

## 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

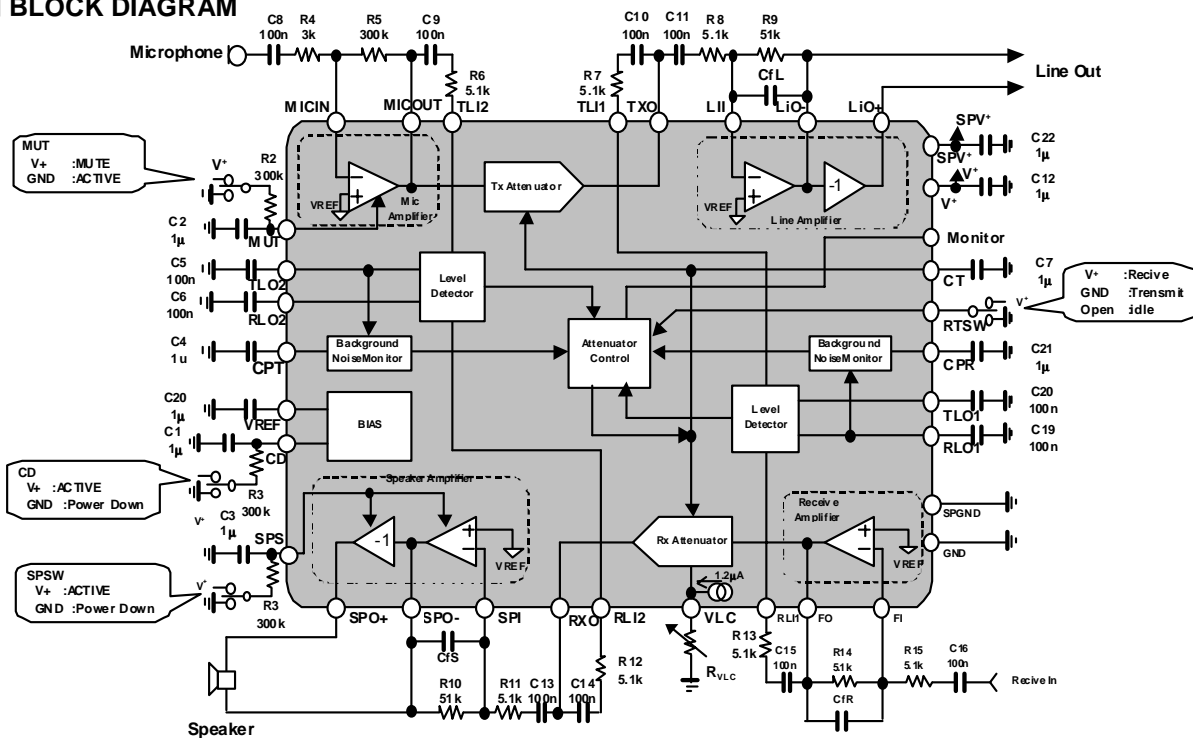
### APPLICATION

- 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 <sub>+</sub>	7	V
Power Dissipation	P <sub>D</sub>	1600(Note1)	mW
Operating Temperature Range	Topr	-40 ~ +85	°C
Storage Temperature Range	Tstg	-40 ~ +125	°C
Maximum Input Voltage	V <sub>IMAX</sub>	0 ~ V <sup>+</sup> (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 <sup>+</sup>	-	3.9	5.0	5.5	V

## ■ ELECTRICAL CHARACTERISTICS (Ta=25°C, V<sup>+</sup>=5V, Vin=150mVrms/1kHz, MUT=CD=SPSW= V<sup>+</sup>, MON=OPEN, R<sub>VLC</sub>=0Ω)

### ●Power Supply

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current 1	I <sub>CC1</sub>	RX-mode (Receive)	2.0	3.5	6.0	mA
Operating Current 2	I <sub>CC2</sub>	TX-mode (Transmit)	2.0	3.5	6.0	mA
Operating Current 3	I <sub>CC3</sub>	Idle-mode (Standby)	2.0	3.5	6.0	mA
Operating Current 4	I <sub>CC4</sub>	Idle-mode ,CD=PD	1.0	2.5	4.0	mA
Operating Current 5	I <sub>CC5</sub>	Idle-mode ,CD=PD,SPSW=PD	0.5	1	1.5	mA
Reference Voltage	V <sub>REF</sub>	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 <sub>R1</sub>	RX-mode (Receive)	3.0	6.0	9.0	dB
Receive Attenuator Gain 2	G <sub>R2</sub>	TX-mode (Transmit)	-42	-46	-50	dB
Receive Attenuator Gain 3	G <sub>R3</sub>	Idle-mode (Standby)	-17	-20	-23	dB
Range R to T mode	dG <sub>R</sub>	RX-mode – TX-mode	47	52	57	dB
Dynamic DC offset	G <sub>RDC</sub>	RX-mode – TX-mode (DC)	-50	-	50	mV
Volume control range	G <sub>RVR</sub>	RX-mode,R <sub>VLC</sub> =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 <sub>T1</sub>	TX-mode (Transmit)	3.0	6.0	9.0	dB
Transmit Attenuator Gain 2	G <sub>T2</sub>	RX-mode (Receive)	-42	-46	-50	dB
Transmit Attenuator Gain 3	G <sub>T3</sub>	Idle-mode (Standby)	-17	-20	-23	dB
Range R to T mode	dG <sub>T</sub>	TX-mode – RX-mode	47	52	57	dB
Dynamic DC offset	G <sub>TDC</sub>	TX-mode – RX-mode (DC)	-50	-	50	mV

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

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

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Offset Voltage	V <sub>ROS</sub>	RF=300kΩ	-50	0.0	50	mV
Input Bias Current	I <sub>RBIAS</sub>		-	30	-	nA
Voltage Gain 1	G <sub>VR1</sub>	f=1kHz	-	40	-	dB
Voltage Gain 2	G <sub>VR2</sub>	f=20kHz	-	36	-	dB
Maximum Output Voltage	V <sub>RMAX</sub>	THD=1%	1.0	-	-	Vrms

●Line Amplifier (LINEIN=50mVrms, Gv=26dB, RL=1.2kΩ)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Offset Voltage	V <sub>LOS</sub>	RF=51kΩ	-50	0.0	50	mV
Input Bias Current	I <sub>RBIAS</sub>		-	30	-	nA
Voltage Gain 1	G <sub>VL1</sub>	f=1kHz	-	26	-	nA
Voltage Gain 2	G <sub>VL2</sub>	f=20kHz	-	25	-	nA
Gain Bandwidth	G <sub>LBW</sub>	RL=600Ω, LIO	-	1.5	-	MHz
Closed Loop Gain	G <sub>LC</sub>	RL=1.2kΩ, LIO- to LIO+	-0.5	0	0.5	dB
Maximum Output Voltage	V <sub>LMAX</sub>	RL=1.2kΩ, THD=1%	2.0	-	-	Vrms
Total Harmonic Distortion	THD <sub>LN</sub>	VIN=100mVrms, Gv=20dB RL=1.2Ω	-	-	0.5	%

