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

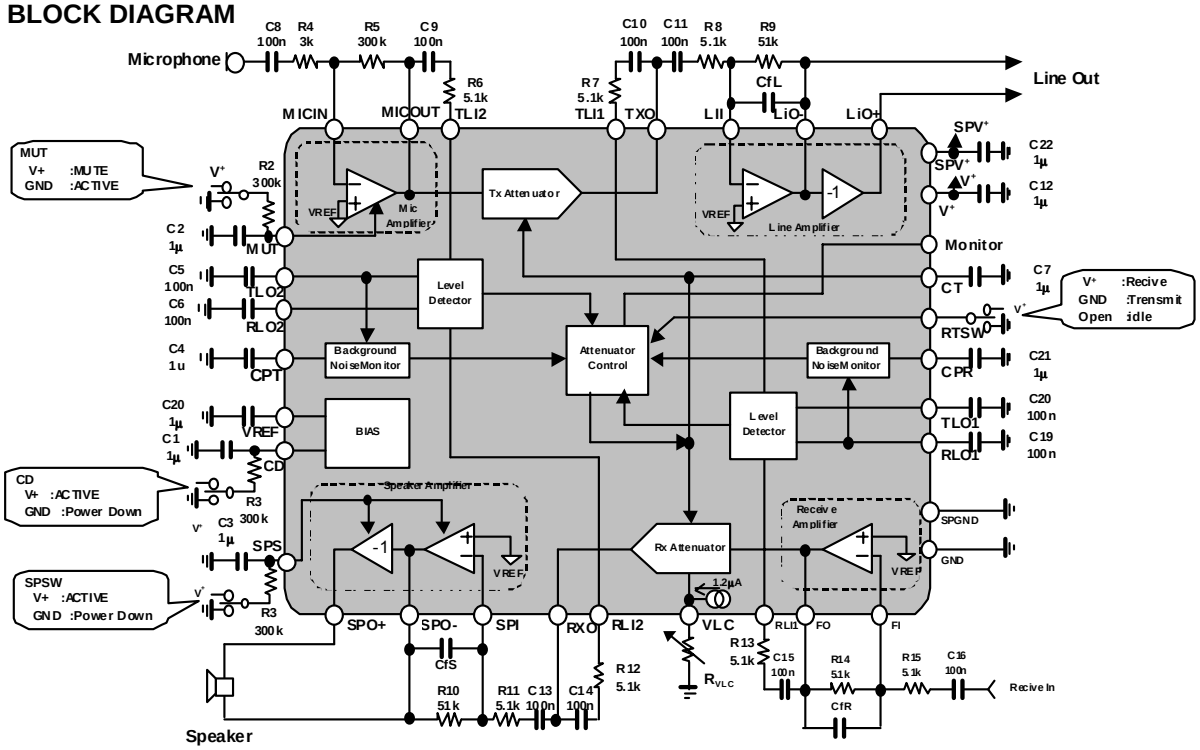
■ APPLICATION

- 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 (32Pin)

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 (MUT)

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.

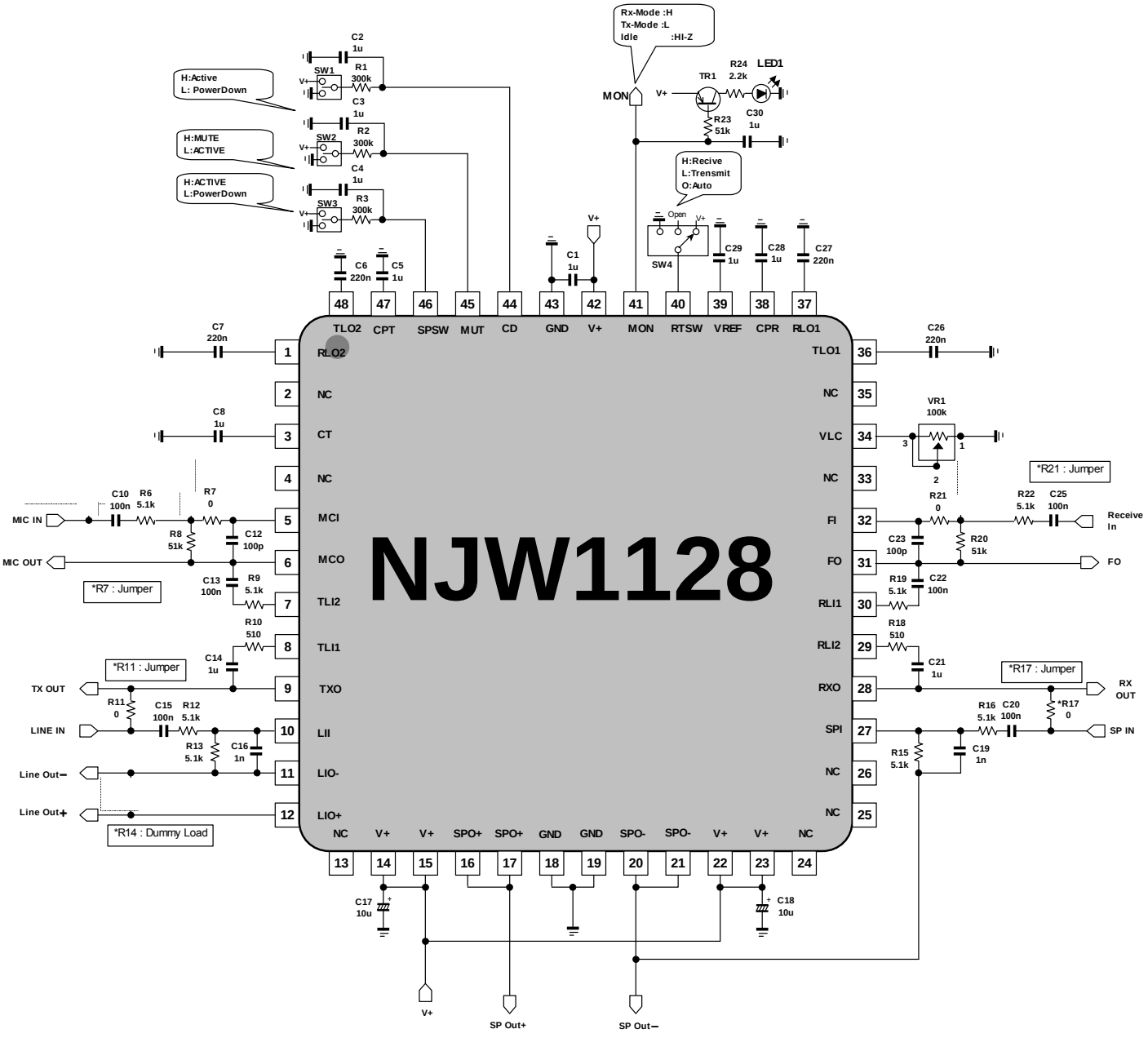
●RTSW

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} (26pin)

