Voice Switched Speakerphone Circuit with Speaker Amplifier

■ GENERAL DESCRIPTION

The **NJW1128** is a Voice Switched Speakerphone Circuit. It includes all of functions processing a high quality hands–free speakerphone system, such as the necessary amplifiers (Mic , Receive ,Line, Speaker), attenuators, level detectors functions.

The **NJW1128** is controllable independently power-down of the speaker amplifier and the entire IC excluding the speaker amplifier.

All external capacitors are sufficient small so that ceramic capacitors are applied.

■ PACKAGE OUTLINE

NJW1128FR3

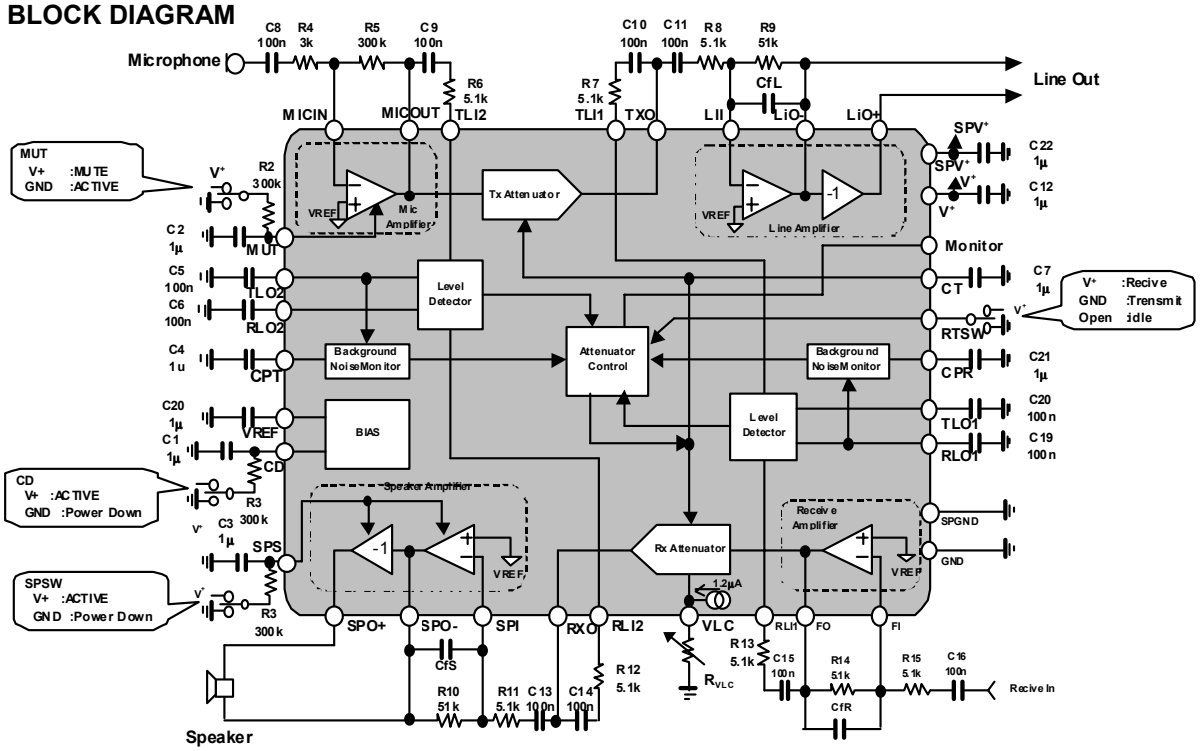
■ APPLICATION

- Video Door Phone
- Conference System
- Wireless Application
- Security System

■ FEATURES

- Operating voltage range 3.9 to 5.5V
- Attenuator gain range between Transmit and Receive 52dB
- Speaker amplifier
- Microphone amplifier with mute function
- Force to Receive, Transmit, or Idle modes
- Mode –watching monitor
- Background noise monitor for each path
- 4-point signal sensing
- Chip disable Pin powers down the entire IC excluding the speaker amplifier
- Speaker switch Pin power down the speaker amplifier
- Microphone and Receive Amplifiers pinned out for flexibility
- Package Outline LQFP48-R3

■ BLOCK DIAGRAM



■ **ABSOLUTE MAXIMUM RATING** (Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	V_+	7	V
Power Dissipation	P_D	1,330(Note1)	mW
Operating Temperature Range	Topr	-40 ~ +85	°C
Storage Temperature Range	Tstg	-40 ~ +125	°C
Maximum Input Voltage	V_{IMAX}	0 ~ V^+ (Note2)	V

(Note1) EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layer, FR-4) mounting

■ **OPERATING VOLTAGE**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V^+	-	3.9	5.0	5.5	V

■ **ELECTRICAL CHARACTERISTICS** (Ta=25°C,V^+=5V,Vin=150mVrms/1kHz,MUT=CD=SPSW= V^+,MON=OPEN, R_{VLC}=0Ω)

●**Power Supply**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current 1	I_{CC1}	RX-mode (Receive)	2.0	3.5	6.0	mA
Operating Current 2	I_{CC2}	TX-mode (Transmit)	2.0	3.5	6.0	mA
Operating Current 3	I_{CC3}	Idle-mode (Standby)	2.0	3.5	6.0	mA
Operating Current 4	I_{CC4}	Idle-mode ,SPSW=PD	1.0	2.5	4.0	mA
Operating Current 5	I_{CC5}	Idle-mode ,CD=PD,SPSW=PD	0.5	1	1.5	mA
Reference Voltage	V_{REF}	No signal,Idle-mode	2.2	2.5	2.8	V

●**Receive Attenuator**(RxIN=200Vrms,Receive Amplifier Gv=0dB)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Receive Attenuator Gain 1	G_{R1}	RX-mode (Receive)	3.0	6.0	9.0	dB
Receive Attenuator Gain 2	G_{R2}	TX-mode (Transmit)	-42	-46	-50	dB
Receive Attenuator Gain 3	G_{R3}	Idle-mode (Standby)	-17	-20	-23	dB
Range R to T mode	dG_R	RX-mode – TX-mode	47	52	57	dB
Dynamic DC offset	G_{RDC}	RX-mode – TX-mode (DC)	-50	-	50	mV
Volume control range	G_{RVR}	RX-mode,R_{VLC}=0Ω-100kΩ	35	45	55	dB

●**Transmit Attenuator** (TxIN=200Vrms,Mic.amplifier Gv=0dB)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Transmit Attenuator Gain 1	G_{T1}	TX-mode (Transmit)	3.0	6.0	9.0	dB
Transmit Attenuator Gain 2	G_{T2}	RX-mode (Receive)	-42	-46	-50	dB
Transmit Attenuator Gain 3	G_{T3}	Idle-mode (Standby)	-17	-20	-23	dB
Range R to T mode	dG_T	TX-mode – RX-mode	47	52	57	dB
Dynamic DC offset	G_{TDC}	TX-mode – RX-mode (DC)	-50	-	50	mV

●**MIC Amplifier**(TxIN=1mVrms,Gv=40dB,R_L=5.1kΩ)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Offset Voltage	V_{MOS}	RF=300kΩ	-50	0.0	50	mV
Input Bias Current	I_{MBIAS}		-	30	-	nA
Voltage Gain 1	G_{VM1}	f=1kHz	-	40	-	dB
Voltage Gain 2	G_{VM2}	f=20kHz	-	36	-	dB
Maximum Output Voltage	V_{MMAX}	THD=1%	1.0	-	-	Vrms
Maximum Attenuation	G_{MMUTE}	MUT=MUTE	-70	-73	-	dB

●**Receive Amplifier** (RxIN=1mVrms,Gv=40dB,R_L=5.1kΩ)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Offset Voltage	V_{ROS}	RF=300kΩ	-50	0.0	50	mV
Input Bias Current	I_{RBIAS}		-	30	-	nA
Voltage Gain 1	G_{VR1}	f=1kHz	-	40	-	dB
Voltage Gain 2	G_{VR2}	f=20kHz	-	36	-	dB
Maximum Output Voltage	V_{RMAX}	THD=1%	1.0	-	-	Vrms

●**Line Amplifier** (LINEIN=50mVrms, G_V=26dB,R_L=1.2kΩ)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Offset Voltage	V_{LOS}	RF=51kΩ	-50	0.0	50	mV
Input Bias Current	I_{RBIAS}		-	30	-	nA
Voltage Gain 1	G_{vL1}	f=1kHz	-	26	-	nA
Voltage Gain 2	G_{vL2}	f=20kHz	-	25	-	nA
Gain Bandwidth	G_{LBW}	RL=600Ω,LIO	-	1.5	-	MHz
Closed Loop Gain	G_{LC}	RL=1.2kΩ,LIO- to LIO+	-0.5	0	0.5	dB
Maximum Output Voltage	V_{LMAX}	RL=1.2kΩ,THD=1%	2.0	-	-	Vrms
Total Harmonic Distortion	THD_{LN}	VIN=100mVrms,G_V=20dB RL=1.2Ω	-	-	0.5	%

●**Speaker Amplifier** (SPIN=50mVrms, G_V=26dB,R_L=32Ω)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Offset Voltage	V_{SPOS}	RF=51kΩ	-50	0.0	50	mV
Voltage Gain 1	G_{VSP1}	f=1kHz	-	26	-	dB
Voltage Gain 2	G_{VSP2}	f=20kHz	-	24	-	dB
Voltage Gain 3	G_{VSP3}	f=1kHz, G_{VSP}=6dB,RL=8Ω	-	6	-	dB
Voltage Gain 4	G_{VSO4}	f=20kHz, G_{VSP}=6dB,RL=8Ω	-	4	-	dB
Closed Loop Gain	G_{LC}	SPO- to SPO+	-0.6	0	0.6	dB
Maximum Output Power	Po_{MAX1}	RL=32Ω,THD=3%	200	300	-	mW
	Po_{MAX2}	RL=8Ω,THD=3%	300	500	-	mW
Total Harmonic Distortion	THD_{SP1}	VIN=500mVrms,f=1KHz, RL=32Ω,G_{VD}=26dB		-	1.0	%
	THD_{SP2}	VIN=500mVrms,f=1KHz, RL=8Ω,G_{VD}=6dB	-	-	1.0	%

●MONITOR TERMINAL (MON)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
R_X-mode	Rx	-	V^+-0.6	-	V^+	V
T_X-mode	Tx	-	GND	-	0.6	V
Idle-mode	Idle	No Signal	2.4	2.5	2.6	V
Maximum Output Current	I_{MON}	Rx-mode / Tx-mode	-	0.9	-	mA

■ CONTROL CHARACTERISTICS (CD,MUT,SPSW)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Low Level Input Voltage	V_{IL1}	-	-	-	0.3	V
High Level Input Voltage	V_{IH1}	-	1.5	-	-	V

■ CONTROL CHARACTERISTICS (RTSW)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Low Level Input Voltage	V_{IL2}	-	-	-	0.3	V
High Level Input Voltage	V_{IH2}	-	V^+-0.3	-	-	V

■ FUNCTION

●CD

INPUT VOLTAGE	STATUS	OPERATION
V_{IH}	ACTIVE	NJW1128 is active.
V_{IL}	MUTE	NJW1128 is stand-by except Speaker Amplifier.