●Speaker Amplifier (SPIN=50mVrms, Gv=26dB, RL=32Ω)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Offset Voltage	V <sub>SPOS</sub>	RF=51kΩ	-50	0.0	50	mV
Voltage Gain 1	G <sub>VSP1</sub>	f=1kHz	-	26	-	dB
Voltage Gain 2	G <sub>VSP2</sub>	f=20kHz	-	24	-	dB
Voltage Gain 3	G <sub>VSP3</sub>	f=1kHz, G <sub>VSP</sub> =6dB, RL=8Ω	-	6	-	dB
Voltage Gain 4	G <sub>VSO4</sub>	f=20kHz, G <sub>VSP</sub> =6dB, RL=8Ω	-	4	-	dB
Closed Loop Gain	G <sub>LC</sub>	SPO- to SPO+	-0.6	0	0.6	dB
Maximum Output Power	P <sub>OMAX1</sub>	RL=32Ω, THD=3%	200	300	-	mW
	P <sub>OMAX2</sub>	RL=8Ω, THD=3%	300	500	-	mW
Total Harmonic Distortion	THD <sub>SP1</sub>	VIN=500mVrms, f=1KHz, RL=32Ω, G <sub>VD</sub> =26dB		-	1.0	%
	THD <sub>SP2</sub>	VIN=500mVrms, f=1KHz, RL=8Ω, G <sub>VD</sub> =6dB	-	-	1.0	%

## ●MONITOR TERMINAL (32Pin)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Rx-mode	Rx	-	$V^+ - 0.6$	-	$V^+$	V
Tx-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.

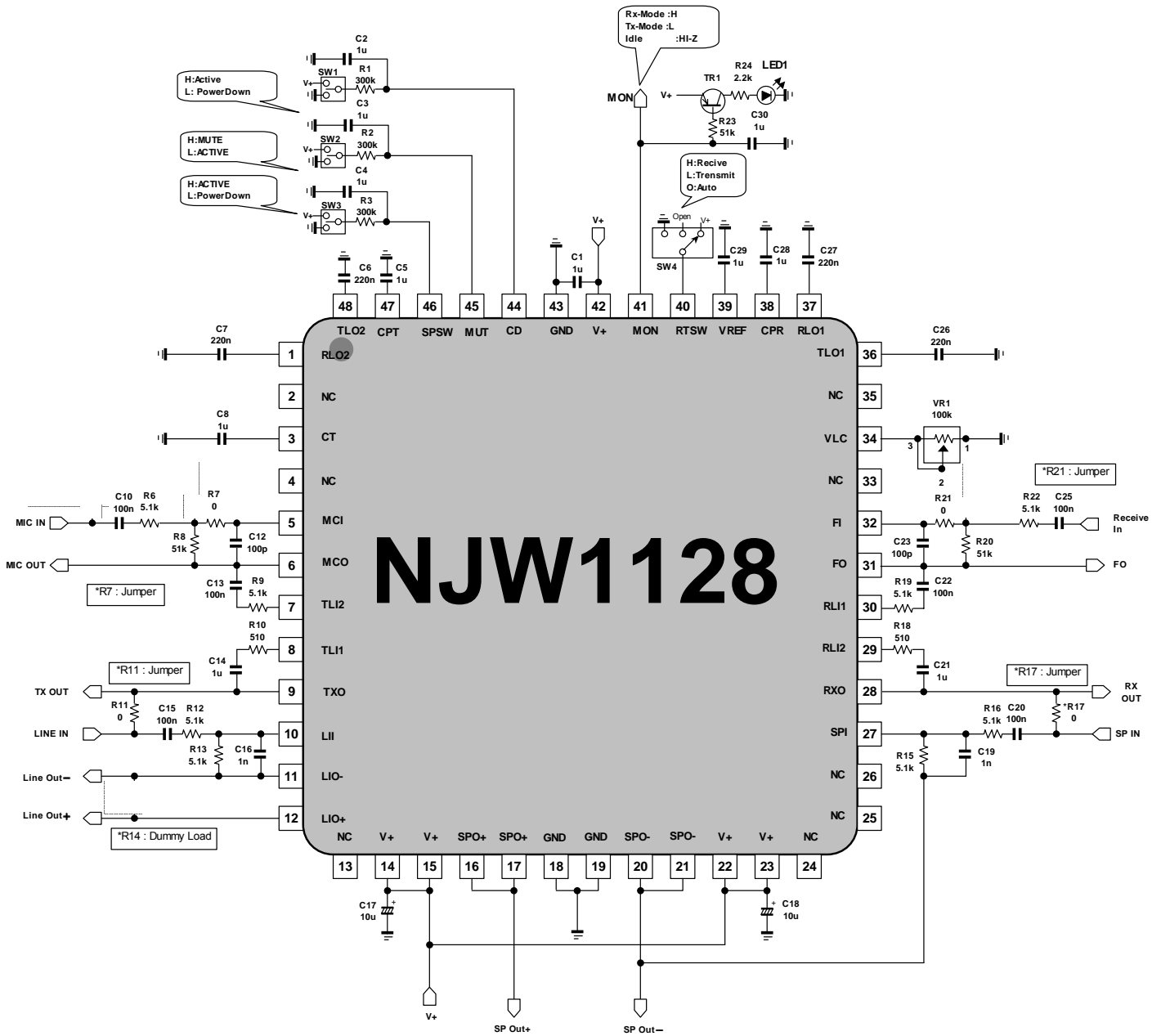
### ●RTSW

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.
100k $\Omega$	$Vol_{MIN}$	The Receive attenuator Volume is minimum.

