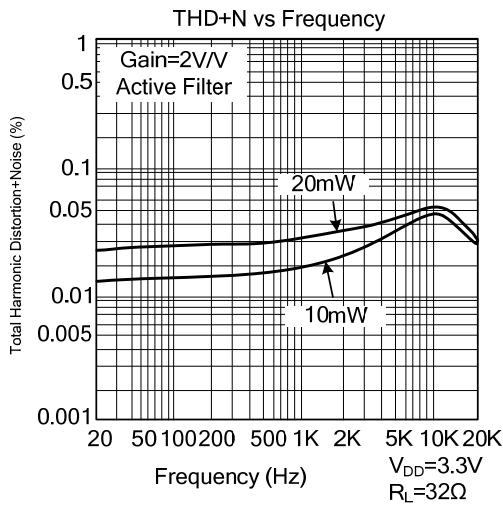
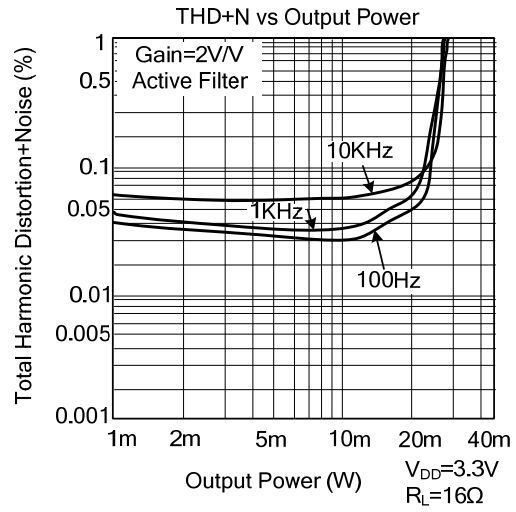
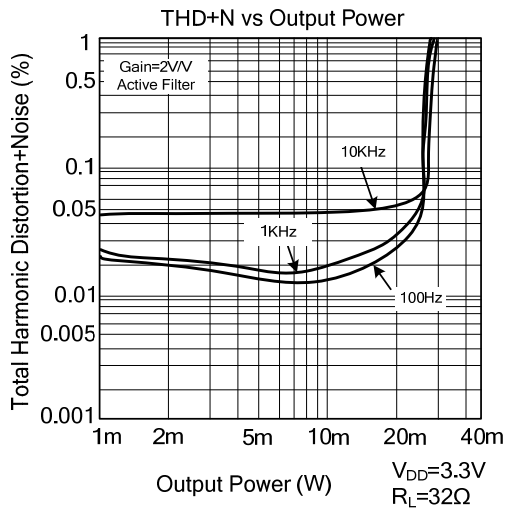
## ■ TYPICAL APPLICATION CIRCUIT



R1=15kΩ, R2=30kΩ, R3=43kΩ, C1=47pF, C2=180pF

■ TYPICAL CHARACTERISTICS

$V_{DD}=3.3\text{ V}$ ,  $T_A=25^\circ\text{C}$ ,  $C(\text{PUMP})=C(V_{SS})=1\mu\text{F}$ ,  $C_{IN}=2.2\mu\text{F}$ ,  $R_{IN}=15\text{k}\Omega$ ,  $R_{FB}=30\text{k}\Omega$  (unless otherwise noted)



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