

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

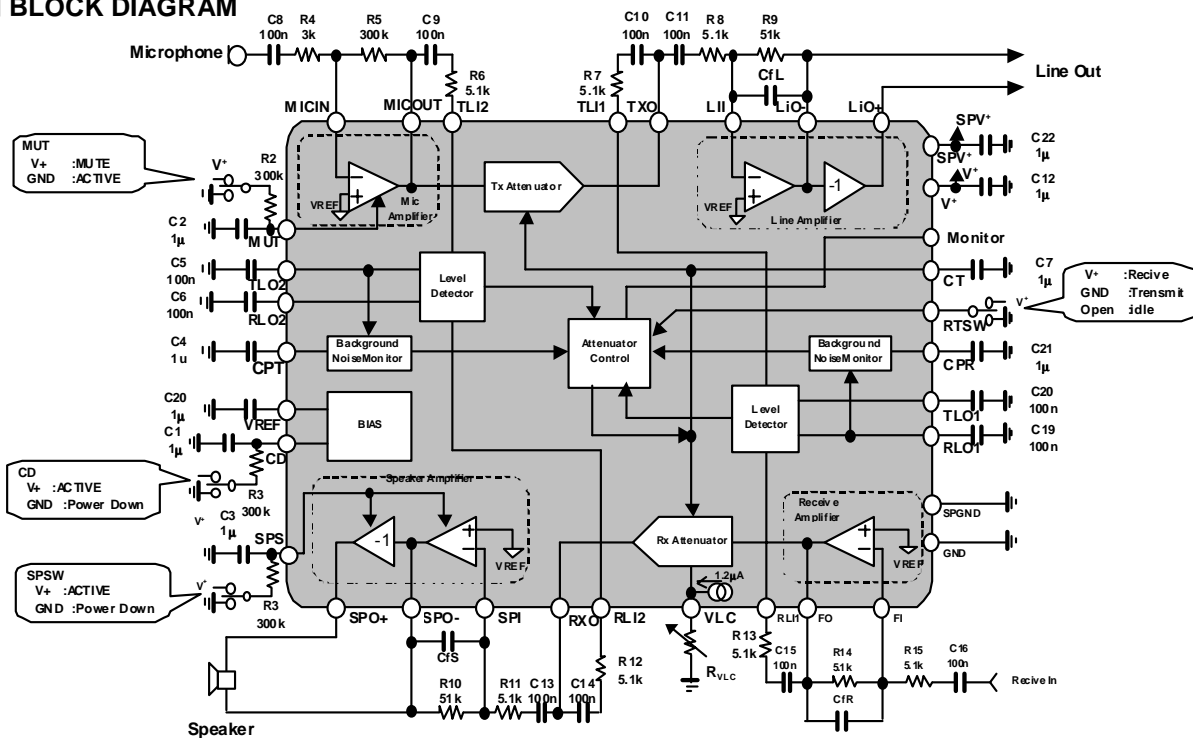
APPLICATION

- 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 |

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●**MIC Amplifier**(TxIN=1mVrms, Gv=40dB, RL=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, RL=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, Gv=26dB, RL=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, 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 _{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 | P _{OMAX1} | RL=32Ω, THD=3% | 200 | 300 | - | mW |
| | P _{OMAX2} | 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 | % |

NJW1128

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●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