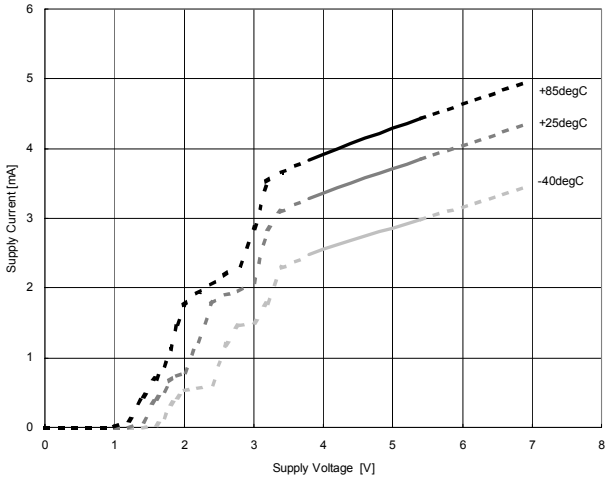
IMPEDANCE	STATUS	OPERATION
0	Vol_{MAM}	The Receive attenuator Volume is maximum.
100kΩ	Vol_{MIN}	The Receive attenuator Volume is minimum.

■ APPLICATION CIRCUIT

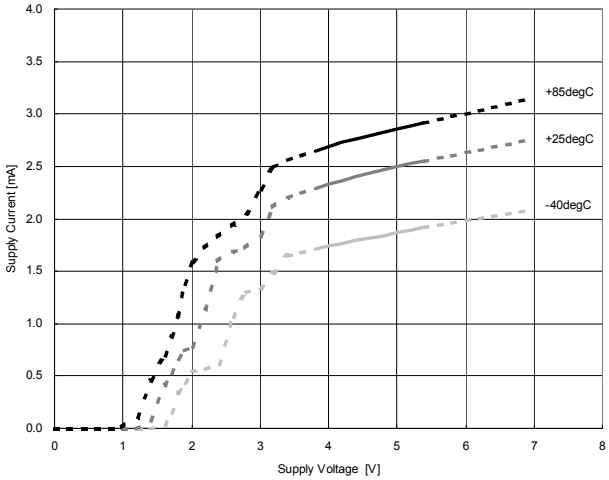


■ TYPICAL CHARACTERISTICS

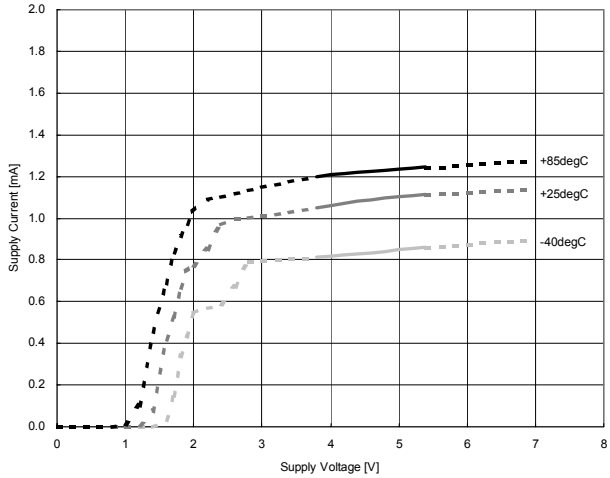
Supply Current vs Supply Voltage
No Signal , Supply Current 1



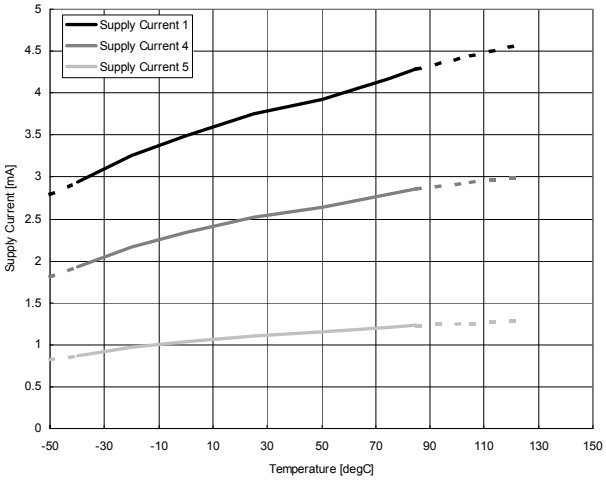
Supply Current vs Supply Voltage
No Signal , Supply Current 4



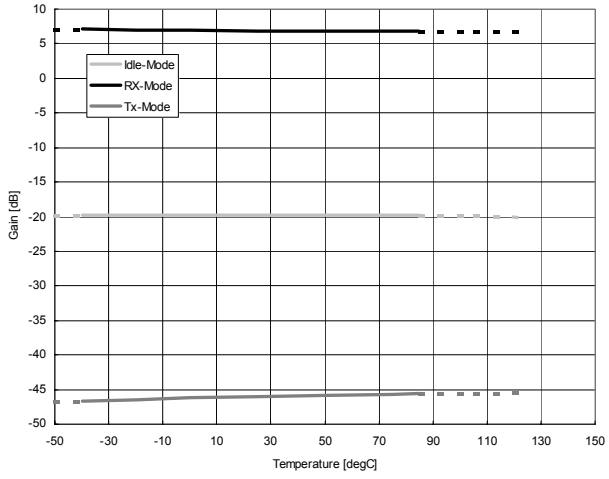
Supply Current vs Supply Voltage
No Signal , Supply Current 5