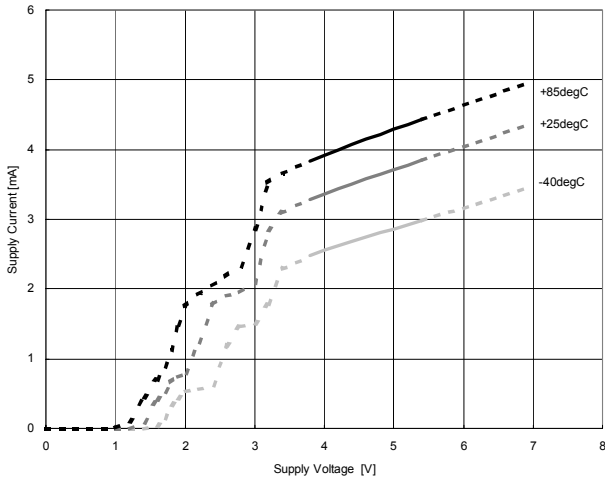
## APPLICATION CIRCUIT



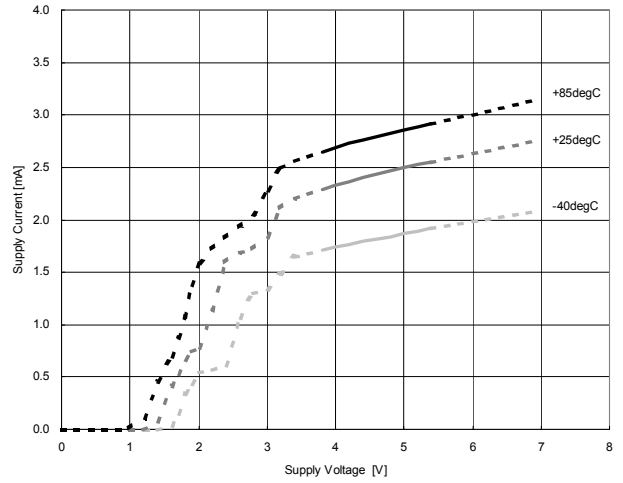
# NJW1128

## TYPICAL CHARACTERISTICS

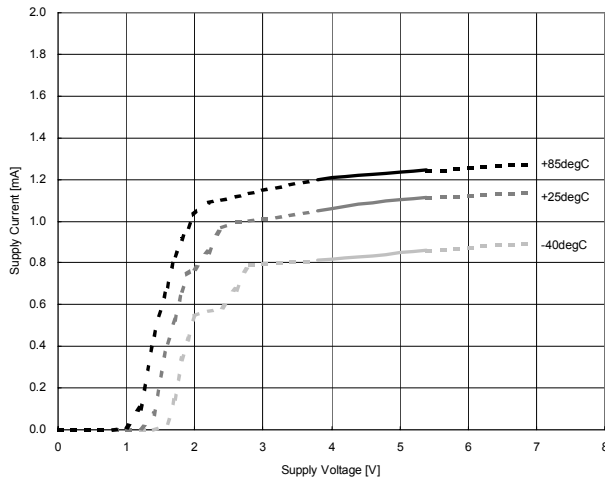
Supply Current vs Supply Voltage  
No Signal, Supply Current 1



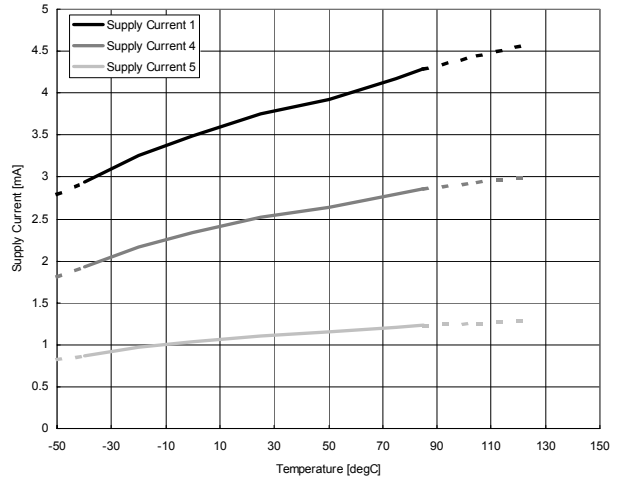
Supply Current vs Supply Voltage  
No Signal, Supply Current 4



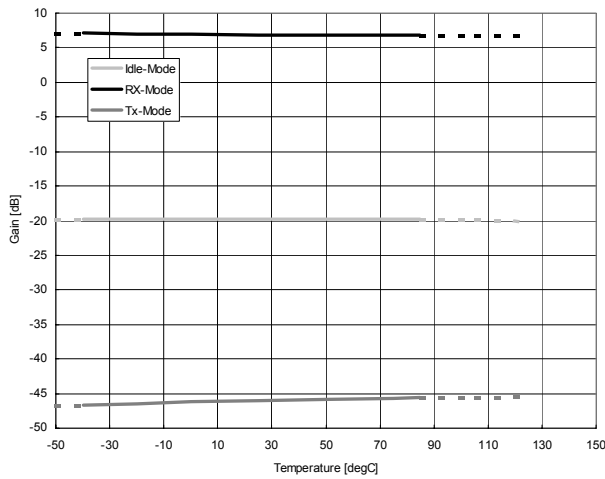
Supply Current vs Supply Voltage  
No Signal, Supply Current 5



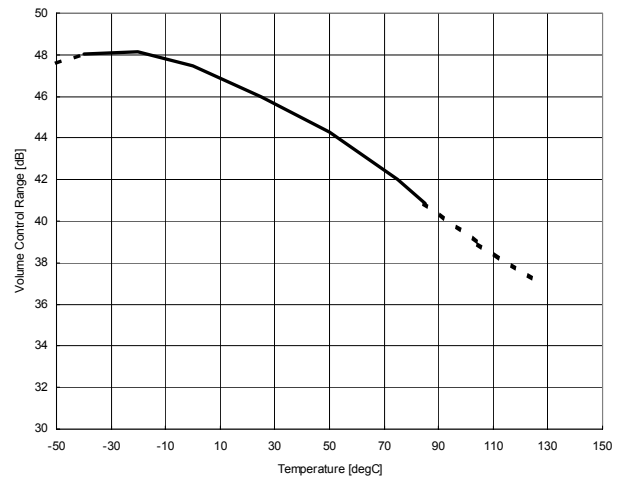
Supply Current vs Temperature  
V+ = 5.0V, No Signal



RxAtt Gain vs Temperature  
V+ = 5.0V, RecieveAmp : 0dB, RL=5.1k $\Omega$

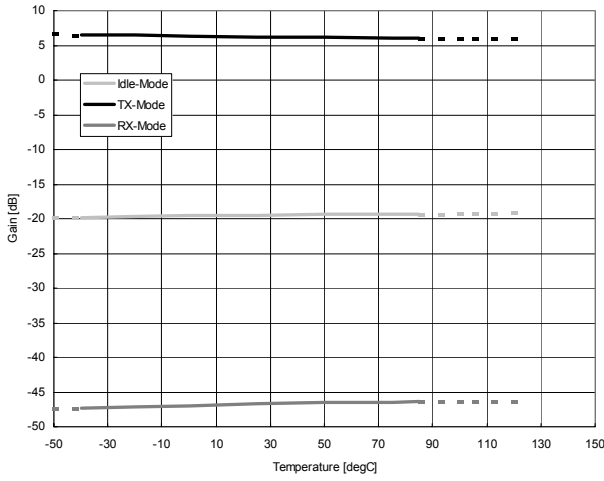


RxAtt Gain vs Temperature  
V+ = 5.0V, Rx-Mode, RecieveAmp : 0dB, RL=5.1k $\Omega$