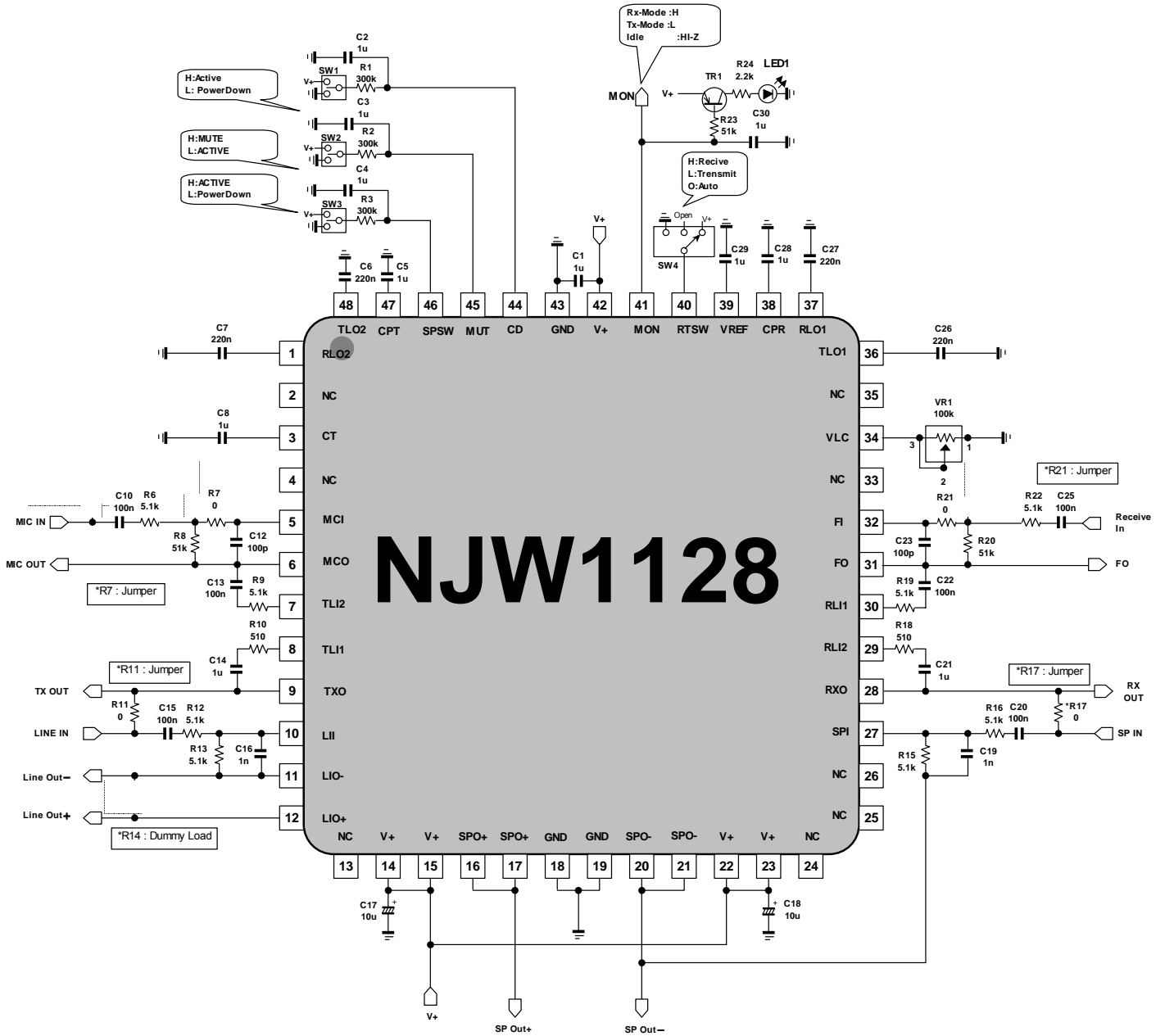
| INPUT VOLTAGE | STATUS | OPERATION |
|---------------|----------|--|
| V_{IH} | Receive | Force to Receive mode. |
| OPEN | AUTO | Receive mode and Transmit mode are automatically switched. |
| V_{IL} | Transmit | Force to Transmit mode. |

● R_{VLC} (26pin)

| IMPEDANCE | STATUS | OPERATION |
|---------------|-------------|---|
| 0 | Vol_{MAM} | The Receive attenuator Volume is maximum. |
| 100k Ω | Vol_{MIN} | The Receive attenuator Volume is minimum. |