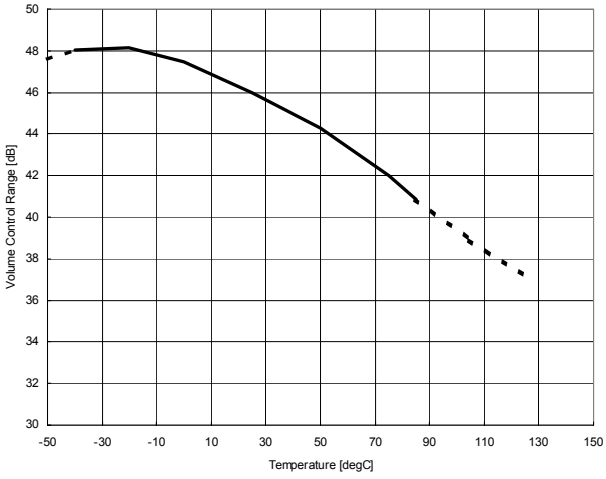
Supply Current vs Temperature
V+ =5.0V , No Signal



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

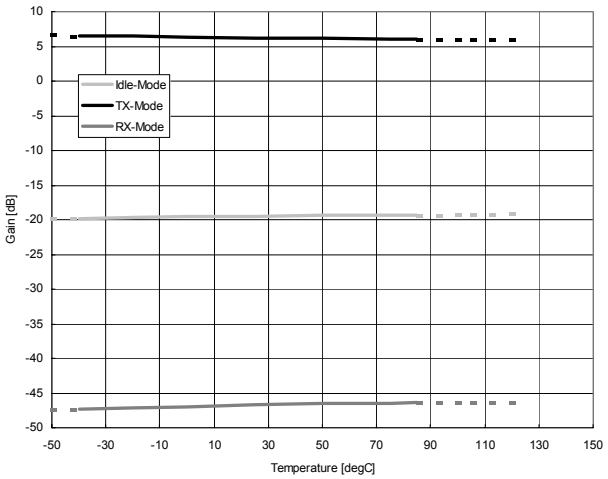


RxAtt Gain vs Temperature
V+ =5.0V , Rx-Mode , RecieveAmp : 0dB , RL=5.1kΩ

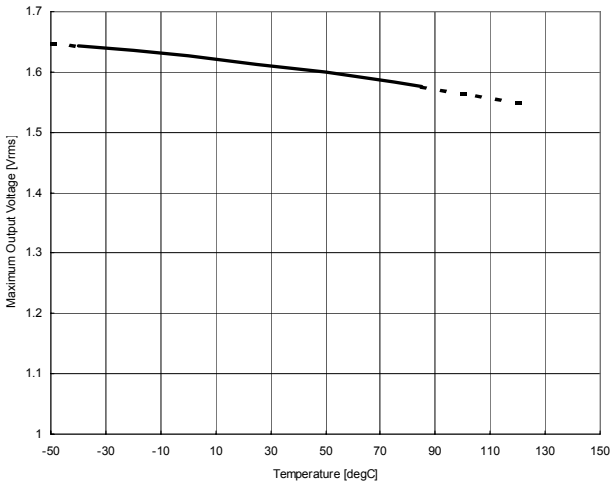


■ TYPICAL CHARACTERISTICS

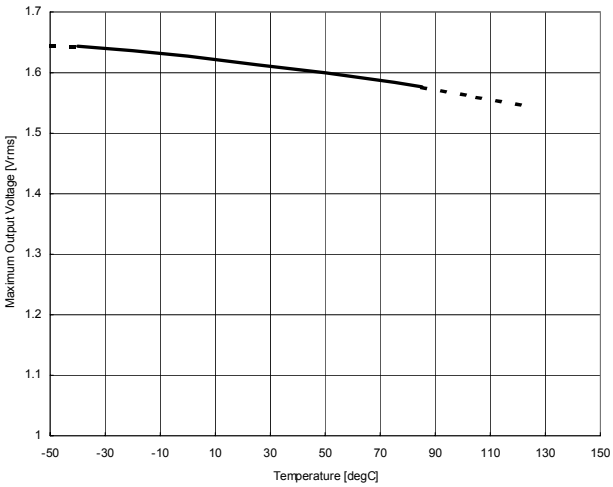
TxAtt Gain vs Temperature
V+ = 5.0V , MicAmp : 0dB , RL=5.1kΩ



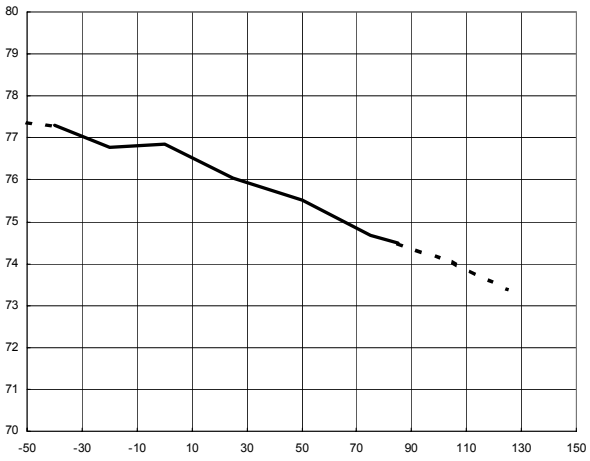
RecieveAmp Maximum Output Voltage vs Temperature
V+ = 5.0V , f = 1kHz Rf = 300kΩ , Gv=40dB , RL=5.1kΩ , THD+N = 1% , BW=400Hz-30kHz



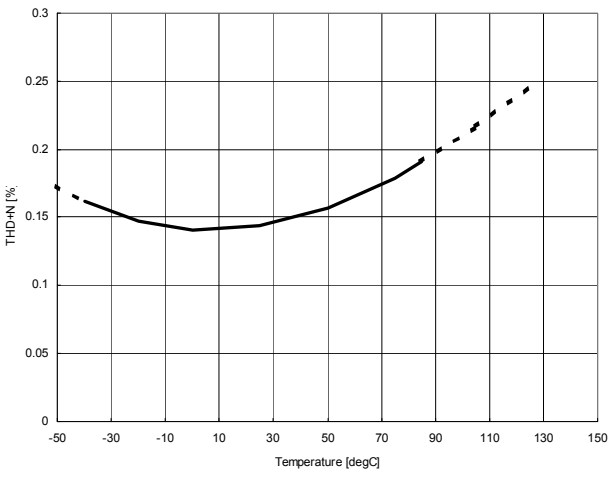
MicAmp Maximum Output Voltage vs Temperature
V+ =5.0V , f = 1kHz , Rf = 300kΩ , Gv=40dB , RL=5.1kΩ , THD+N = 1% , BW=400Hz-30kHz