●MUT

INPUT VOLTAGE	STATUS	OPERATION
V_{IH}	MUTE	The microphone input is mute.
V_{IL}	ACTIVE	The microphone input is active.

●SPSW

INPUT VOLTAGE	STATUS	OPERATION
V_{IH}	ACTIVE	The Speaker Amplifier is Active.
V_{IL}	PD	The Speaker Amplifier is Stand-by.

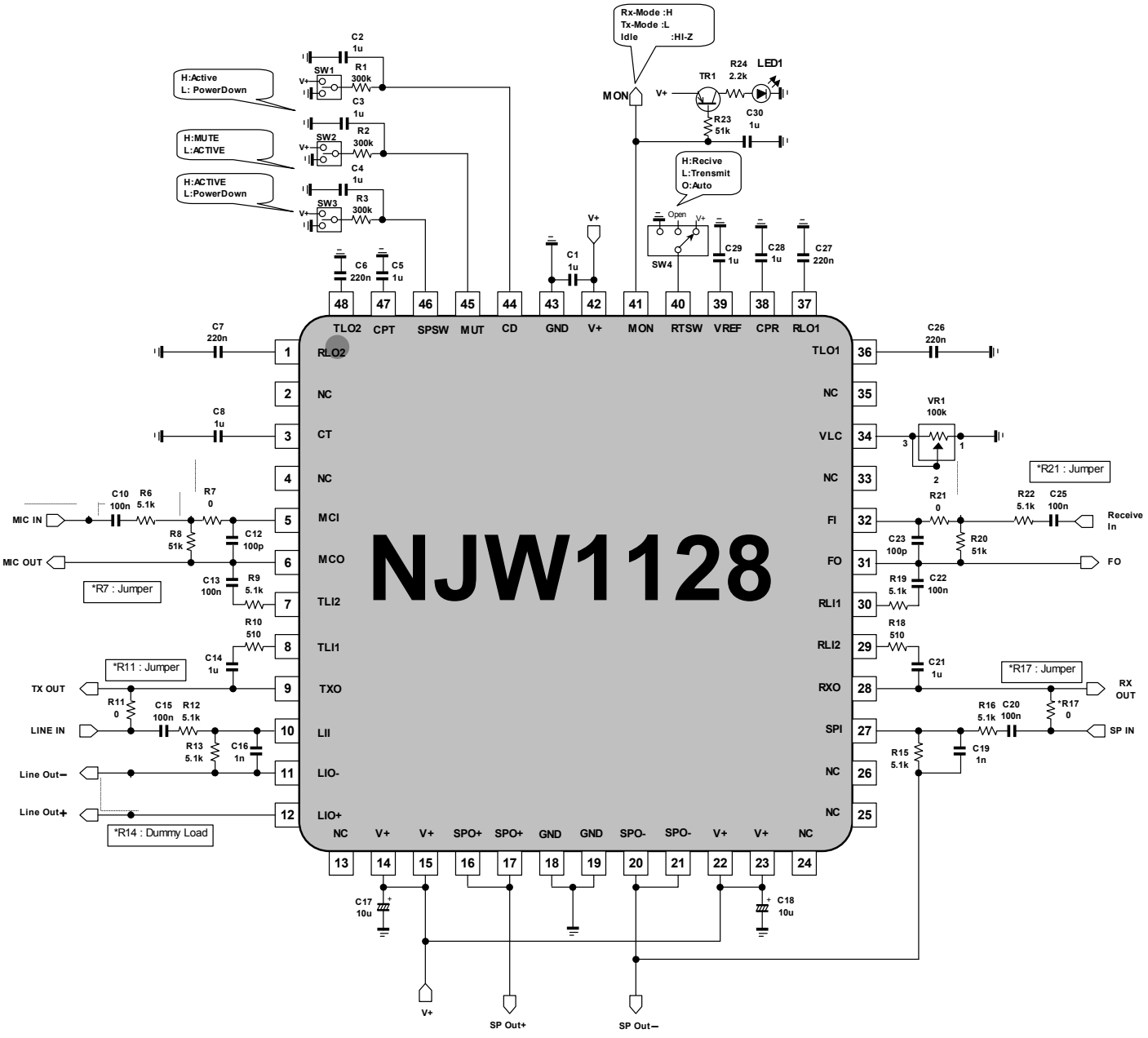
●RTSW

INPUT VOLTAGE	STATUS	OPERATION
V_{IH}	Receive	Force to Receive mode.
OPEN	AUTO	Receive mode and Transmit mode are automatically switched.
V_{IL}	Transmit	Force to Transmit mode.

●R_{VLC} (34pin)

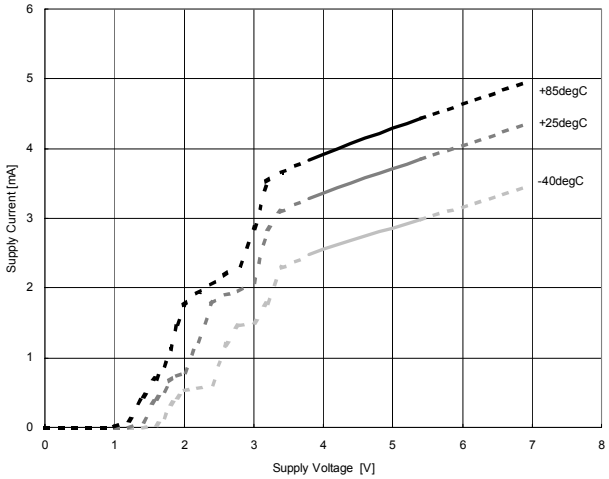
IMPEDANCE	STATUS	OPERATION
0	Vol_{MAM}	The Receive attenuator Volume is maximum.
100kΩ	Vol_{MIN}	The Receive attenuator Volume is minimum.

■ APPLICATION CIRCUIT

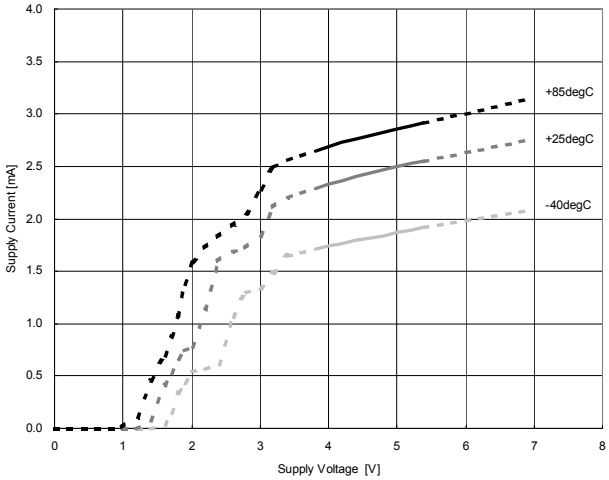


■ TYPICAL CHARACTERISTICS

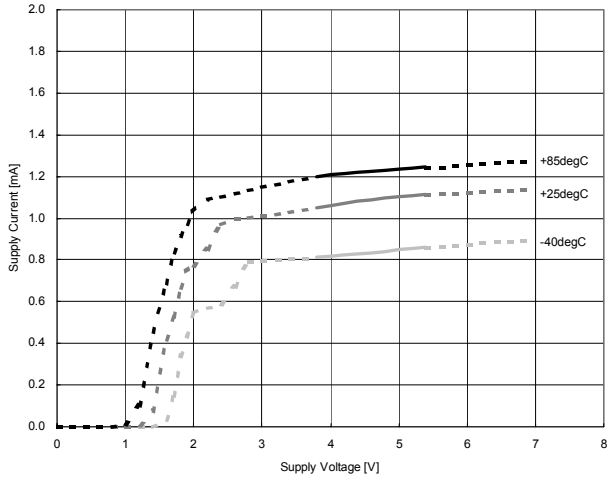
Supply Current vs Supply Voltage
No Signal , Supply Current 1



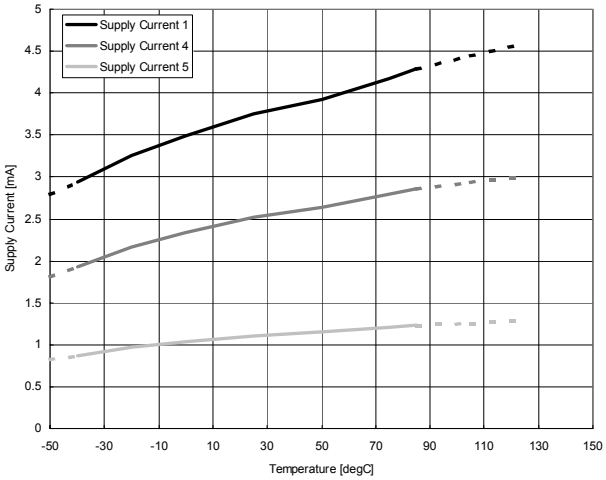
Supply Current vs Supply Voltage
No Signal , Supply Current 4



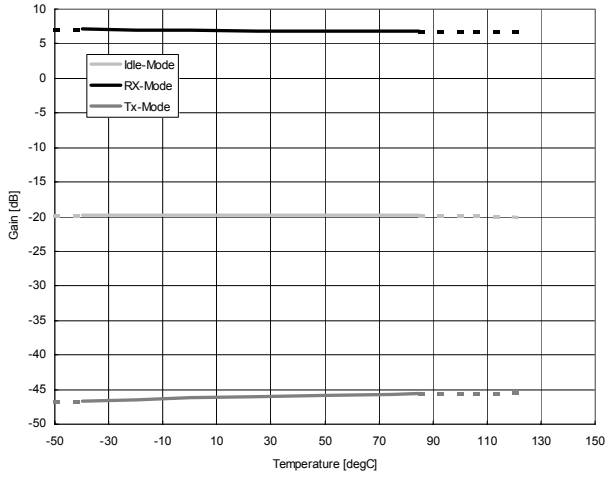
Supply Current vs Supply Voltage
No Signal , Supply Current 5



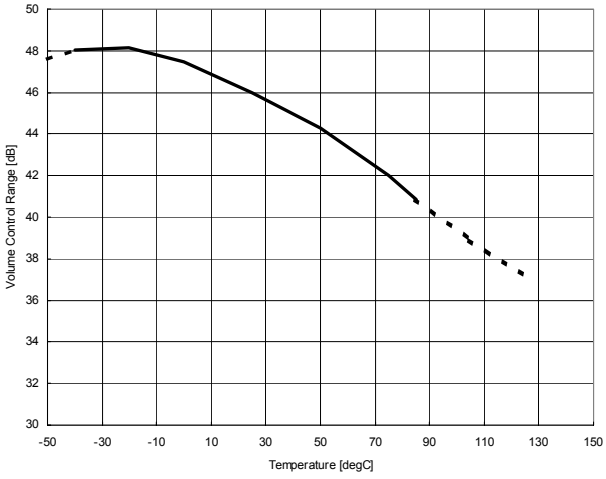
Supply Current vs Temperature
V+ =5.0V , No Signal