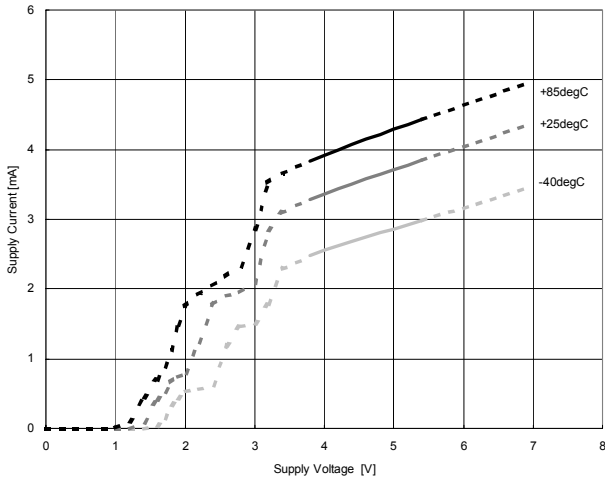
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APPLICATION CIRCUIT

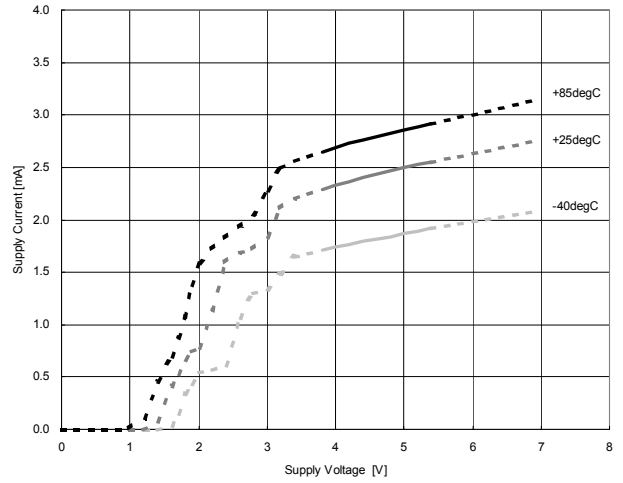


TYPICAL CHARACTERISTICS

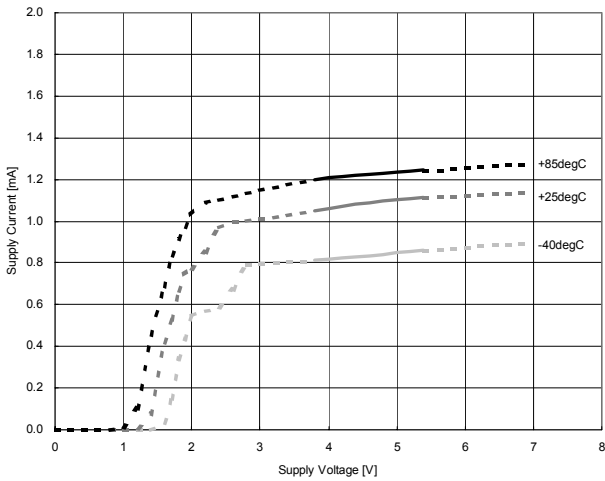
Supply Current vs Supply Voltage
No Signal, Supply Current 1



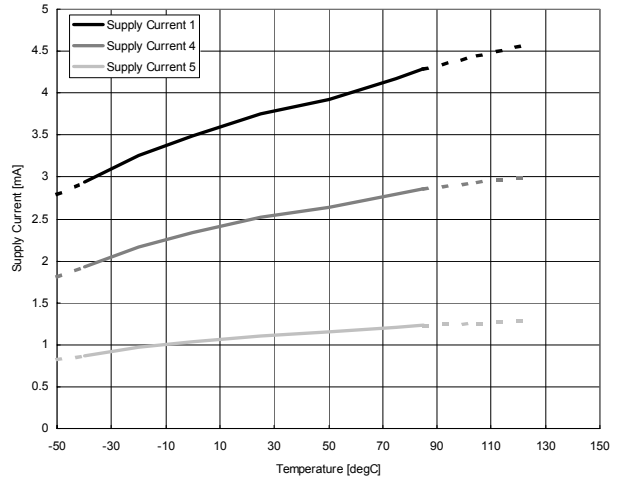
Supply Current vs Supply Voltage
No Signal, Supply Current 4