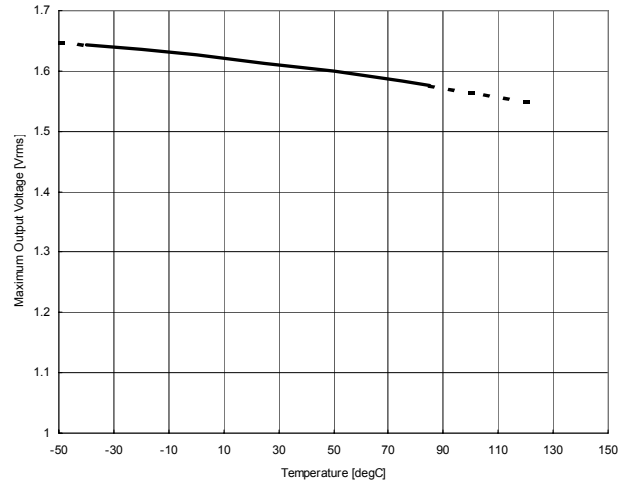


## TYPICAL CHARACTERISTICS

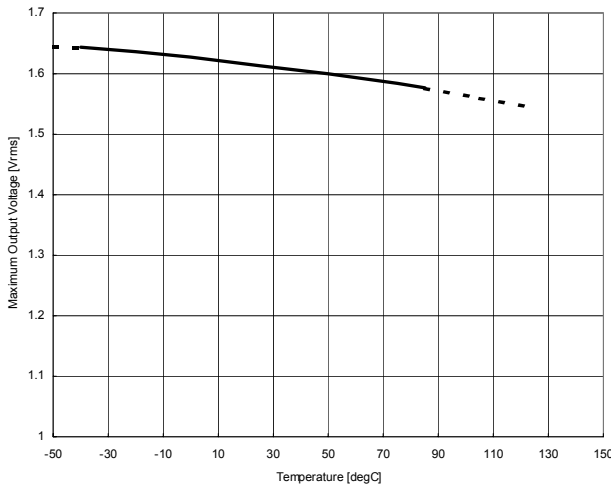
TxAI Gain vs Temperature  
 $V+ = 5.0V$ , MicAmp: 0dB,  $R_L = 5.1k\Omega$



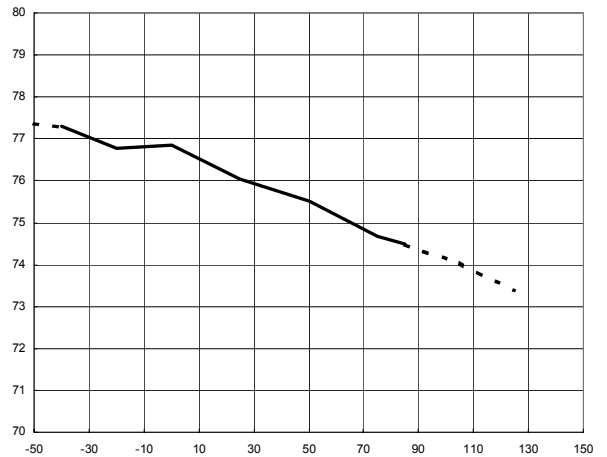
ReceivAmp Maximum Output Voltage vs Temperature  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $R_f = 300k\Omega$ ,  $G_v = 40dB$ ,  $R_L = 5.1k\Omega$ , THD+N = 1%, BW=400Hz-30kHz



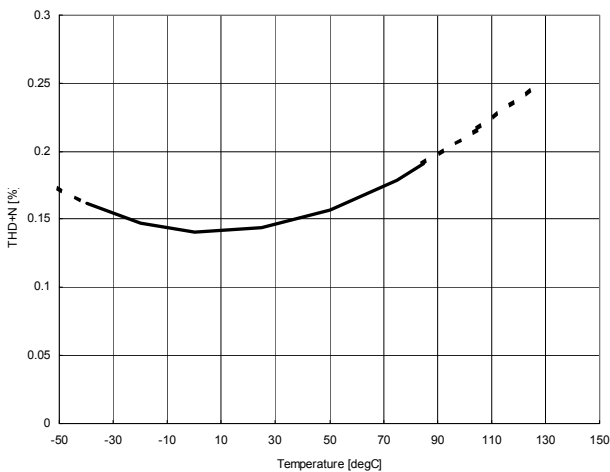
MicAmp Maximum Output Voltage vs Temperature  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $R_f = 300k\Omega$ ,  $G_v = 40dB$ ,  $R_L = 5.1k\Omega$ , THD+N = 1%, BW=400Hz-30kHz



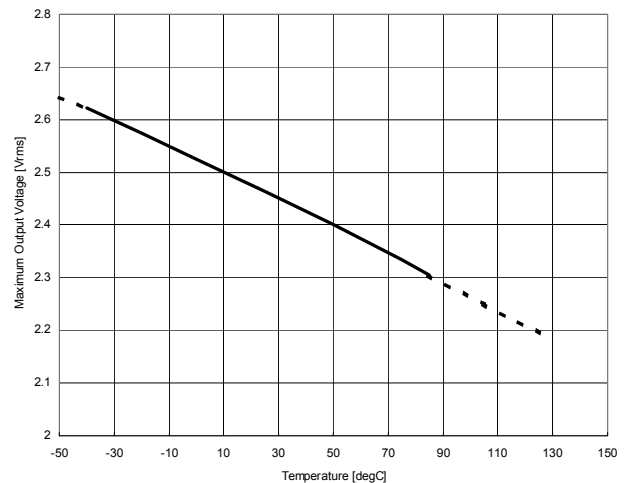
MicAmp Mute Range vs Temperature  
 $V+ = 5.0V$ ,  $R_f = 300k\Omega$ ,  $G_v = 40dB$ ,  $R_L = 5.1k\Omega$ , A-Weighting



LineAmp THD vs Temperature  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $R_f = 51k\Omega$ ,  $G_v = 26dB$ ,  $V_{in} = 50mV_{rms}$ ,  $R_L = 1.2k\Omega$ , BW=400Hz-30kHz

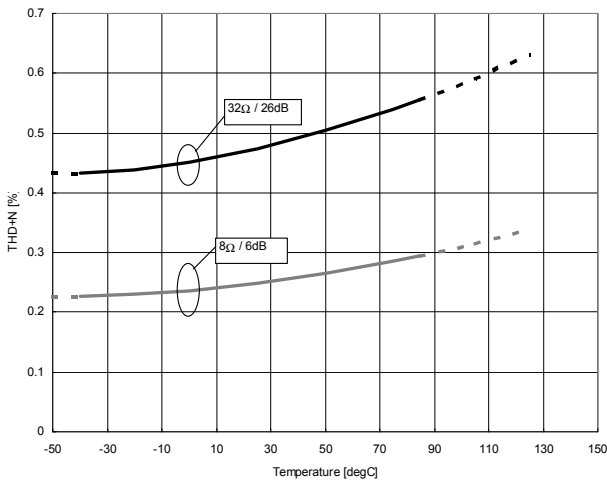


LineAmp Maximum Output Voltage vs Temperature  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $R_f = 51k\Omega$ ,  $G_v = 26dB$ ,  $R_L = 1.2k\Omega$ , THD+N = 1%, BW=400Hz-30kHz