RxAtt Gain vs Temperature
V+ =5.0V , RecieveAmp : 0dB , RL=5.1kΩ

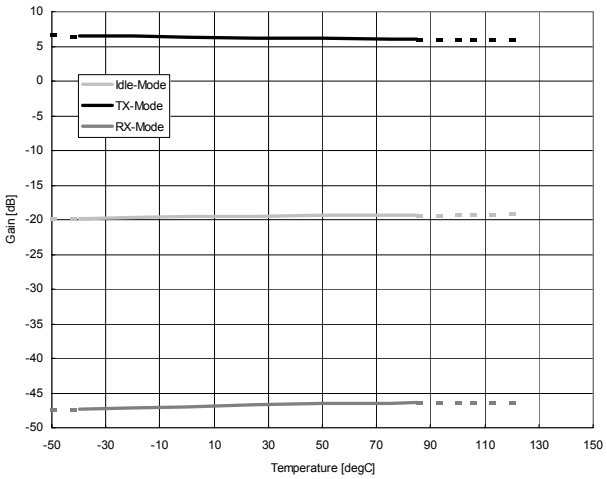


RxAtt Gain vs Temperature
V+ =5.0V , Rx-Mode , RecieveAmp : 0dB , RL=5.1kΩ

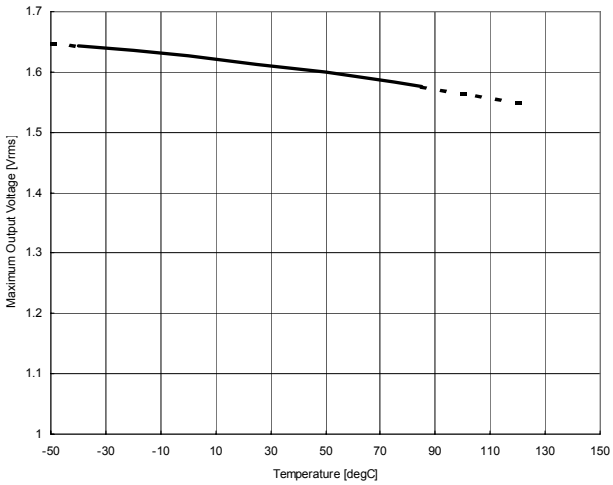


■ TYPICAL CHARACTERISTICS

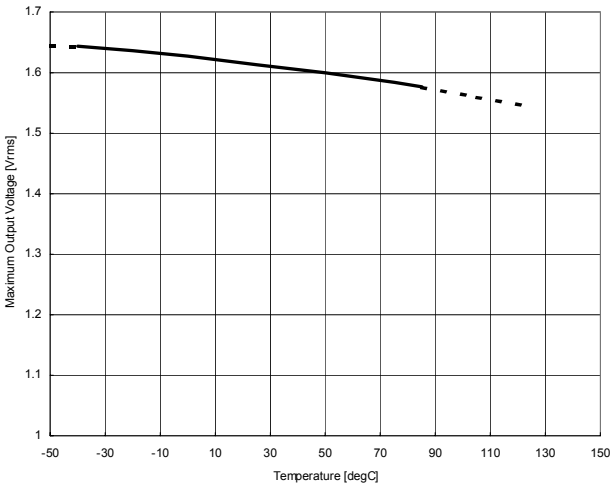
TxAtt Gain vs Temperature
V+ = 5.0V , MicAmp : 0dB , RL=5.1kΩ



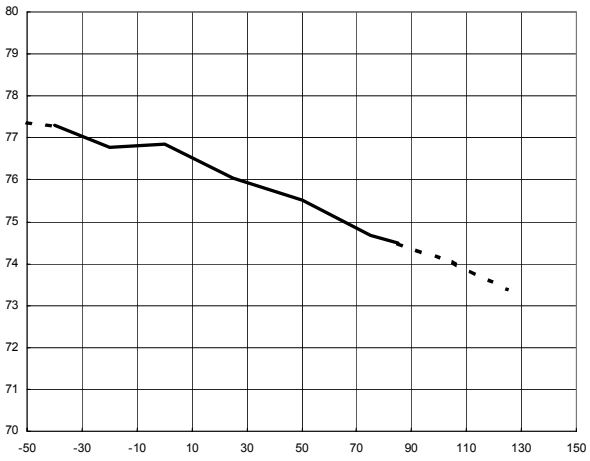
RecieveAmp Maximum Output Voltage vs Temperature
V+ = 5.0V , f = 1kHz Rf = 300kΩ , Gv=40dB , RL=5.1kΩ , THD+N = 1% , BW=400Hz-30kHz



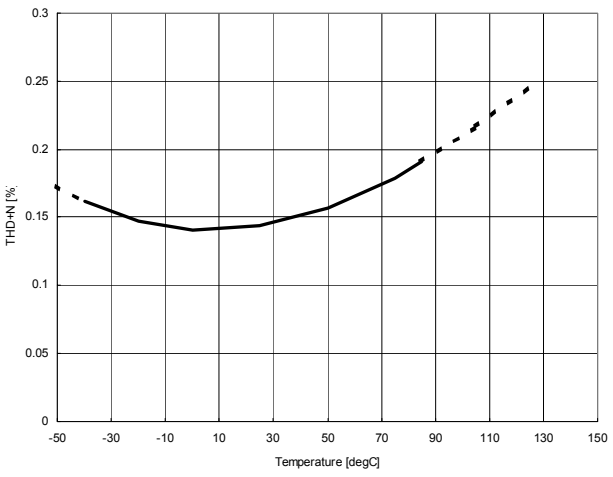
MicAmp Maximum Output Voltage vs Temperature
V+ =5.0V , f = 1kHz , Rf = 300kΩ , Gv=40dB , RL=5.1kΩ , THD+N = 1% , BW=400Hz-30kHz



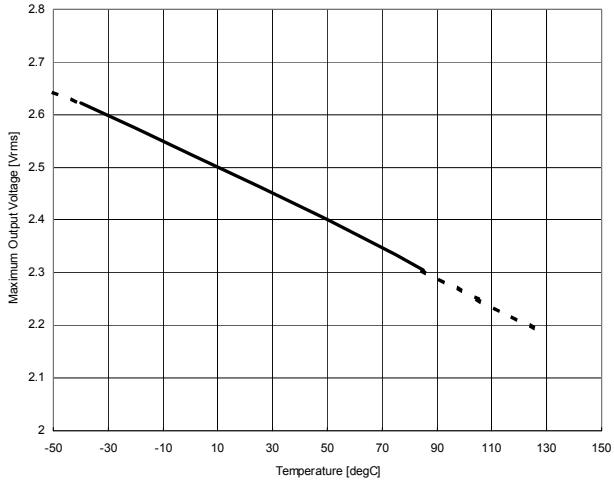
MicAmp Mute Range vs Temperature
V+ =5.0V , Rf = 300kΩ , Gv=40dB , RL=5.1kΩ , A-Weighting



LineAmp THD vs Temperature
V+ =5.0V , f = 1kHz , Rf = 51kΩ , Gv=26dB , Vin = 50mVrms , RL=1.2kΩ , BW=400Hz-30kHz

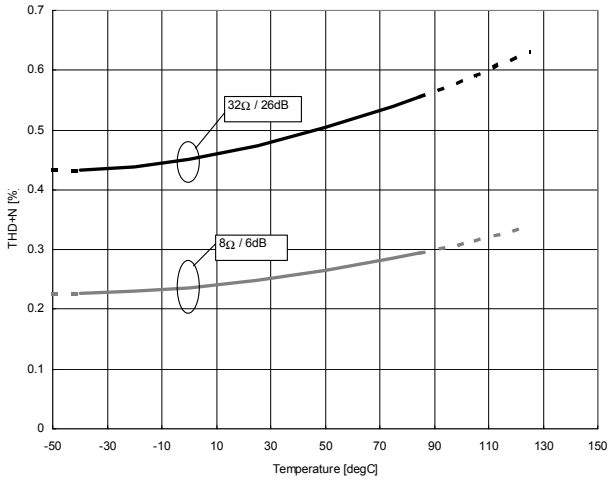


LineAmp Maximum Output Voltage vs Temperature
V+ =5.0V , f = 1kHz , Rf = 51kΩ , Gv=26dB , RL=1.2kΩ , THD+N = 1% , BW=400Hz-30kHz

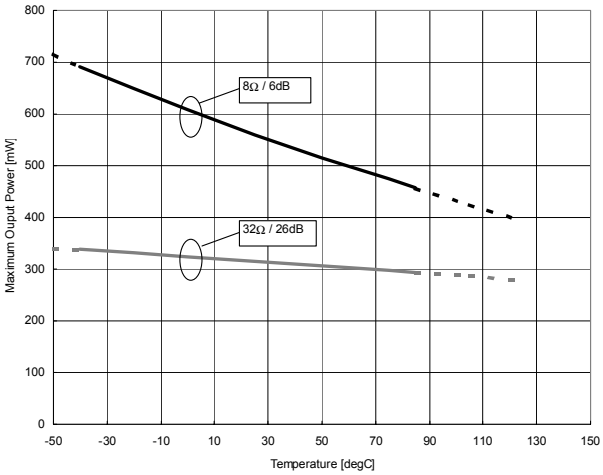


■ TYPICAL CHARACTERISTICS

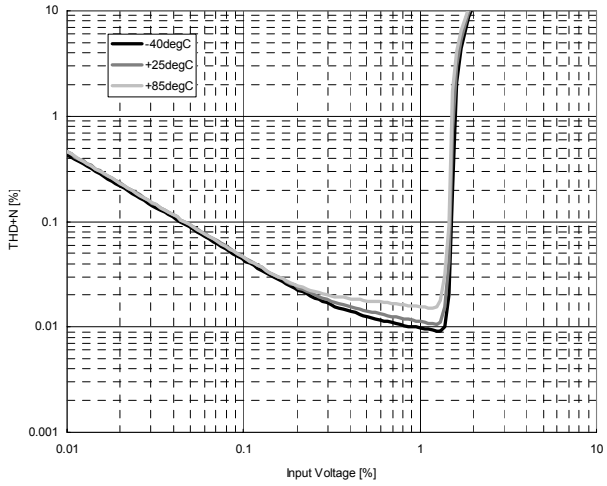
Speaker Amp THD vs Temperature
V+ =5.0V , f = 1kHz , BW=400Hz-30kHz



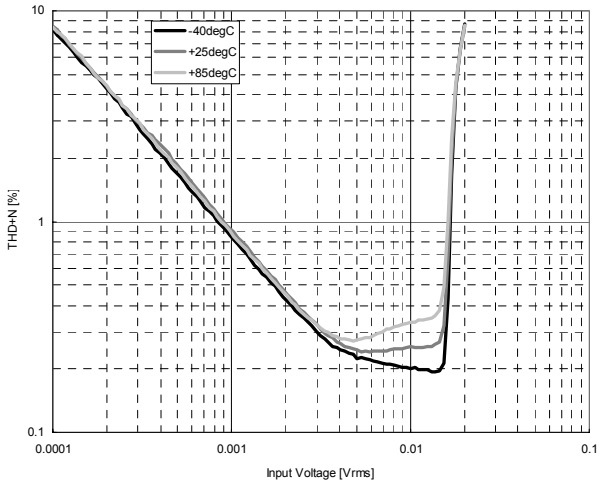
Speaker Amp Maximum Output Power vs Temperature
V+ =5.0V , f = 1kHz , THD+N = 3% , BW=400Hz-30kHz