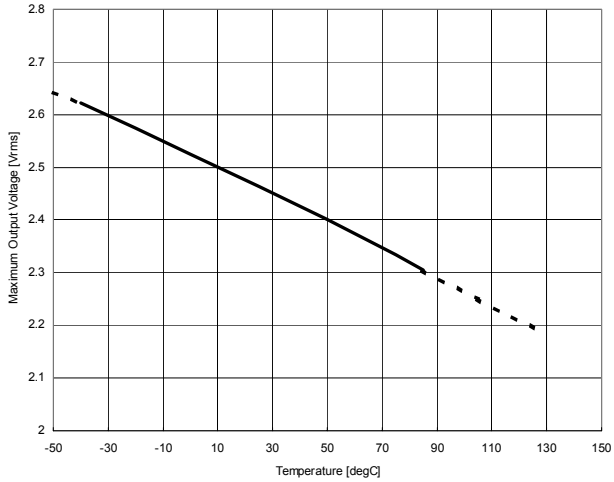
MicAmp Mute Range vs Temperature
V+ =5.0V , Rf = 300kΩ , Gv=40dB , RL=5.1kΩ , A-Weighting



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

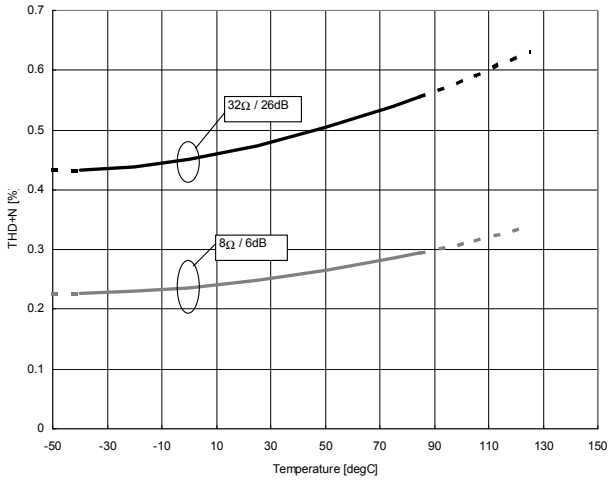


LineAmp Maximum Output Voltage vs Temperature
V+ =5.0V , f = 1kHz , Rf = 51kΩ , Gv=26dB , RL=1.2kΩ , THD+N = 1% , BW=400Hz-30kHz

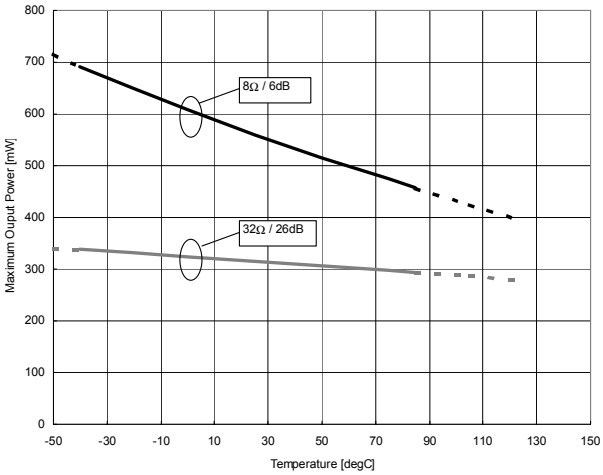


■ TYPICAL CHARACTERISTICS

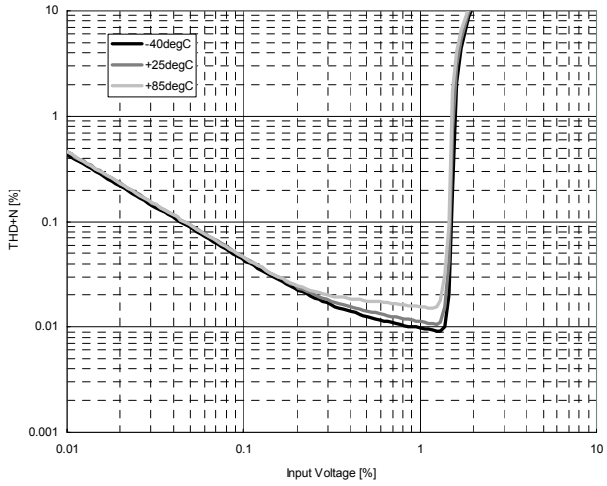
Speaker Amp THD vs Temperature
V+ =5.0V , f = 1kHz , BW=400Hz-30kHz



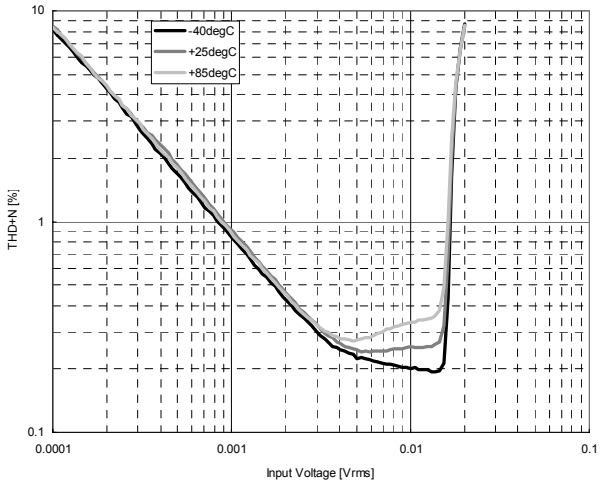
Speaker Amp Maximum Output Power vs Temperature
V+ =5.0V , f = 1kHz , THD+N = 3% , BW=400Hz-30kHz



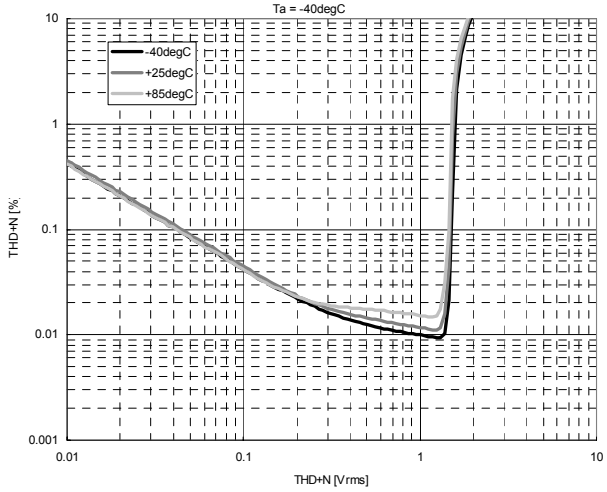
Receive Amp THD+N vs Input Voltage
V+ = 5.0V , f = 1kHz Rf = 3kΩ , Ri=3kΩ , Ci = 1μF , Gv=0dB , RL=5.1kΩ , BW=400Hz-30kHz