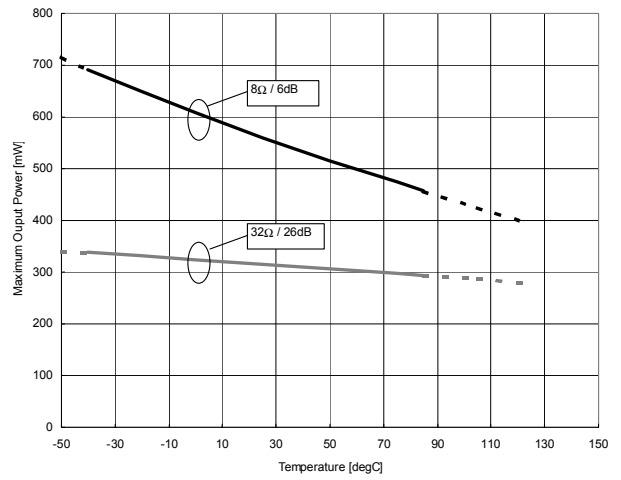


## TYPICAL CHARACTERISTICS

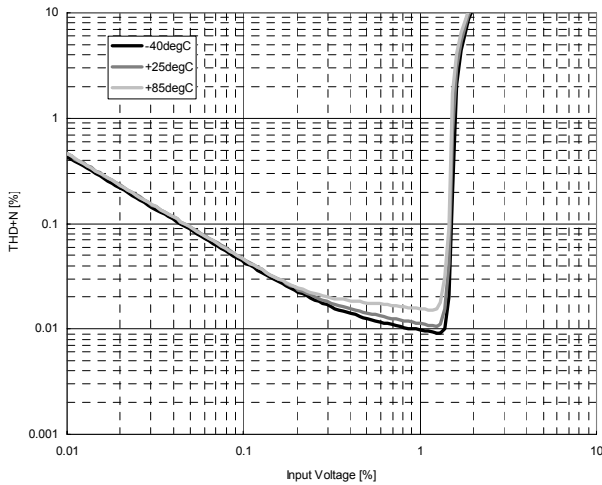
Speaker Amp THD+N vs Temperature  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $BW=400Hz-30kHz$



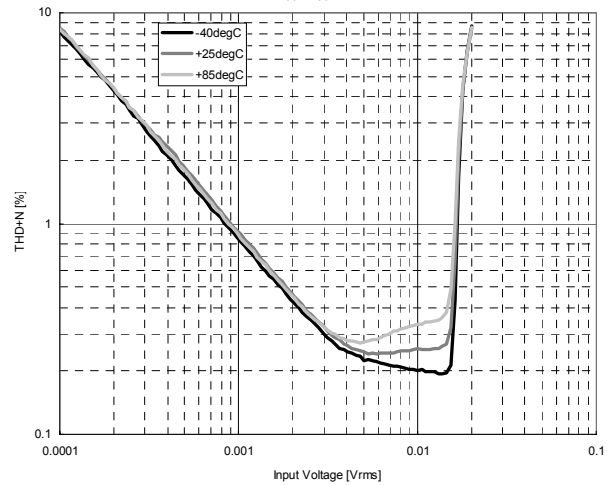
Speaker Amp Maximum Output Power vs Temperature  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $THD+N = 3%$ ,  $BW=400Hz-30kHz$



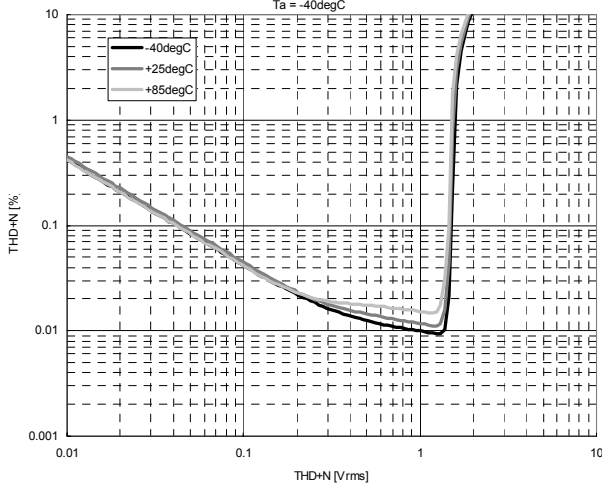
Receive Amp THD+N vs Input Voltage  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $Rf = 3k\Omega$ ,  $Ri = 3k\Omega$ ,  $Ci = 1\mu F$ ,  $Gv = 0dB$ ,  $RL = 5.1k\Omega$ ,  $BW=400Hz-30kHz$



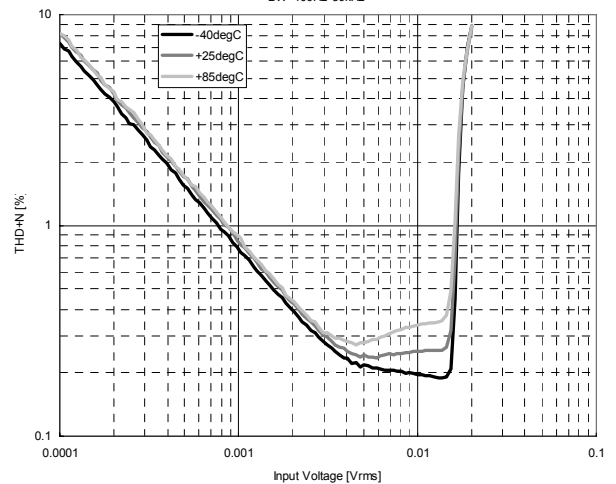
Receive Amp THD+N vs Input Voltage  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $Rf = 300k\Omega$ ,  $Ri = 3k\Omega$ ,  $Ci = 1\mu F$ ,  $Gv = 40dB$ ,  $RL = 5.1k\Omega$ ,  $BW=400Hz-30kHz$



Mic Amp THD+N vs Input Voltage  
 $f = 1kHz$ ,  $Rf = 3k\Omega$ ,  $Ri = 3k\Omega$ ,  $Ci = 1\mu F$ ,  $Gv = 0dB$ ,  $RL = 5.1k\Omega$ ,  $BW=400Hz-30kHz$ ,  $Ta = -40degC$