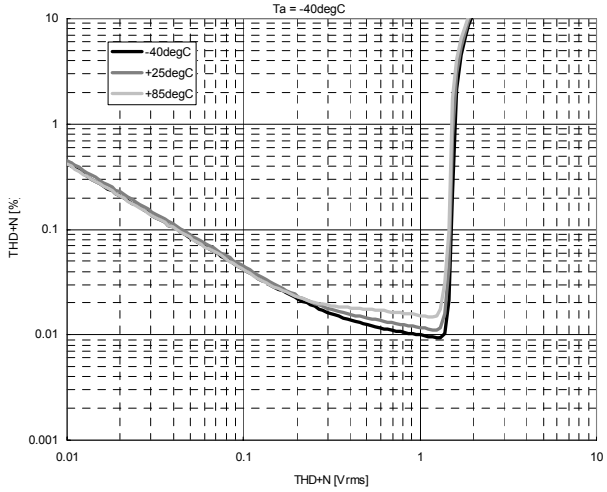
Receive Amp THD+N vs Input Voltage
V+ = 5.0V , f = 1kHz Rf = 3kΩ , Ri=3kΩ , Ci = 1μF , Gv=0dB , RL=5.1kΩ , BW=400Hz-30kHz



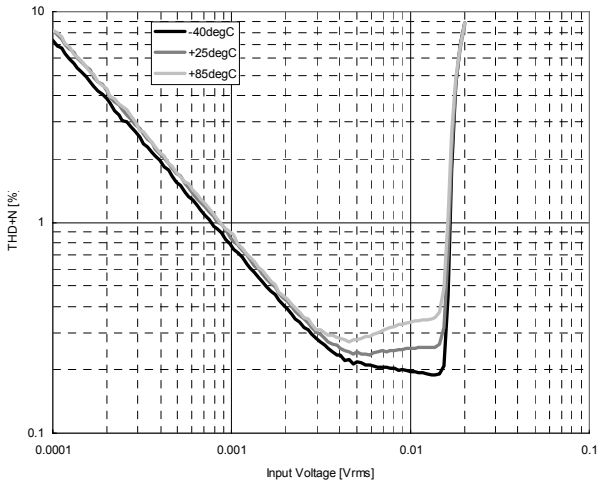
Receive Amp THD+N vs Input Voltage
V+ = 5.0V , f = 1kHz Rf = 300kΩ , Ri=3kΩ , Ci = 1μF , Gv=40dB , RL=5.1kΩ , BW=400Hz-30kHz



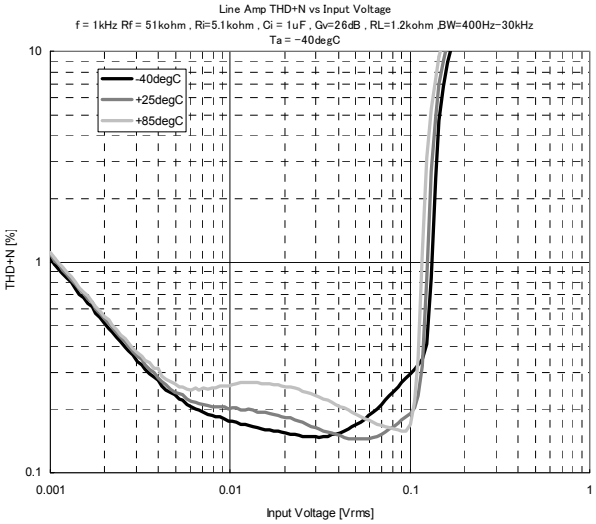
Mic Amp THD+N vs Input Voltage
f = 1kHz Rf = 3kohm , Ri=3kohm , Ci = 1uF , Gv=0dB , RL=5.1kohm ,BW=400Hz-30kHz
Ta = -40degC

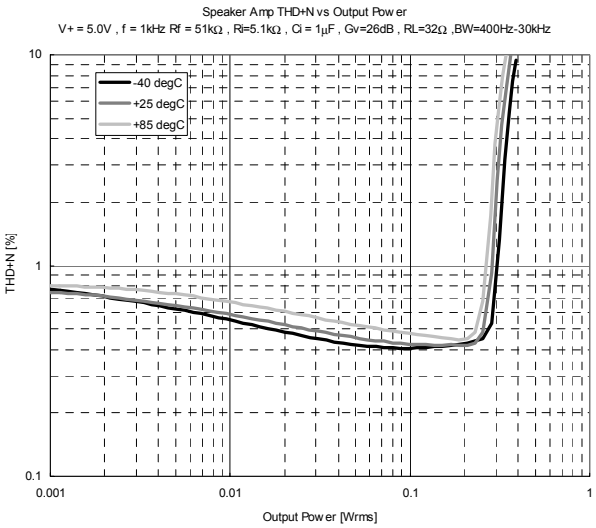


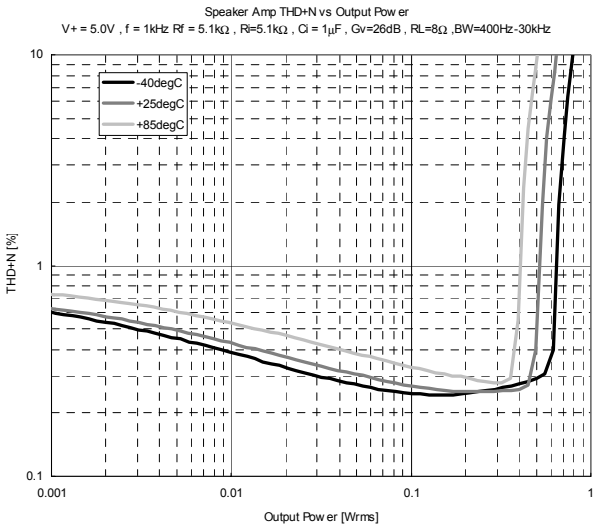
Mic Amp THD+N vs Input Voltage
V+ = 5.0V , f = 1kHz Rf = 300kΩ , Ri=3kΩ , Ci = 1μF , Gv=40dB , RL=5.1kΩ , BW=400Hz-30kHz

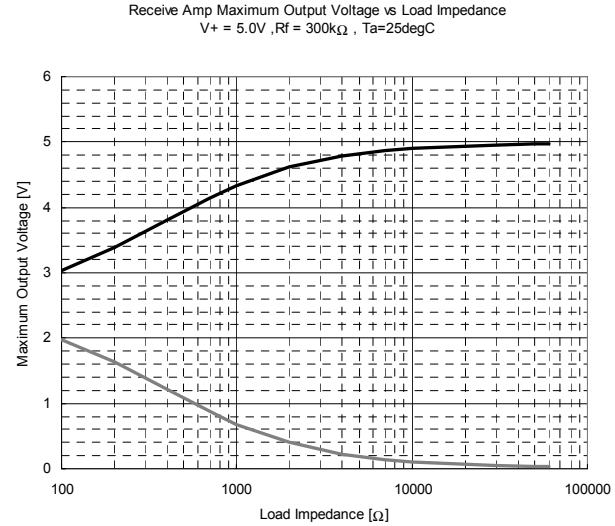


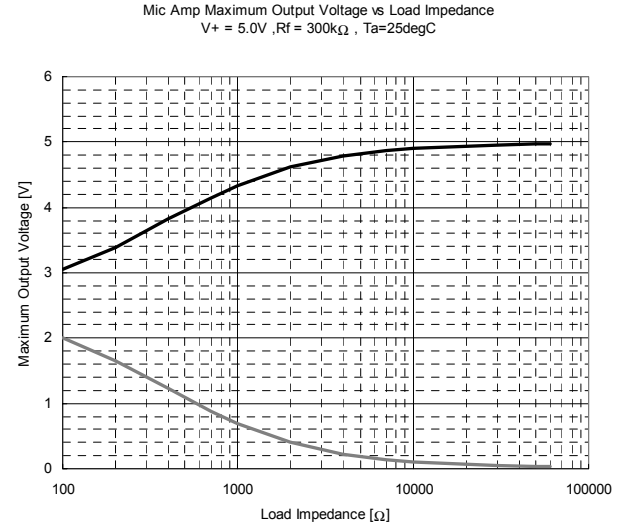
■ TYPICAL CHARACTERISTICS





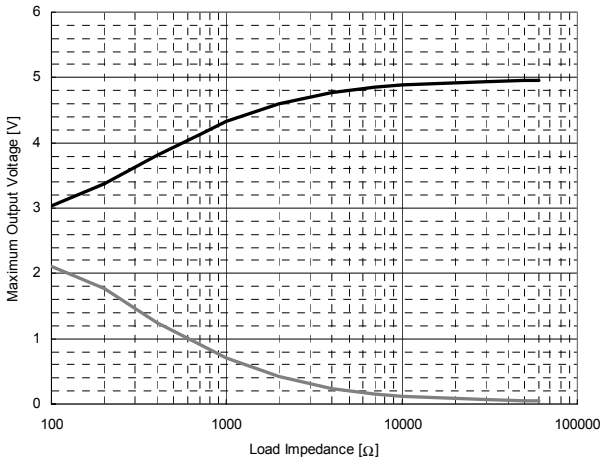




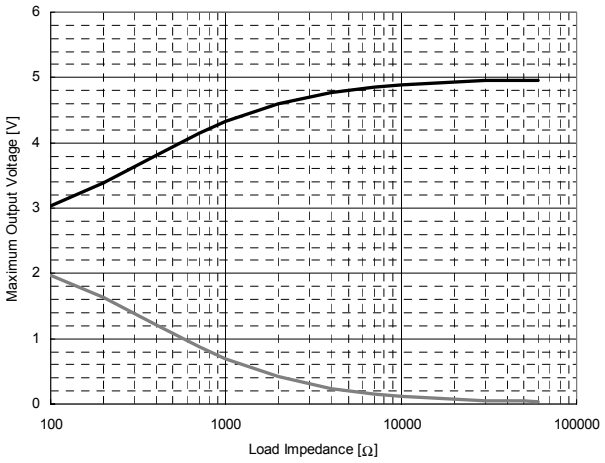


■ TYPICAL CHARACTERISTICS

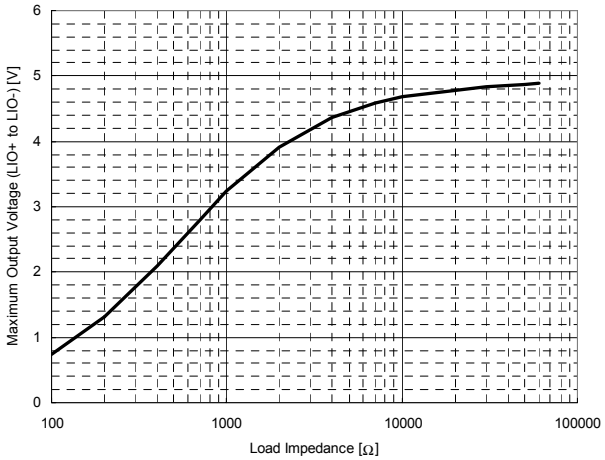
Rx Att Maximum Output Voltage vs Load Impedance
V+=5.0V , Ta=25degC