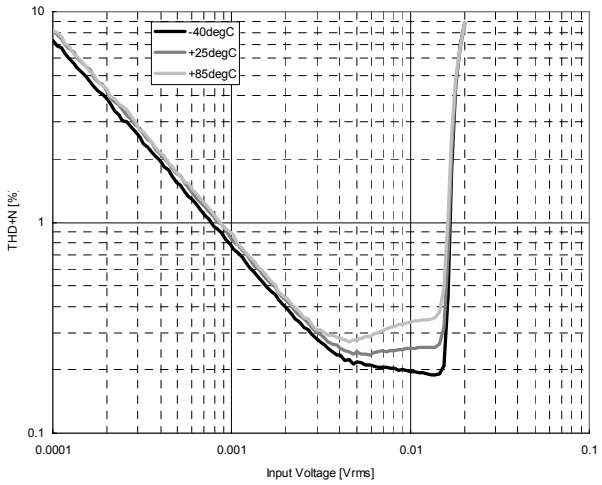
Receive Amp THD+N vs Input Voltage
V+ = 5.0V , f = 1kHz Rf = 300kΩ , Ri=3kΩ , Ci = 1μF , Gv=40dB , RL=5.1kΩ , BW=400Hz-30kHz



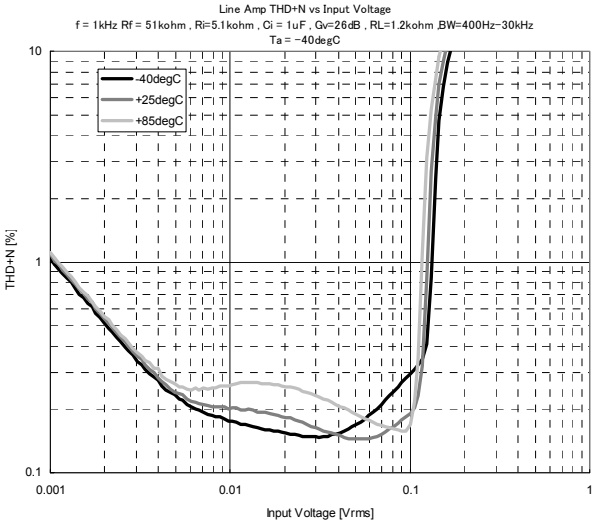
Mic Amp THD+N vs Input Voltage
f = 1kHz Rf = 3kohm , Ri=3kohm , Ci = 1uF , Gv=0dB , RL=5.1kohm ,BW=400Hz-30kHz
Ta = -40degC

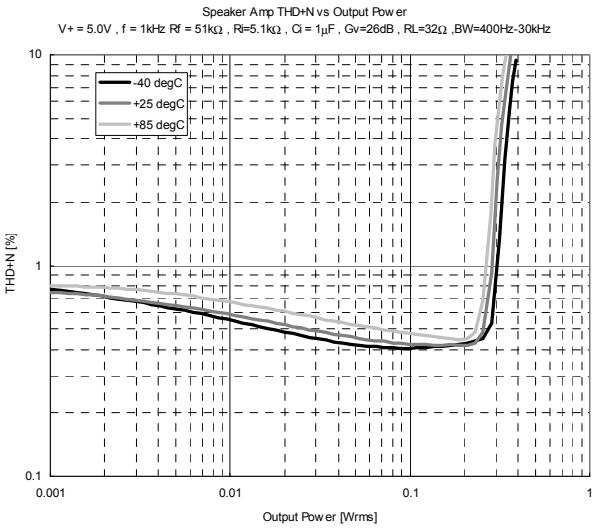


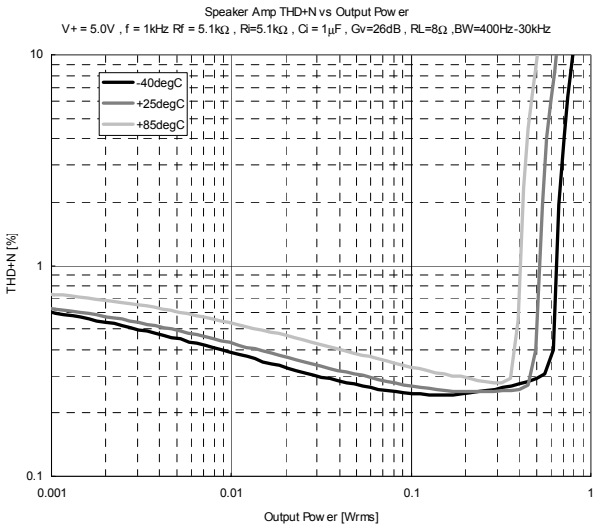
Mic Amp THD+N vs Input Voltage
V+ = 5.0V , f = 1kHz Rf = 300kΩ , Ri=3kΩ , Ci = 1μF , Gv=40dB , RL=5.1kΩ , BW=400Hz-30kHz