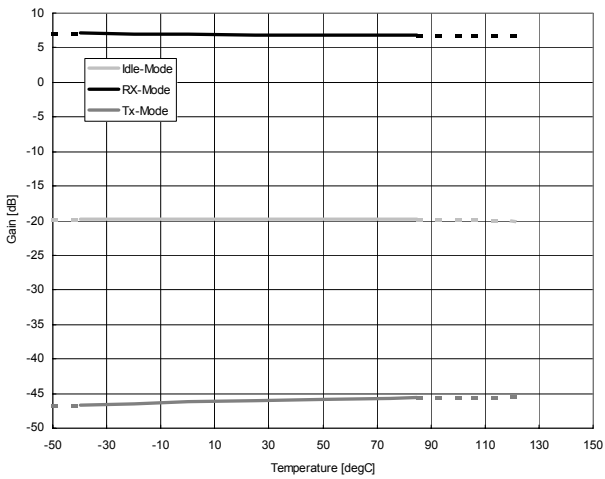
Supply Current vs Supply Voltage
No Signal, Supply Current 5



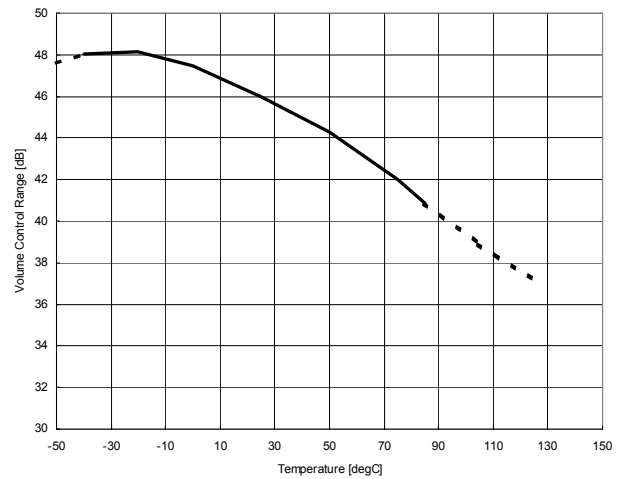
Supply Current vs Temperature
V+ =5.0V, No Signal