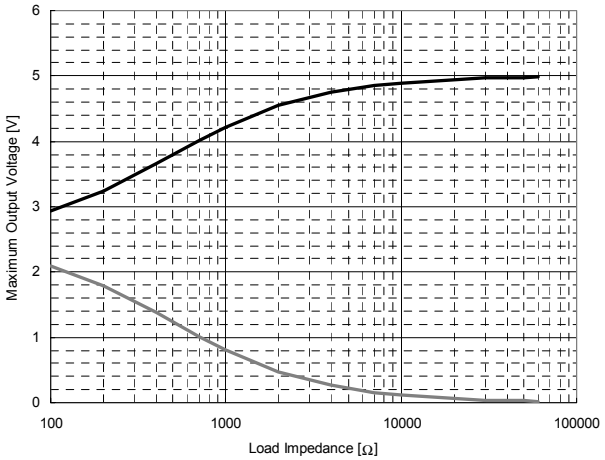
Tx Att Maximum Output Voltage vs Load Impedance
V+=5.0V , Ta=25degC



Line Amp Maximum Output Voltage vs Load Impedance
V+ = 5.0V ,Rf = 51kΩ , Ta=25degC

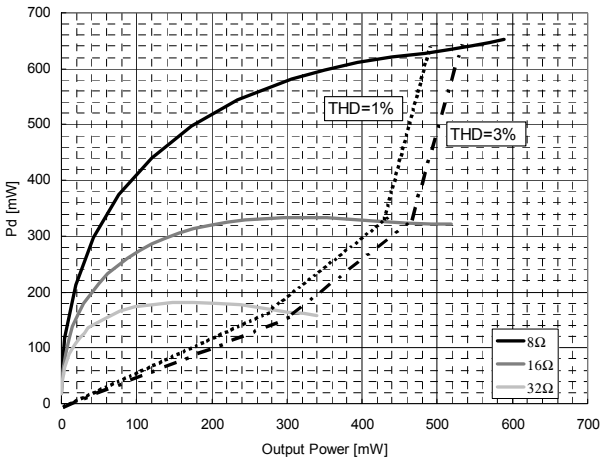


Monitor out Maximum Output Voltage vs Load Impedance
V+=5.0V , Ta=25degC

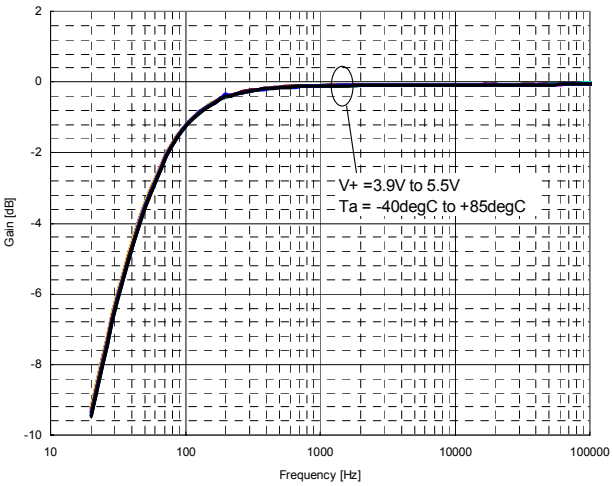


■ TYPICAL CHARACTERISTICS

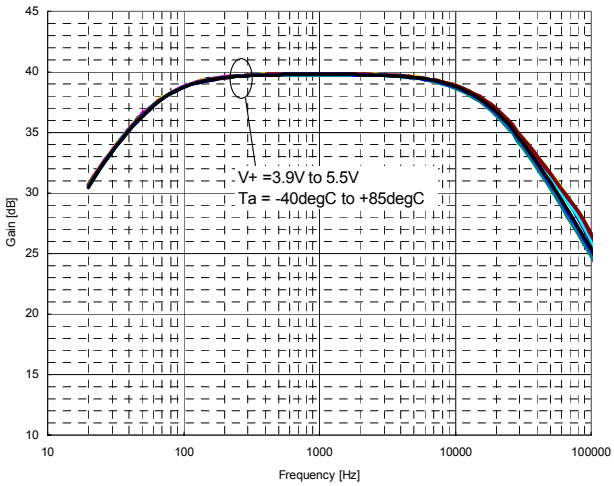
Pd vs Output Power
V+=5.0V , f=1kHz , Gv=6dB , BW=400Hz-30kHz , Ta=25degC



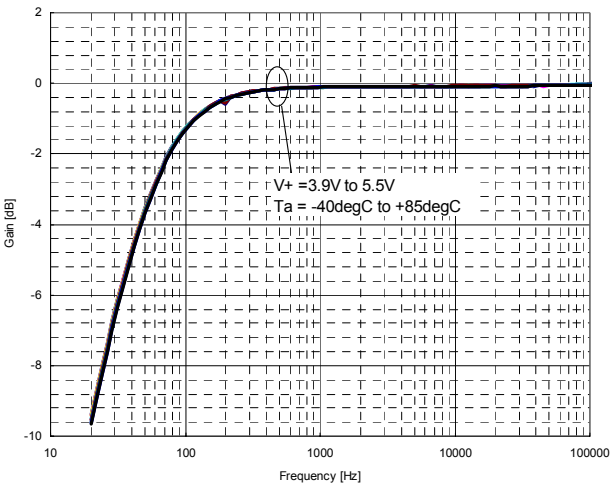
RecieveAmp Voltage Gain vs Frequency
Vin = 100mVrms , Rf = 3kΩ , Ri = 3kΩ , Ci = 1μF , Gv=0dB , RL=5.1kΩ



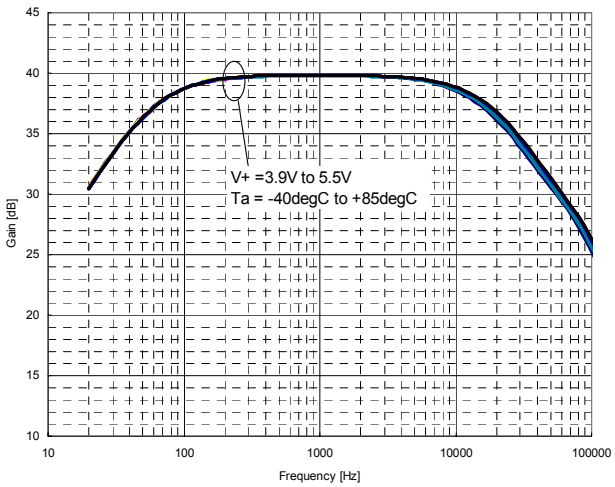
RecieveAmp Voltage Gain vs Frequency
Vin = 1mVrms , Rf = 300kΩ , Ri = 3kΩ , Ci = 1μF , Gv=40dB , RL=5.1kΩ



Mic Amp Voltage Gain vs Frequency
Vin = 100mVrms , Rf = 3kΩ , Ri = 3kΩ , Ci = 1μF , Gv=0dB , RL=5.1kΩ

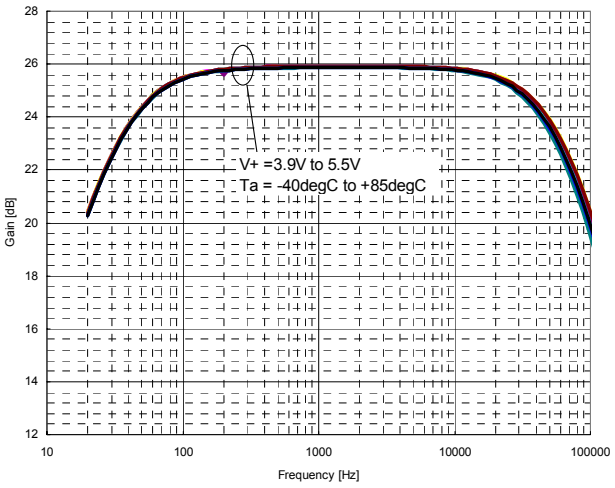


Mic Amp Voltage Gain vs Frequency
Vin = 1mVrms , Rf = 300kΩ , Ri = 3kΩ , Ci = 1μF , Gv=40dB , RL=5.1kΩ

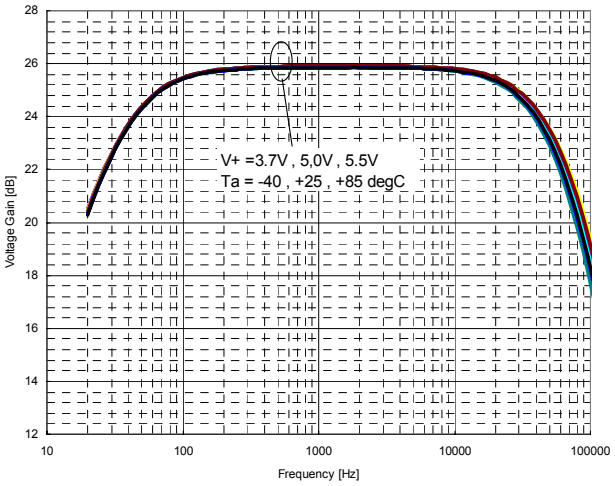


■ TYPICAL CHARACTERISTICS

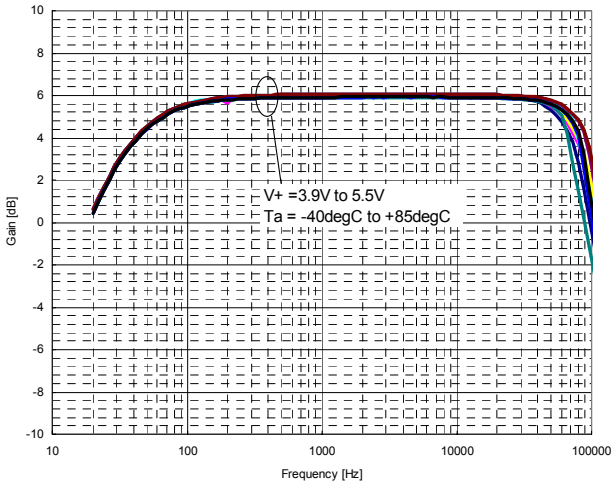
Line Amp Voltage Gain vs Frequency
Vin = 50mVrms , Rf = 51kΩ , Ri = 5.1kΩ , Ci = 1μF , Gv=26dB , RL=1.2kΩ



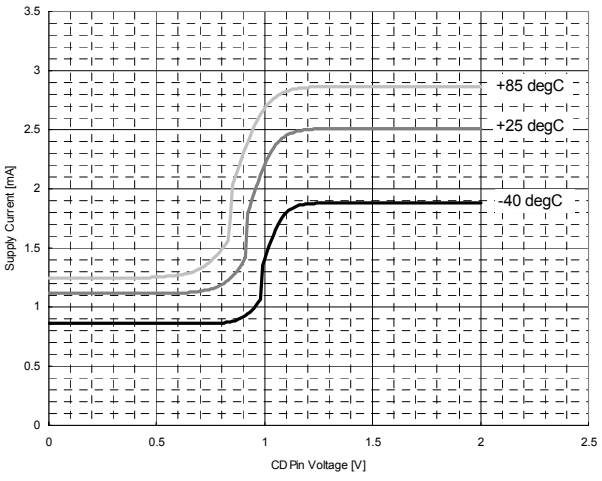
Speaker Amp Voltage Gain vs Frequency
Vin = 50mVrms , Rf = 51kΩ , Ri = 5.1kΩ , Ci = 1μF , Gv=26dB , RL=32Ω