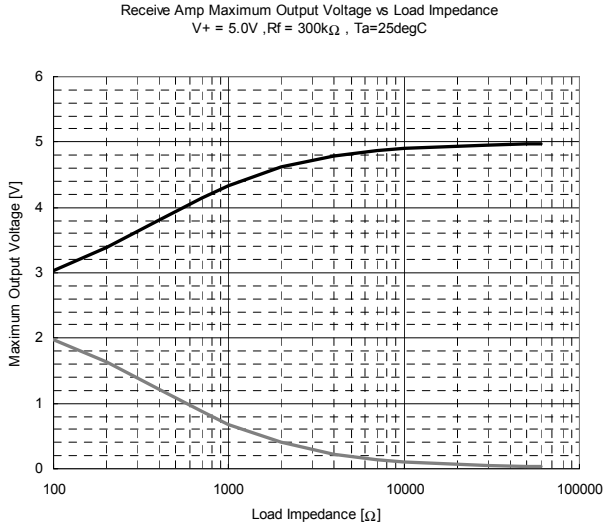


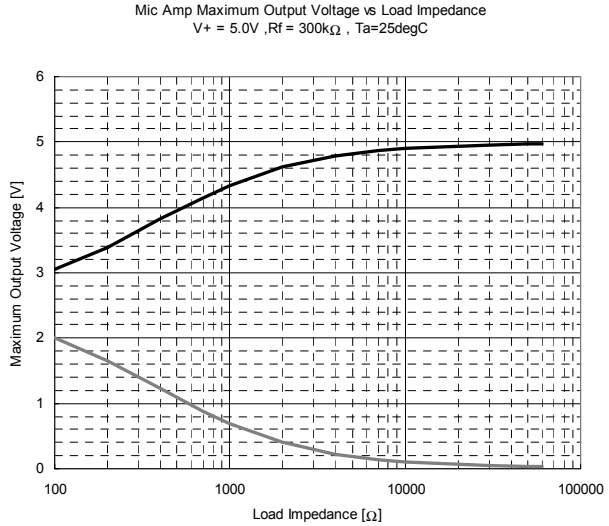
■ TYPICAL CHARACTERISTICS





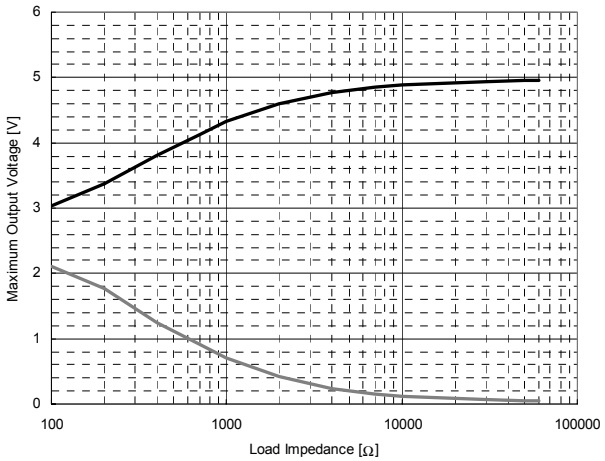




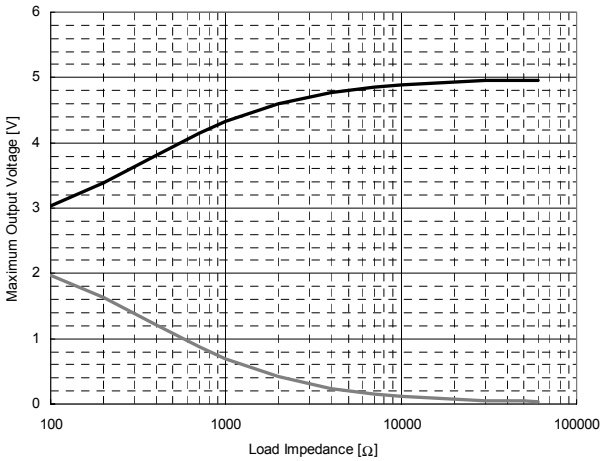


■ TYPICAL CHARACTERISTICS

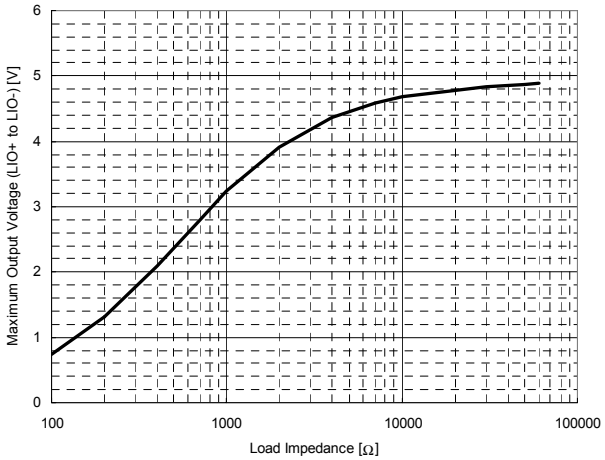
Rx Att Maximum Output Voltage vs Load Impedance
V+=5.0V , Ta=25degC



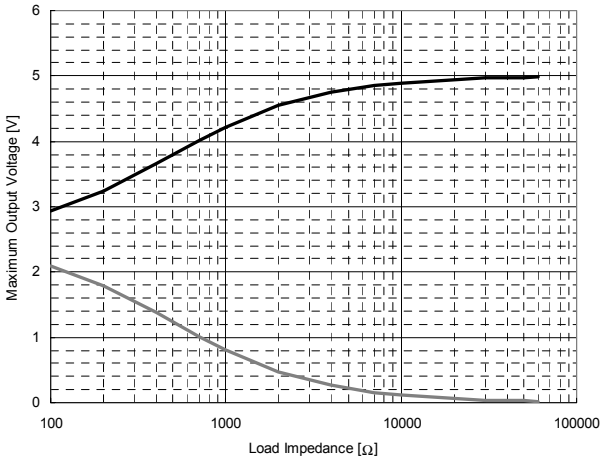
Tx Att Maximum Output Voltage vs Load Impedance
V+=5.0V , Ta=25degC