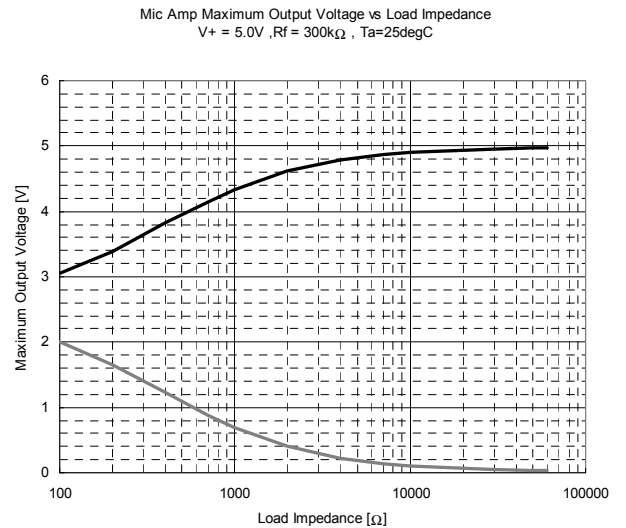
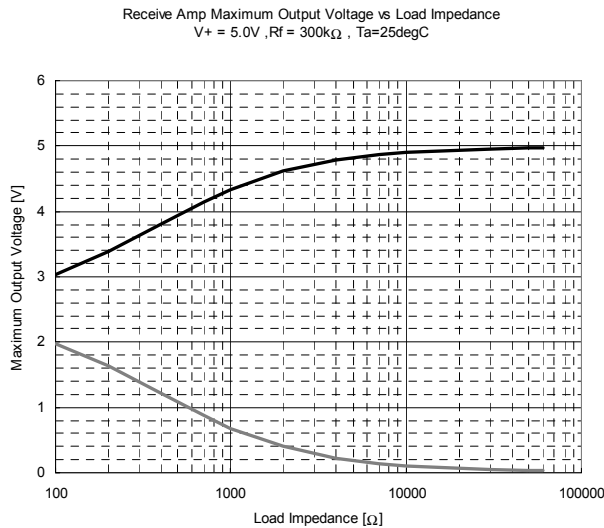
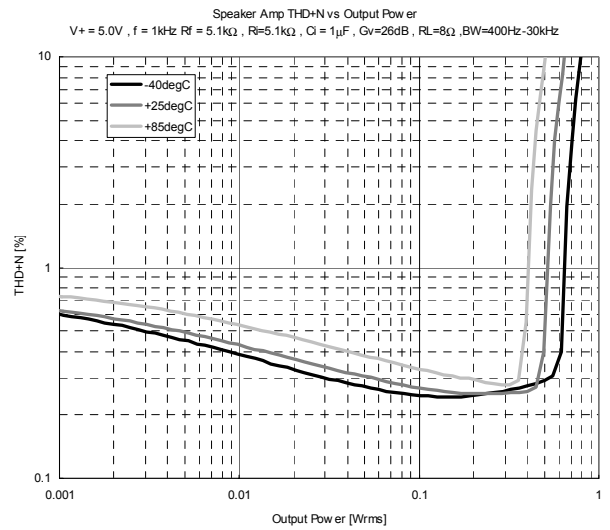
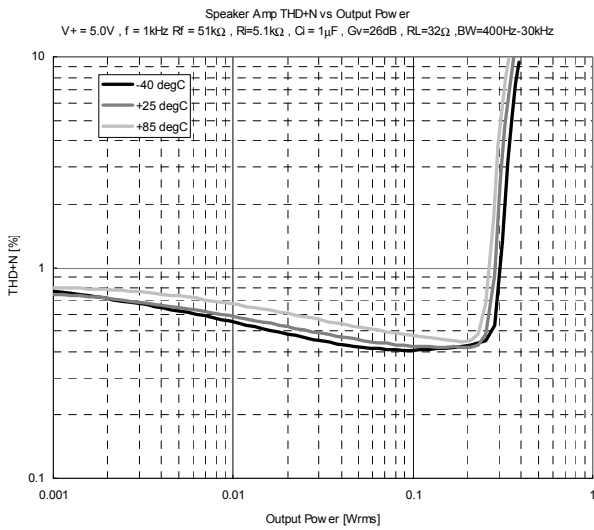
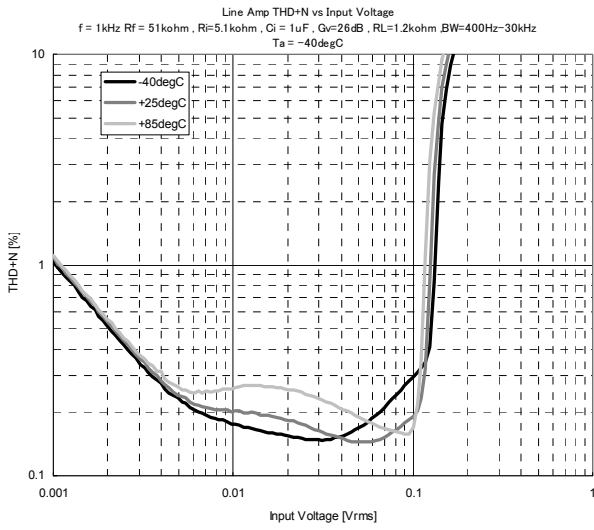


Mic Amp THD+N vs Input Voltage  
 $V+ = 5.0V$ ,  $f = 1kHz$ ,  $Rf = 300k\Omega$ ,  $Ri = 3k\Omega$ ,  $Ci = 1\mu F$ ,  $Gv = 40dB$ ,  $RL = 5.1k\Omega$ ,  $BW=400Hz-30kHz$



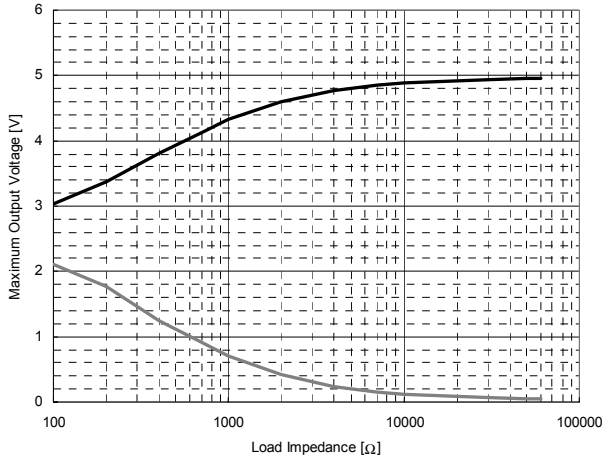


## TYPICAL CHARACTERISTICS

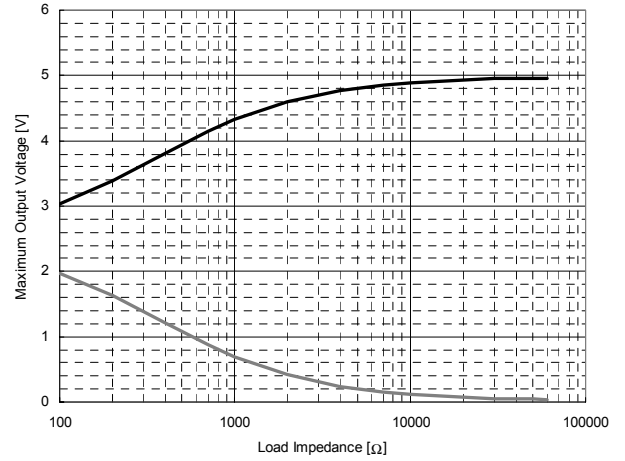


## TYPICAL CHARACTERISTICS

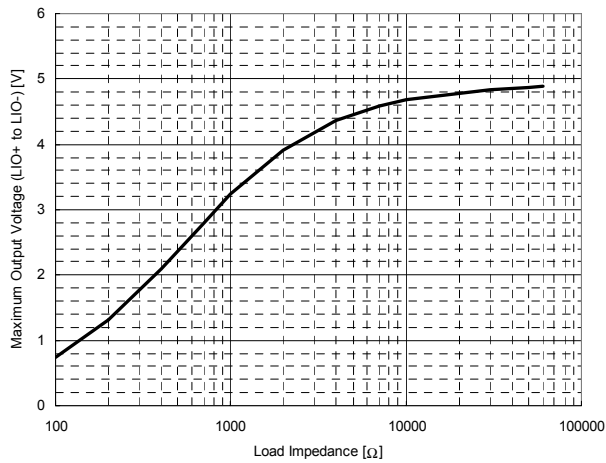
Rx Att Maximum Output Voltage vs Load Impedance  
 $V+ = 5.0V$ ,  $T_a = 25\text{degC}$