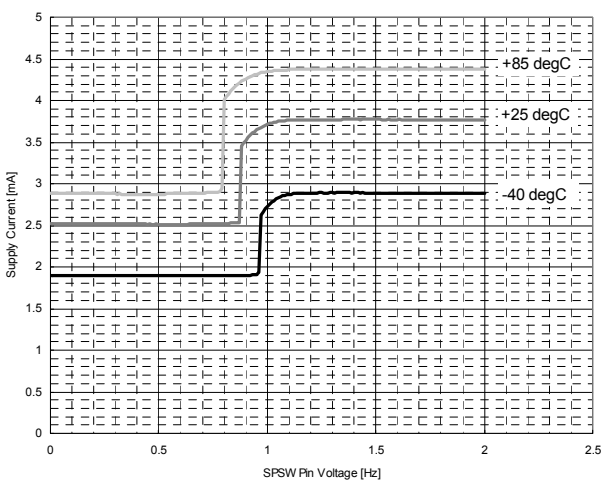
Speaker Amp Voltage Gain vs Frequency
Vin = 500mVrms , Rf = 5.1kΩ , Ri = 5.1kΩ , Ci = 1μF , Gv=6dB , RL=8Ω



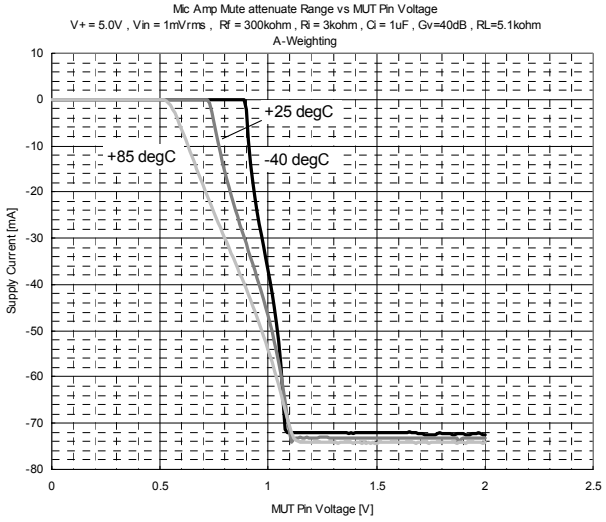
Supply Current vs CD Pin Voltage
V+ = 5.0V , SPSW = PD , RTSW = Open , no Signal

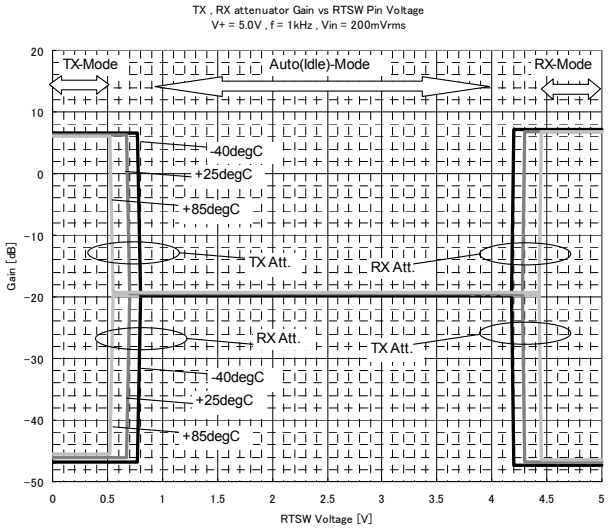


Supply Current vs SPSW Pin Voltage
V+ = 5.0V , CD = Active , RTSW = Open , no Signal



■ TYPICAL CHARACTERISTICS





■APPLICATION NOTES

■GENERAL DESCRIPTION

The **NJW1128** is a Voice Switched Speakerphone Circuit. The **NJW1128** includes all of functions processing a high quality hands–free speakerphone system, such as the necessary amplifiers (Microphone amplifier , Receive amplifier, Line amplifier ,and speaker Amplifier), attenuators, level detectors .

The **NJW1124** detects a signal to judges which path is talking. After that, the one side path is active, another path is attenuated. This is half-duplex system. Appropriate operating keeps closed loop gain less than 0dB, and that prevents acoustic coupling.

All external capacitors are sufficient small so that ceramic capacitors are applied.

The resister and capacitor values in Fig.0.1 below are references. For correct operating, check in actual condition as possible as you can. And adjust the levels input each detectors.
On this application notes, Base unit is defined as the unit included the **NJW1128**.

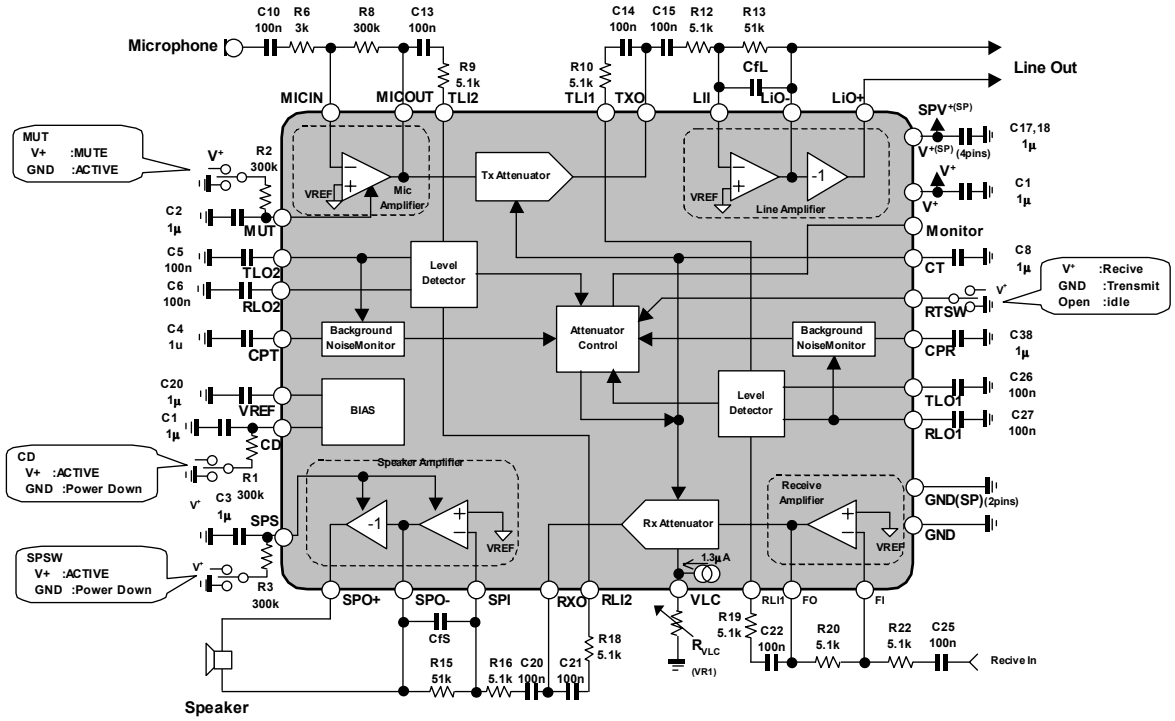


Fig.0.1 NJW1128 Block diagram

The resistance and capacitor value above is just one example.
Certain Half-duplex operation are not guaranteed.
Best value depends on your microphone, speaker, and chassis.
Understand NJW1128 operation and select appropriate value.

<Evaluation-Board Circuit>

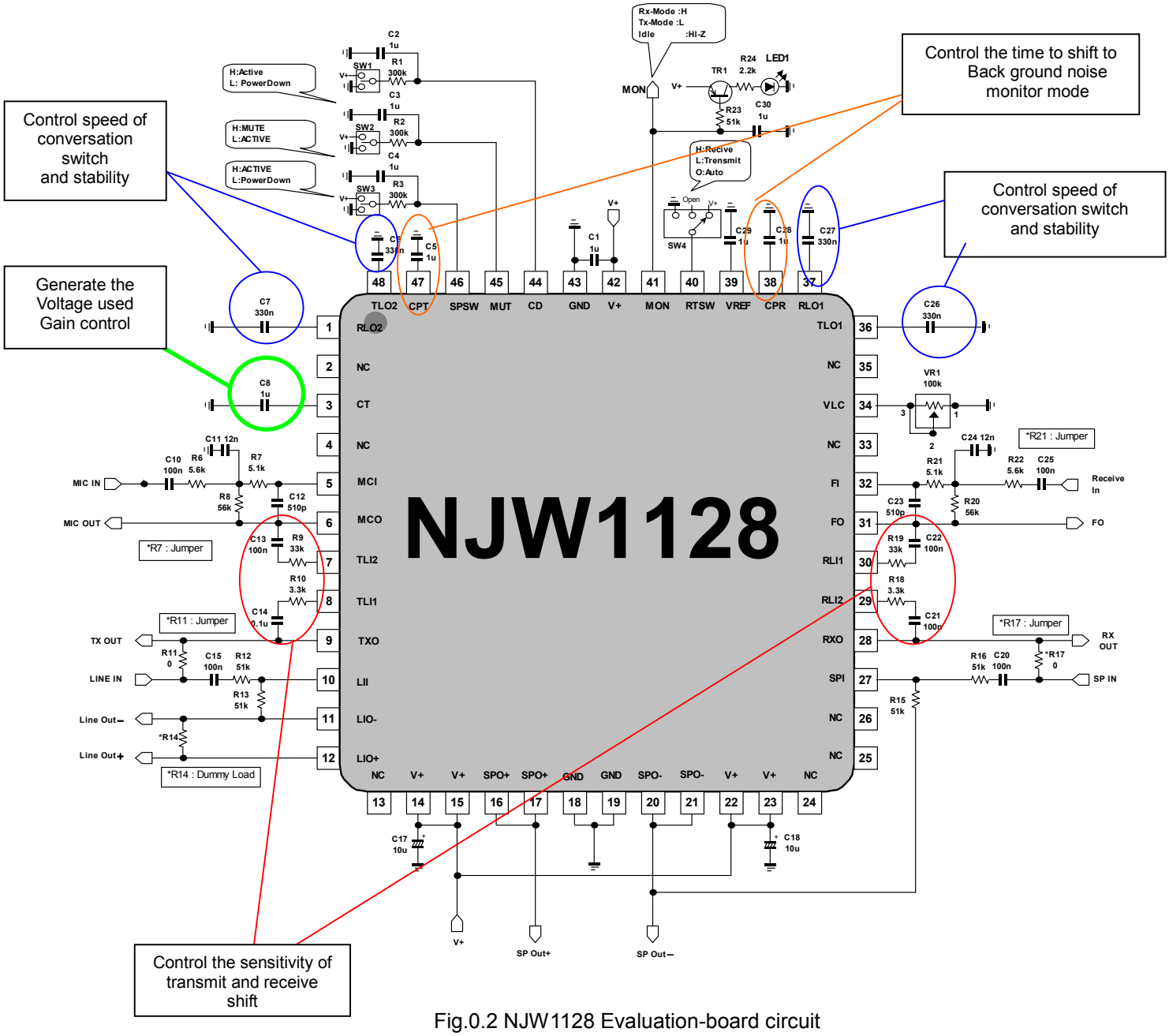


Fig.0.2 NJW1128 Evaluation-board circuit

<Power Supply Wiring layout>

42pin is sensitive for power supply ripple. Thus, ripple should be less than 10mVp-p.
Please use regulator for stable power supply.