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

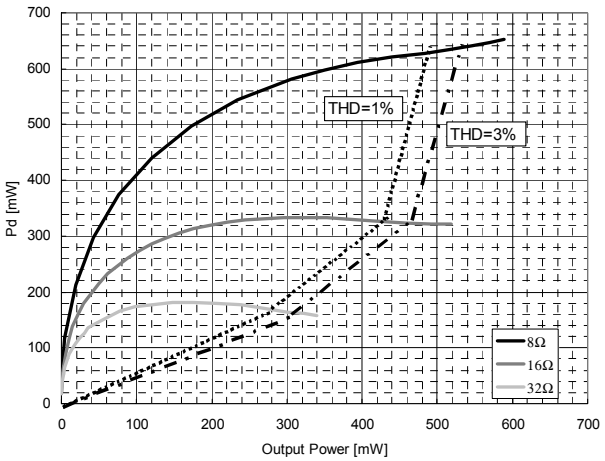


Monitor out Maximum Output Voltage vs Load Impedance
V+=5.0V , Ta=25degC

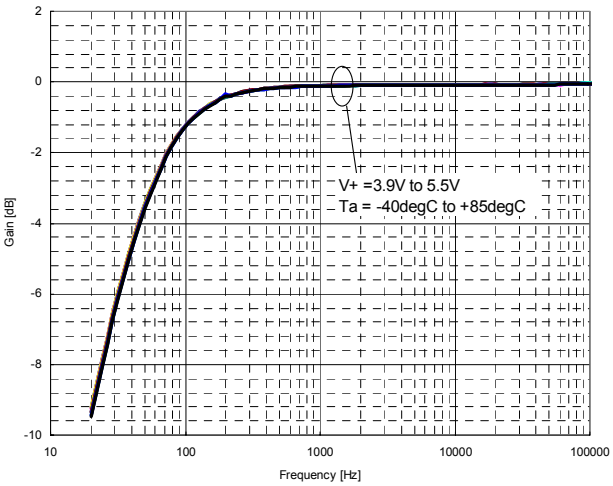


■ TYPICAL CHARACTERISTICS

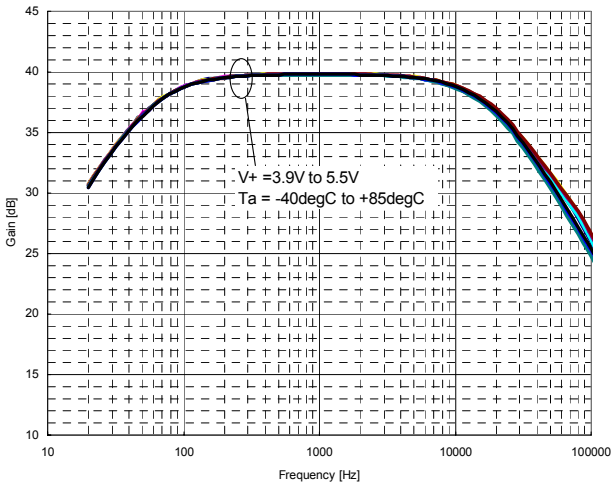
Pd vs Output Power
V+=5.0V , f=1kHz , Gv=6dB , BW=400Hz-30kHz , Ta=25degC



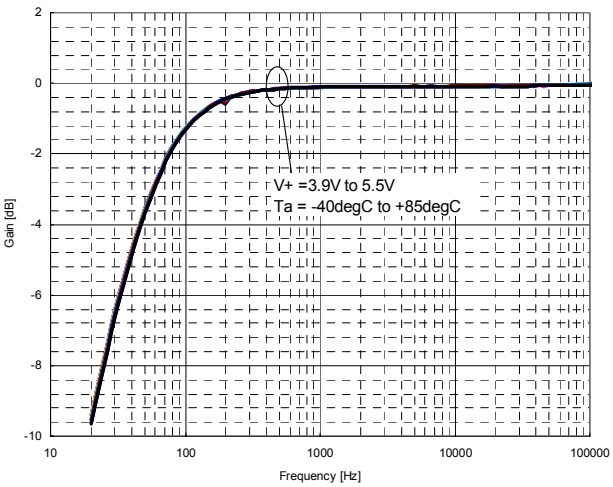
RecieveAmp Voltage Gain vs Frequency
Vin = 100mVrms , Rf = 3kΩ , Ri = 3kΩ , Ci = 1μF , Gv=0dB , RL=5.1kΩ



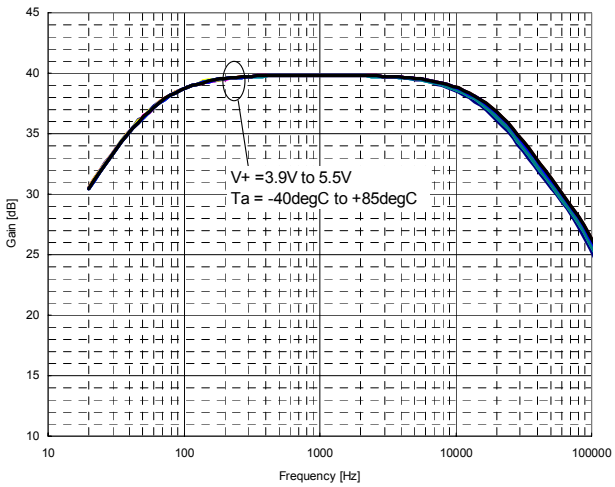
RecieveAmp Voltage Gain vs Frequency
Vin = 1mVrms , Rf = 300kΩ , Ri = 3kΩ , Ci = 1μF , Gv=40dB , RL=5.1kΩ



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

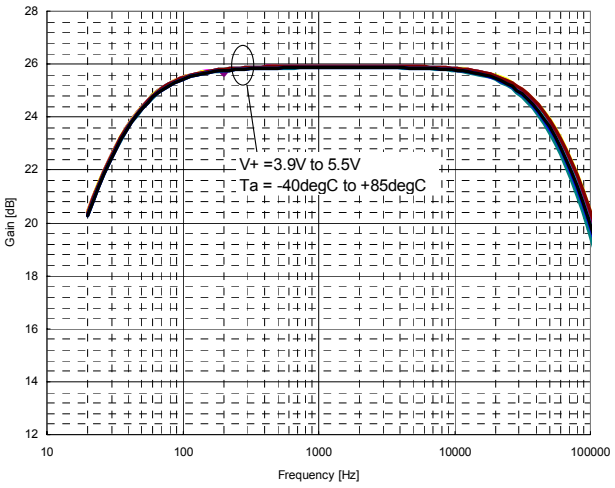


Mic Amp Voltage Gain vs Frequency
Vin = 1mVrms , Rf = 300kΩ , Ri = 3kΩ , Ci = 1μF , Gv=40dB , RL=5.1kΩ