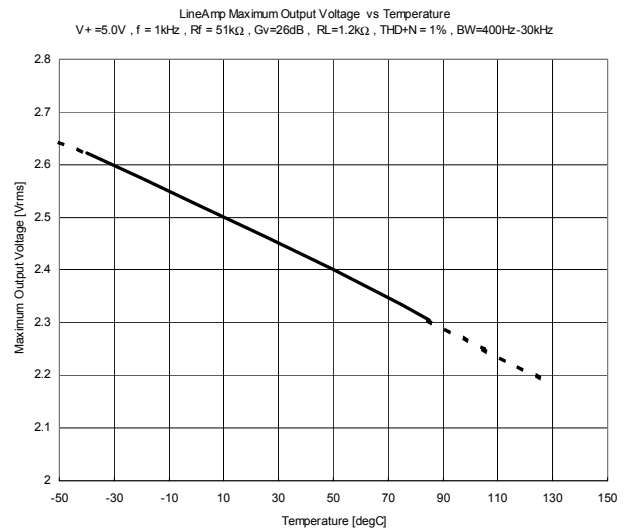
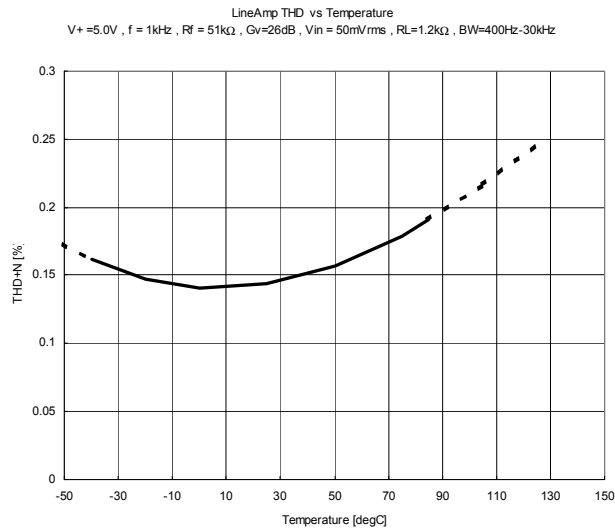
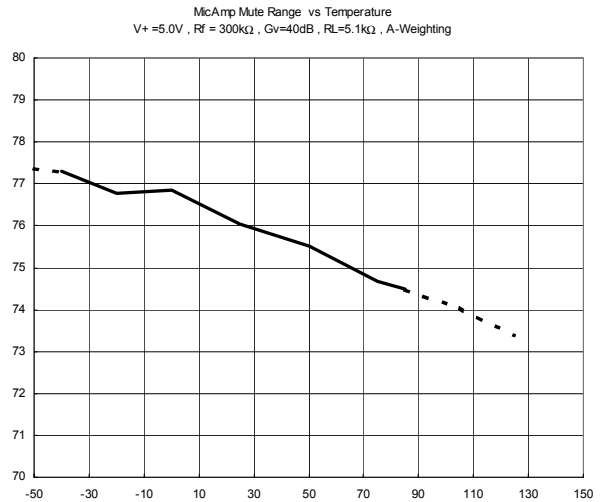
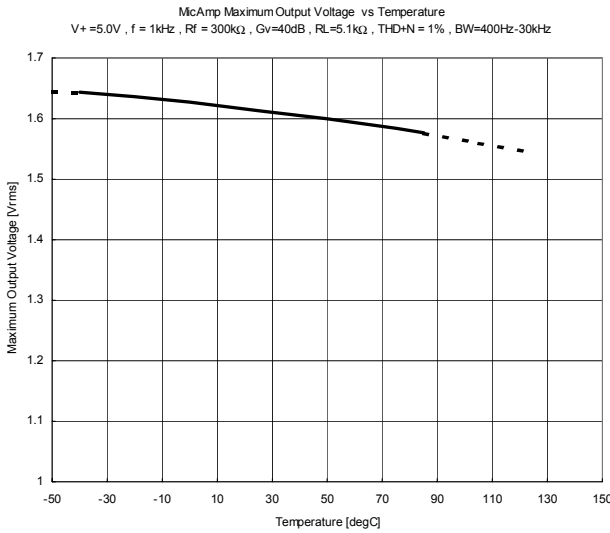
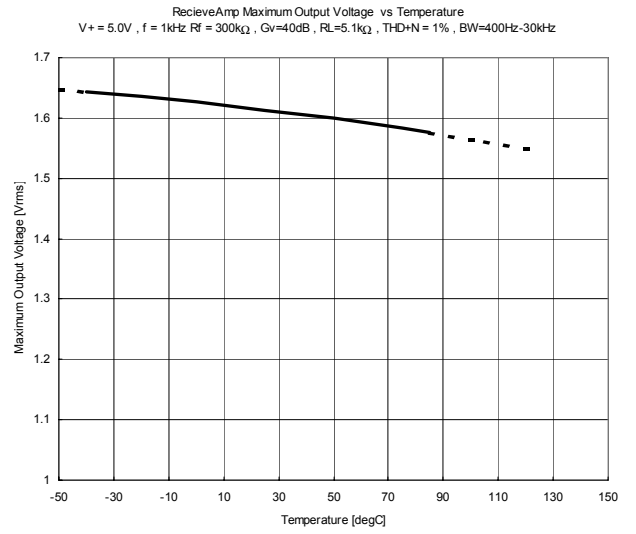
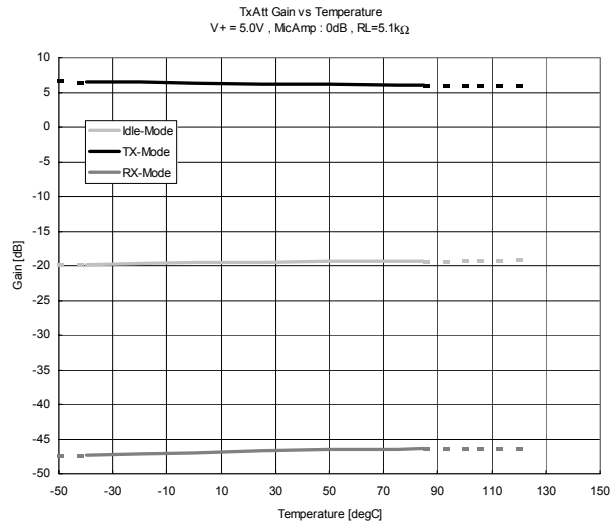
RxAtt Gain vs Temperature
V+ =5.0V, RecieveAmp : 0dB, RL=5.1k Ω