1,42pin, other V+ pin, and 43pin(GND) should have lower common impedance as possible.

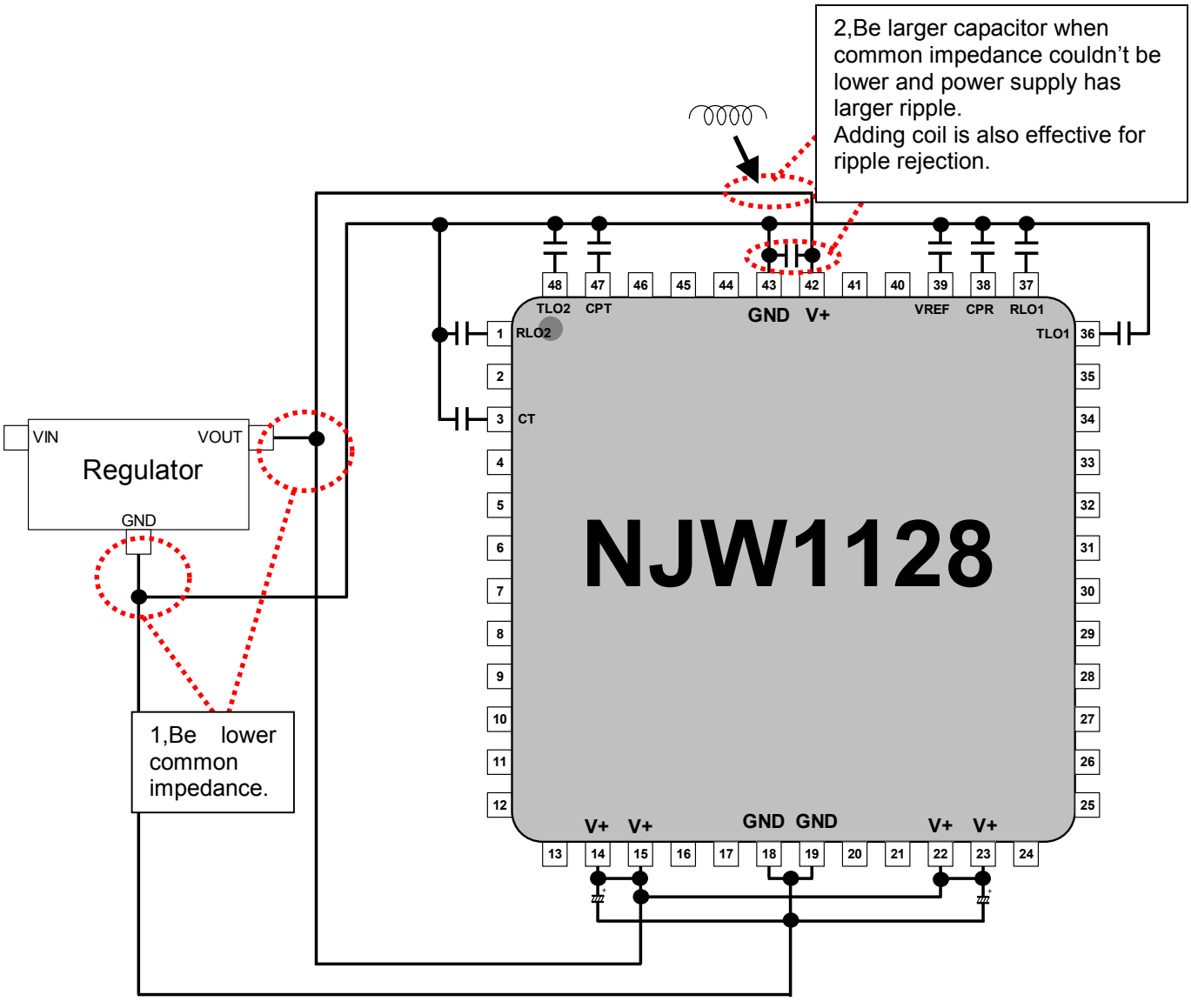
2,Large capacitor between 42pin and 43pin, in case of that common impedance couldn't be lower and power supply has larger ripple.

And, adding coil in front of bypass capacitor of 42pin is also effective for ripple rejection.

Supply same power source to 42pin and 14,15,22,23 pin. They are not able to use on different voltage.
Connect de-coupling capacitor to 14,15,22,23 pin.

43pin and 18,19pin should be connected to GND.
All V^+pin and GND pin should be connected for normal operating. Don't be Open.

Wire lower impedance GND side of capacitor connected to VREF,CPT,CPR,TL01,TL02,RL01,RL02,and CTpin as possible.



[Operating mode]
NJW1128 equips operating modes below.
Fig.0.4 shows simple NJW1128 diagram.

<Tx mode> signal input to mic. In(Transmit side)
Tx Attenuator sets +6dB, signal go route.1 though mic in to line amp.
At same time, route.2 sets –46dB to stop signal.

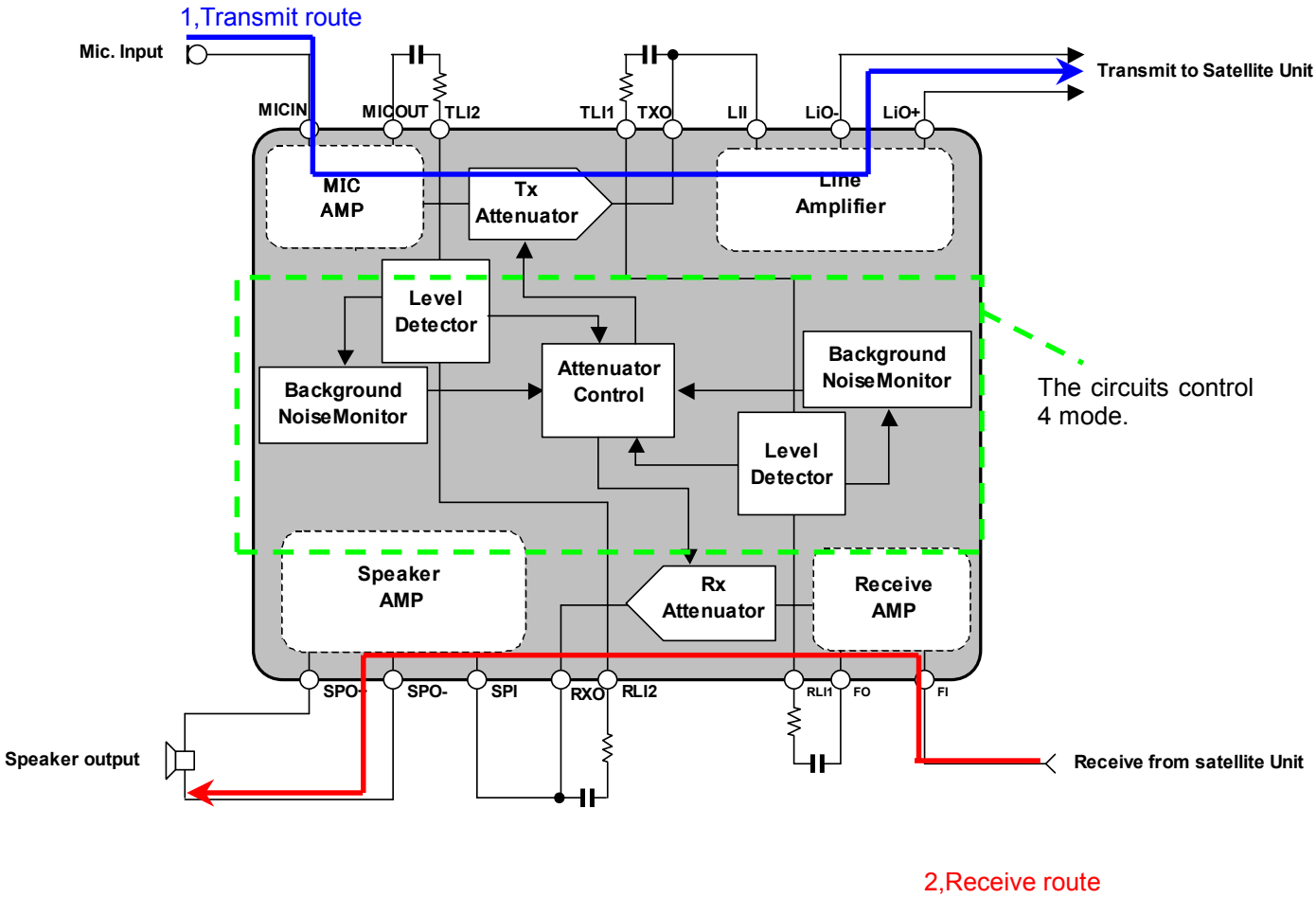
<Rx mode> signal input to Receive. In(Receive side)
Rx Attenuator sets +6dB, signal go route.2 though mic in to line amp.
At same time, route.1 sets –46dB to stop signal.

<Slow idle mode> environmental noise input or no signal input

continuous signal input to mic.input or receive input, or both input no signal
Rx attenuator and Tx attenuator set both –20dB.
Then, shifting transmit mode or receive mode to half conversation(both route -20dB) gradually.

<Fast idle mode> Transmit and Receive input at the same time.
To Mic.input and Receive input signal input at the same time, Rx attenuator and Tx attenuator set both –20dB. route1 and 2 shift half conversation(both route –20dB). Shifting transmit mode or receive mode to half conversation(both route -20dB) sharply.

We recommend forming filter of mic.amp and receive amp. to filtering some frequency we don't need.
That realizes to stable conversation.