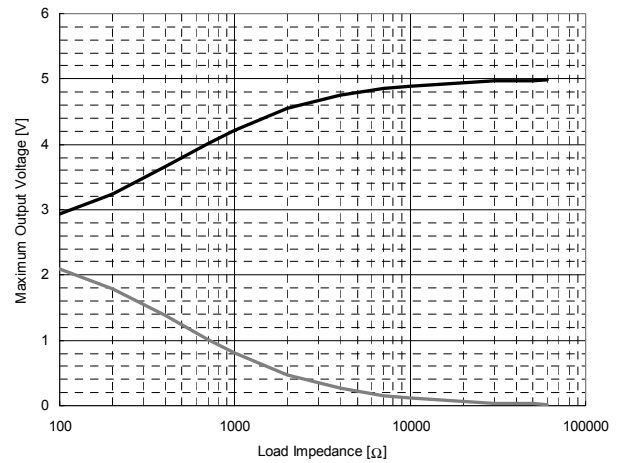
Tx Att Maximum Output Voltage vs Load Impedance  
 $V+ = 5.0V$ ,  $T_a = 25\text{degC}$



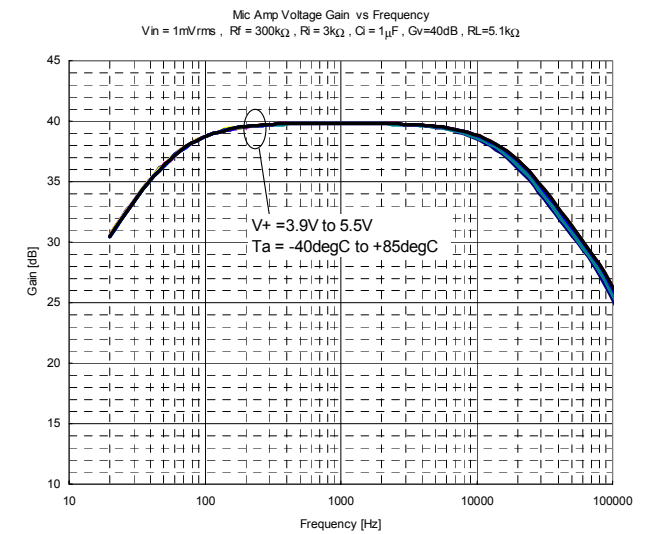
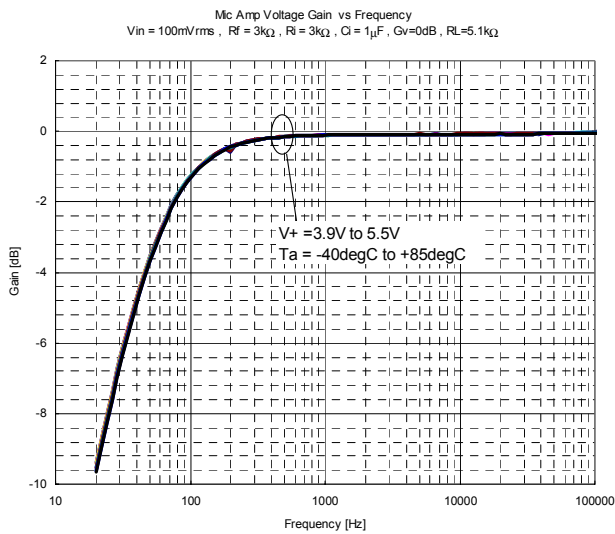
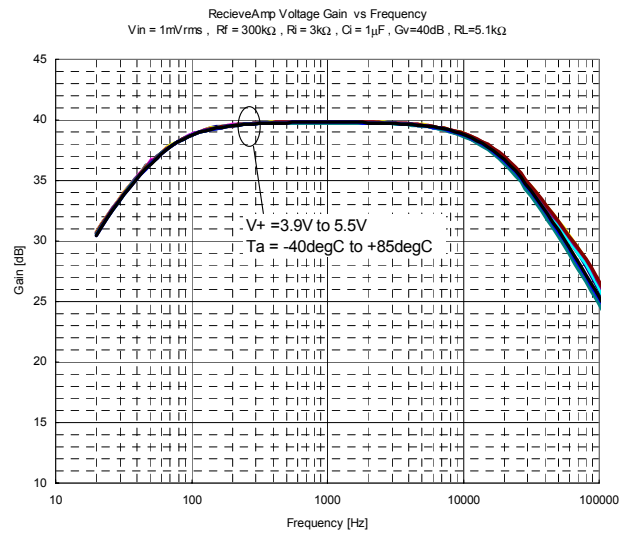
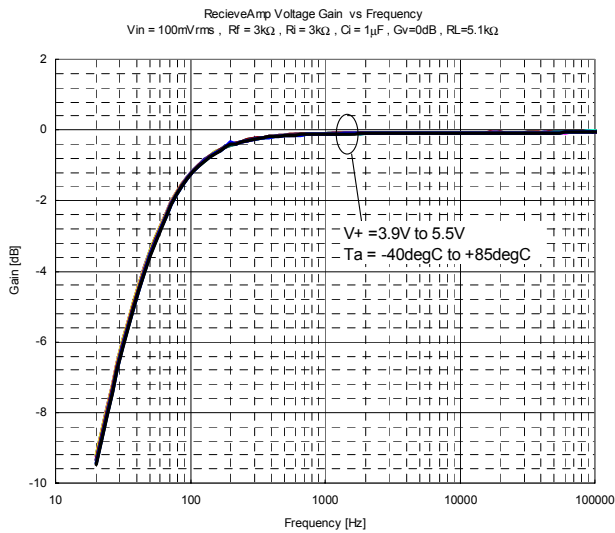
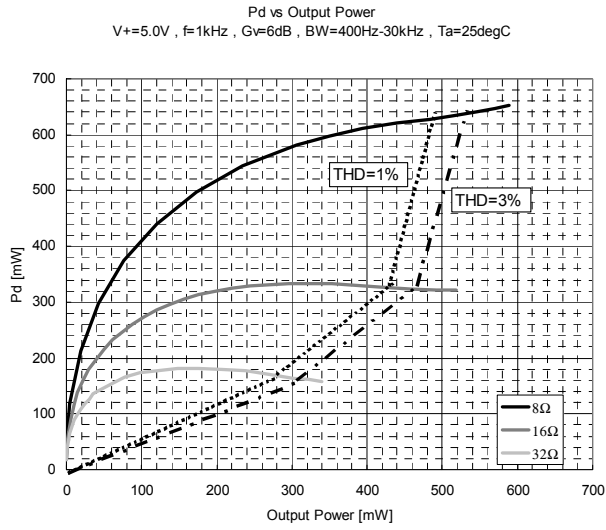
Line Amp Maximum Output Voltage vs Load Impedance  
 $V+ = 5.0V$ ,  $R_f = 51k\Omega$ ,  $T_a = 25\text{degC}$