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

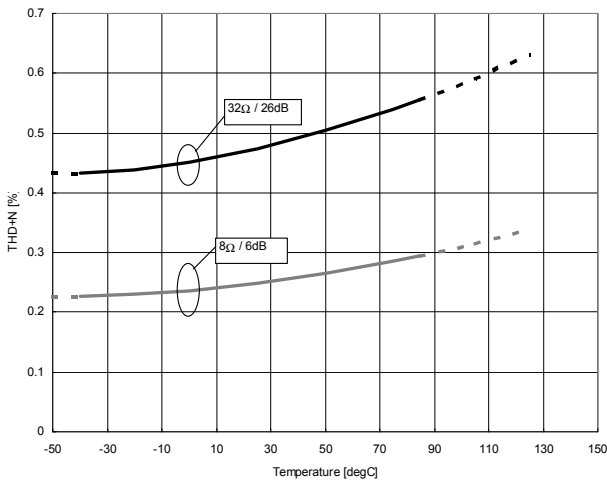


TYPICAL CHARACTERISTICS

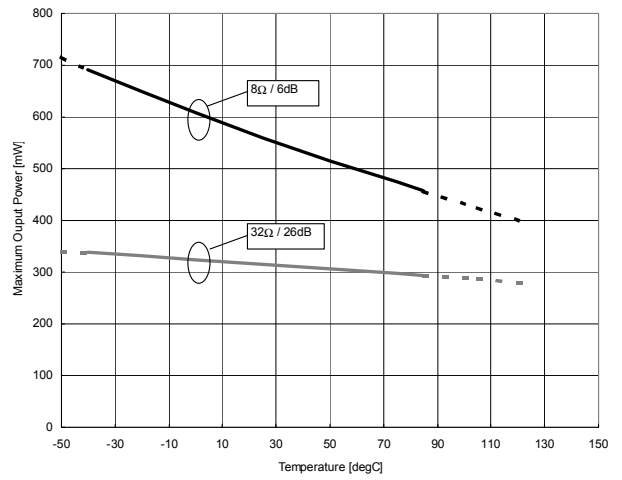


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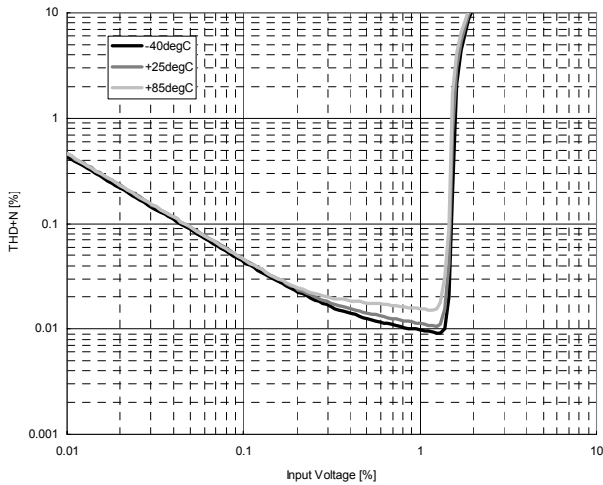
Speaker Amp THD+N vs Temperature
 $V+ = 5.0V, f = 1kHz, BW=400Hz-30kHz$