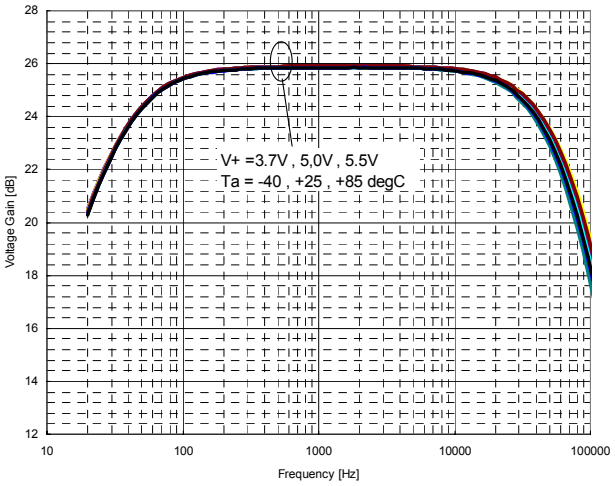


■ TYPICAL CHARACTERISTICS

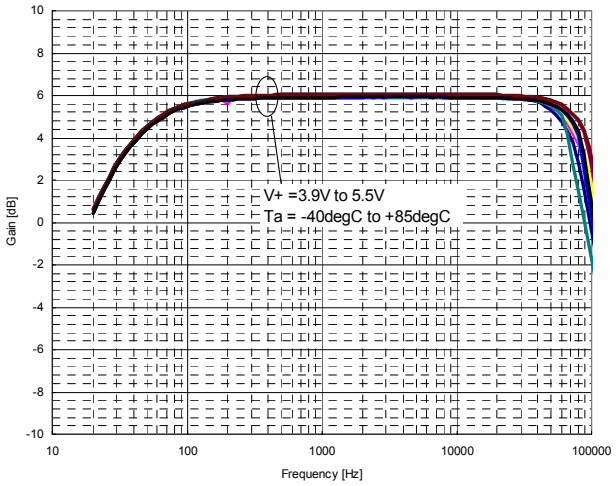
Line Amp Voltage Gain vs Frequency
Vin = 50mVrms , Rf = 51kΩ , Ri = 5.1kΩ , Ci = 1μF , Gv=26dB , RL=1.2kΩ



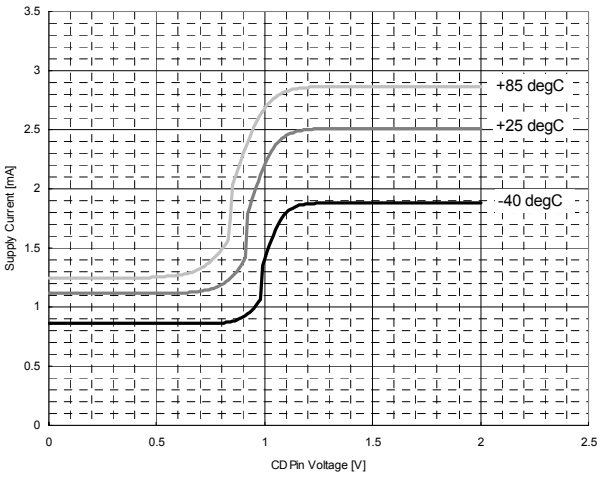
Speaker Amp Voltage Gain vs Frequency
Vin = 50mVrms , Rf = 51kΩ , Ri = 5.1kΩ , Ci = 1μF , Gv=26dB , RL=32Ω



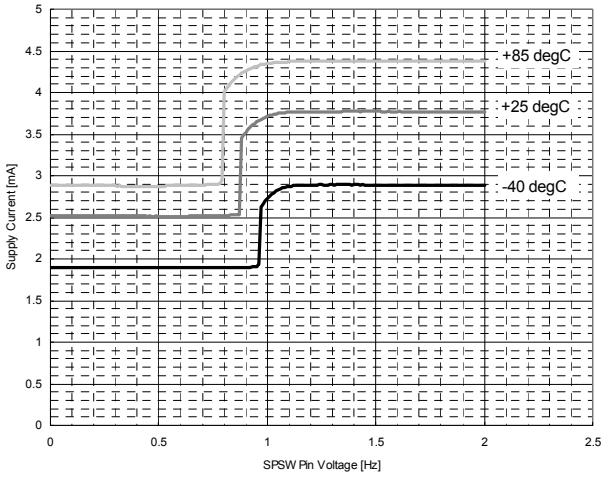
Speaker Amp Voltage Gain vs Frequency
Vin = 500mVrms , Rf = 5.1kΩ , Ri = 5.1kΩ , Ci = 1μF , Gv=6dB , RL=8Ω



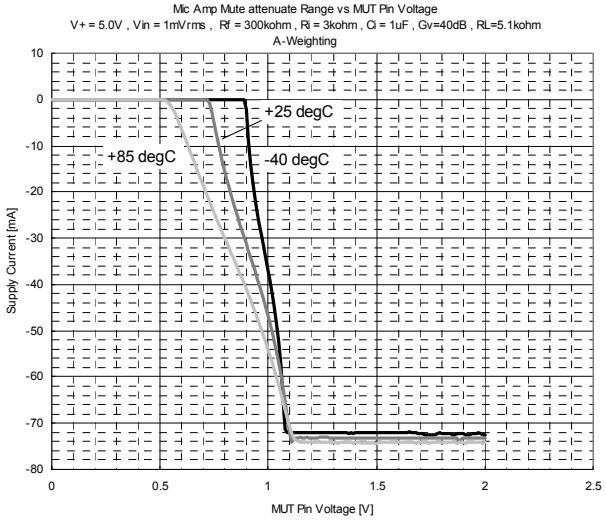
Supply Current vs CD Pin Voltage
V+ = 5.0V , SPSW = PD , RTSW = Open , no Signal

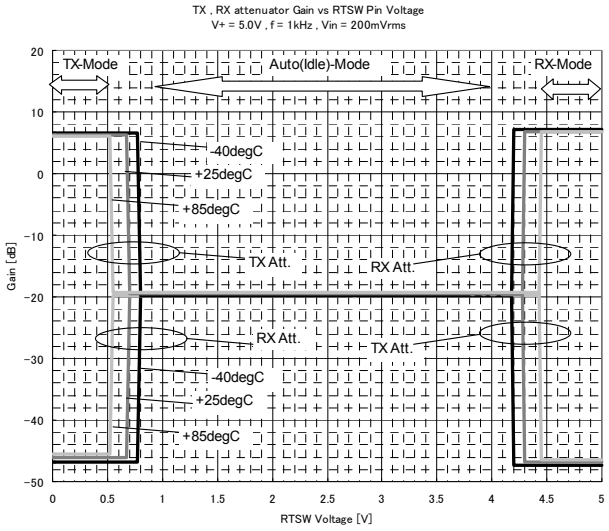


Supply Current vs SPSW Pin Voltage
V+ = 5.0V , CD = Active , RTSW = Open , no Signal



■ TYPICAL CHARACTERISTICS





[CAUTION]
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