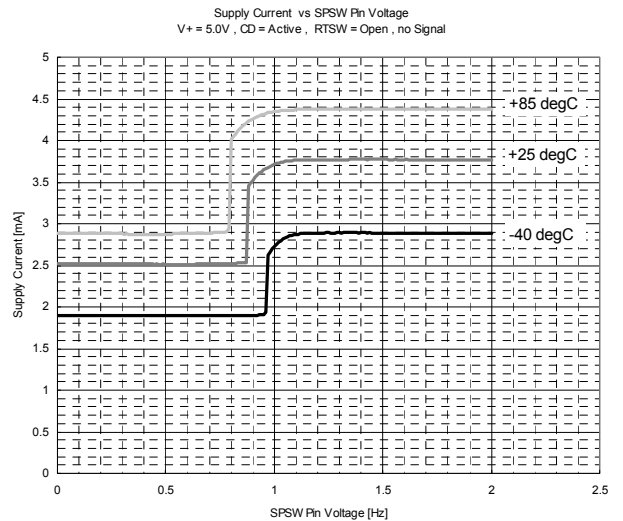
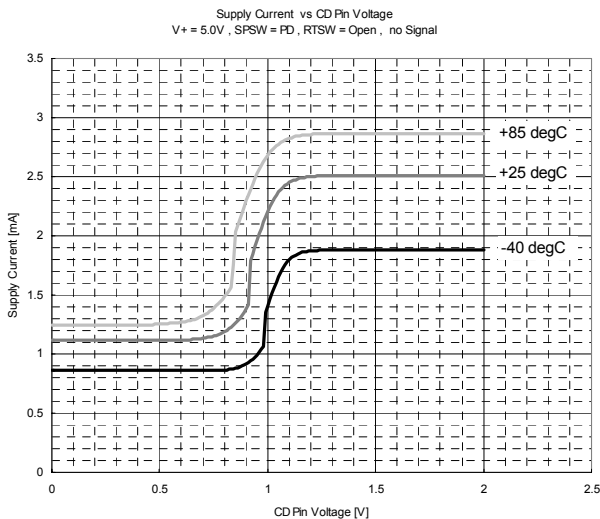
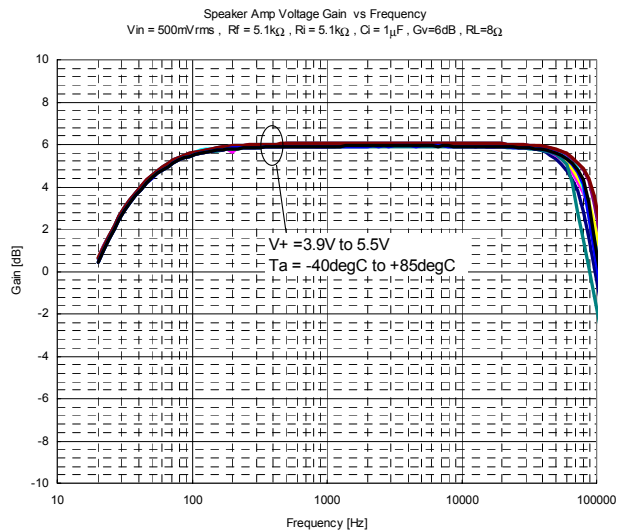
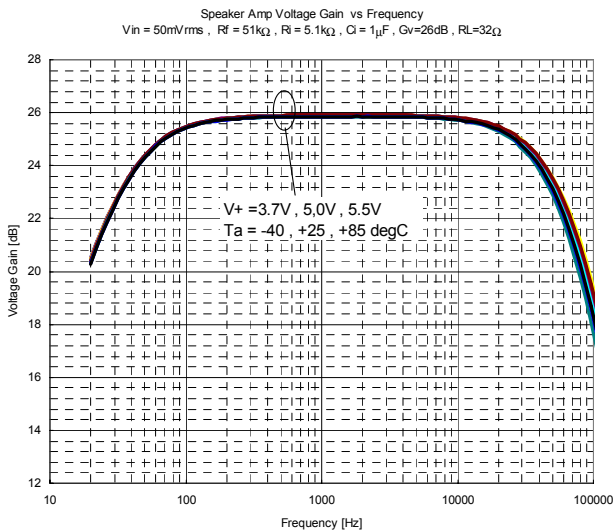
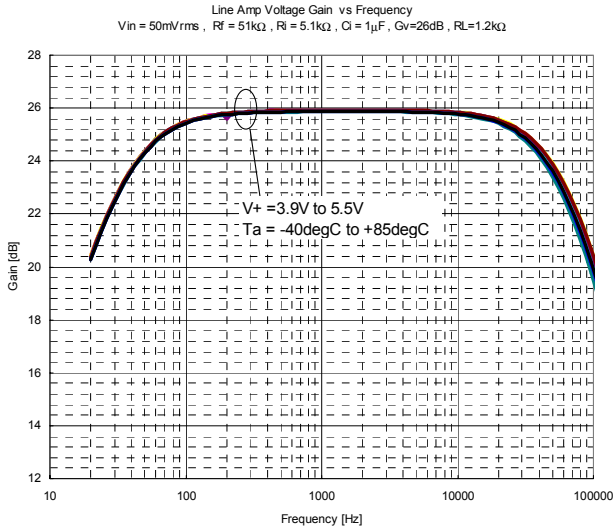
Monitor out Maximum Output Voltage vs Load Impedance  
 $V+ = 5.0V$ ,  $T_a = 25\text{degC}$



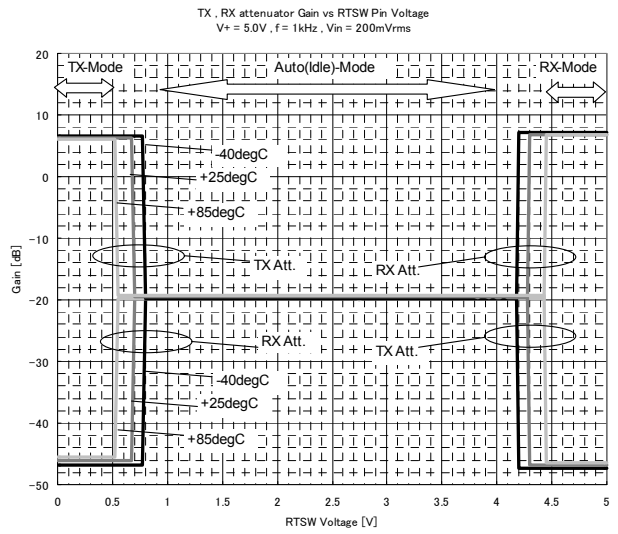
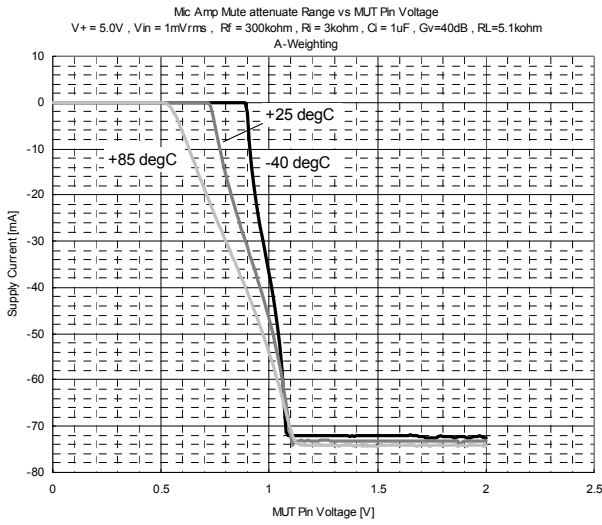
## TYPICAL CHARACTERISTICS



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## TYPICAL CHARACTERISTICS



**[CAUTION]**

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