[2wire-4wire convert circuit]

NJW1128 2wire application should be mixed or isolated by 2wire-4wire convert circuit
Fig0.5 shows conceptual diagram of 2wire - 4wire convert circuit.
Each impedance meeting this condition doesn't transmit VIN1toVout1 and VIN2toVout2.
That means transmit side signal doesn't leak to receive side, opposite side too.
This circuit enable to transmit and receive by 2wire.

$$Z_{14} = \frac{Z_{12} \times Z_{13}}{Z_{11}}$$

$$Z_{24} = \frac{Z_{22} \times Z_{23}}{Z_{21}}$$

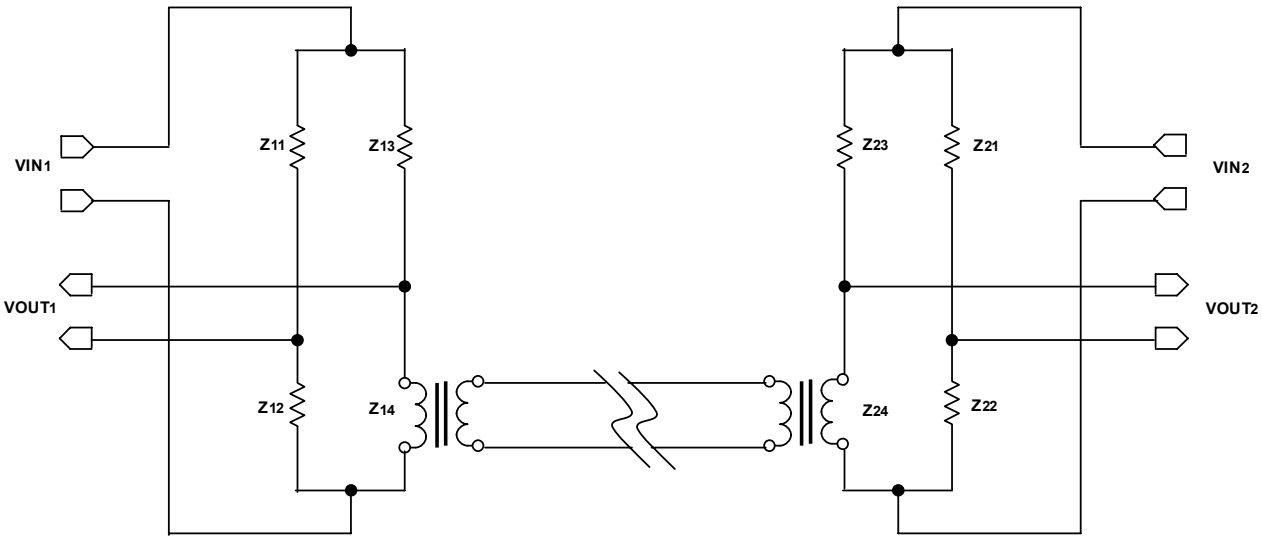


Fig.0.5 2wire-4wire convert circuit Conceptual diagram

Fig.6 shows 2wire –4wire convert circuit consisted of line amp of NJW1128 and Hybrid transformer.
Impedance matching Z1 and Z2 enable to operate normally..

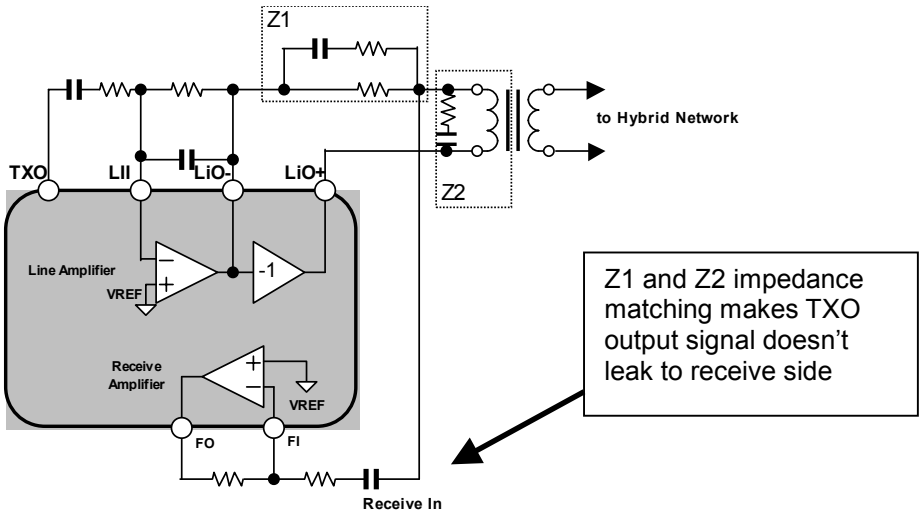


Fig.0.6 2wire –4wire convert circuit consisted of line amp of NJW1128 and Hybrid transformer

More details about equal circuit consisted of Tr or power supply superimposed circuit , refer to other technical book on phone line.

[Thermal Design]
Notice of thermal design on Speaker Amplifier.

Fig.0.7 shows Maximum power dissipation of NJW1128(LQFP48-R3) and Ambient temperature Ta.
Test condition is EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 2layer, FR-4) mounting and EIA/JEDEC STANDARD Test board (76.2x114.3x1.6mm, 4layer, FR-4) mounting.

Calculate appropriate P_D to be lower than Pdmax(maximum Power dissipation).
Fig.0.8 shows PD and Speaker output power .

Actual Pdmax depends on your PCB type, PCB size, wiring. Consider appropriate thermal design.

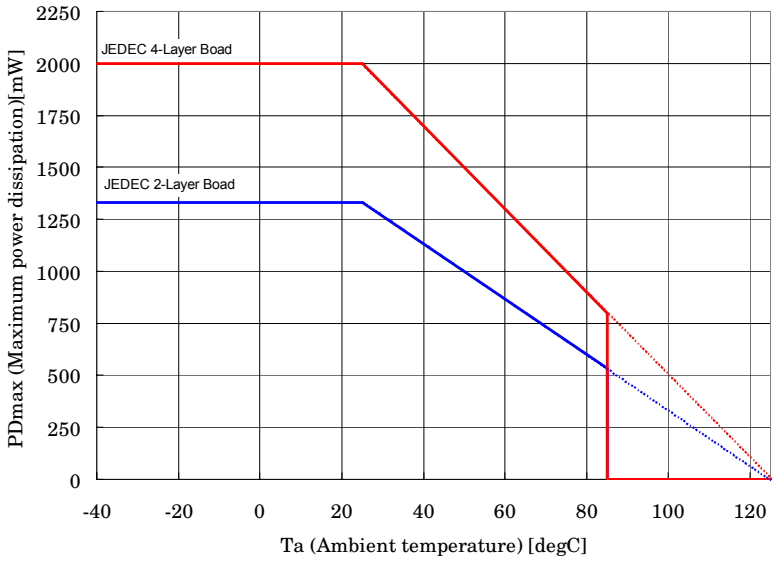


Fig.0.7 NJW1128(LQFP48-R3) $P_D$max and Ta

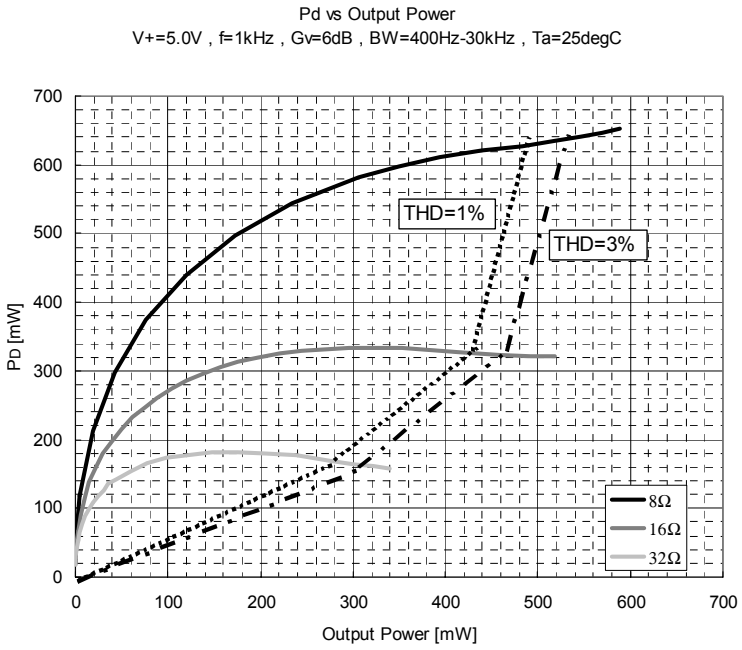


Fig.0.8 NJW1128 P_D and Speaker output power

1.Receive Attenuator

Receive Attenuator has 3 modes depending on base and satellite unit condition.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Receive Attenuator Gain 1	G_{R1}	RX-mode (Receive)	3.0	6.0	9.0	dB
Receive Attenuator Gain 2	G_{R2}	TX-mode (Transmit)	-43	-46	-50	dB
Receive Attenuator Gain 3	G_{R3}	Idle-mode (Standby),CPT=CPR=V^+	-17	-20	-23	dB

1.Receive Attenuator Gain 1 , (Receive mode :Gain=+6dB)
Condition: Receive the signal from satellite unit, and no transmit the signal to satellite unit.

2. Receive Attenuator Gain 2 , (Transmit mode :Gain=-46dB)
Condition: Transmit the signal to satellite unit, and no receive signal from satellite unit.

3. Receive Attenuator Gain 3 , (Idle mode :Gain=-20dB)
Condition: Both lines are attenuated (-20dB).

Receive attenuator mode depends on level controller detection mode.

Volume Control

Receive Attenuator includes Volume Control.
Volume is controlled by resister value connected to VCL pin.
Fig.2 shows Volume attenuate vs. Resister value.
Volume max.(0dB) : 0Ω,
Volume min. (-40dB): 100kΩ .

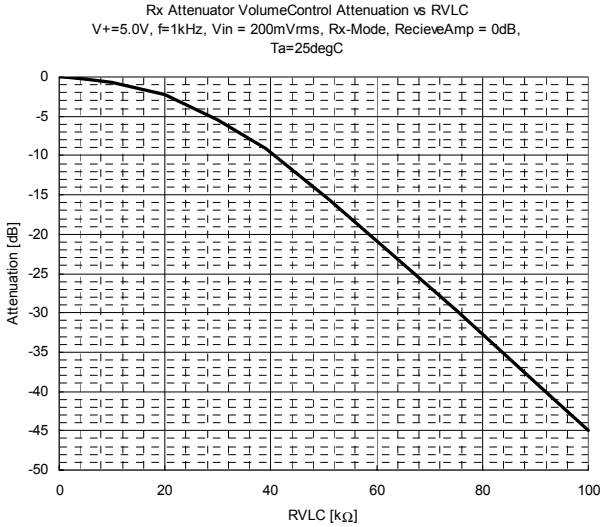


Fig.2 Volume vs. Resister

2.Transmit Attenuator

Transmit Attenuator has 3 modes depending on base and satellite unit condition.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Transmit Attenuator Gain 1	G_{T1}	RX-mode (Receive)	3.0	6.0	9.0	dB
Transmit Attenuator Gain 2	G_{T2}	TX-mode (Transmit)	-43	-46	-50	dB
Transmit Attenuator Gain 3	G_{T3}	Idle-mode (Standby),CPT=CPR=V^+	-17	-20	-23	dB

1.Transmit Attenuator Gain 1 , (Transmit mode :Gain=+6dB)
Condition: Transmit the signal to satellite unit, and No receive the signal from satellite unit.

2. Transmit Attenuator Gain 2 , (Transmit mode :Gain=-46dB)
Condition: No Transmit the signal to satellite unit, and Receive the signal from satellite unit.

3. Transmit Attenuator Gain 3 , (Idle mode :Gain=-20dB)
Condition: Both lines are attenuated (-20dB)

Transmit attenuator mode depends on level controller detection mode.
Transmit Attenuator doesn't equip Volume Control.