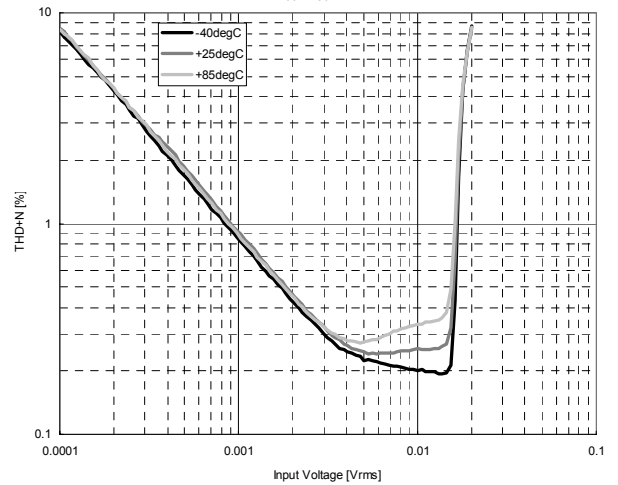
Speaker Amp Maximum Output Power vs Temperature
 $V+ = 5.0V, f = 1kHz, THD+N = 3%, BW=400Hz-30kHz$



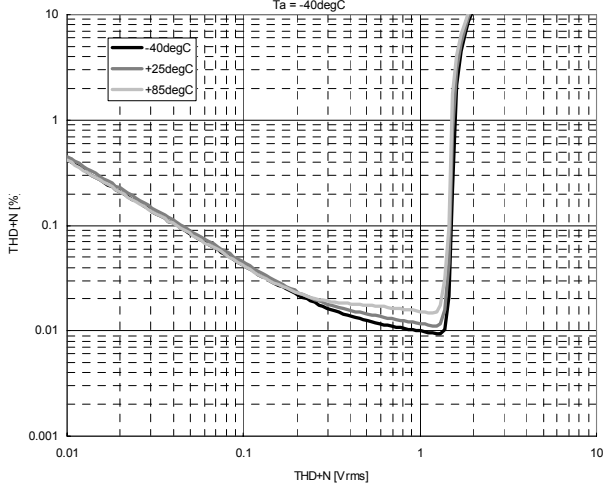
Receive Amp THD+N vs Input Voltage
 $V+ = 5.0V, f = 1kHz, Rf = 3k\Omega, Ri = 3k\Omega, Ci = 1\mu F, Gv = 0dB, RL = 5.1k\Omega, BW=400Hz-30kHz$



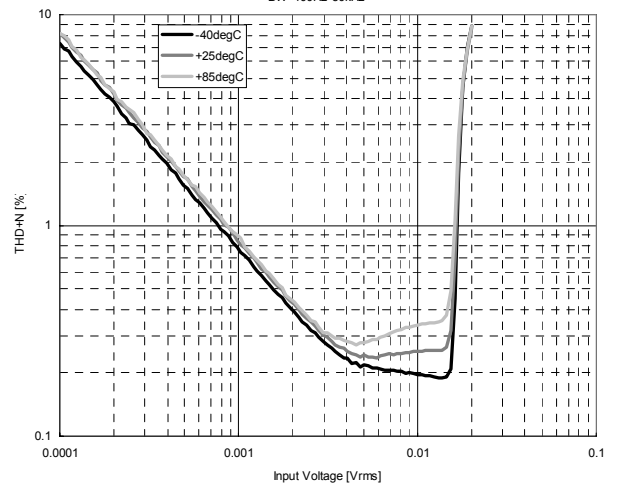
Receive Amp THD+N vs Input Voltage
 $V+ = 5.0V, f = 1kHz, Rf = 300k\Omega, Ri = 3k\Omega, Ci = 1\mu F, Gv = 40dB, RL = 5.1k\Omega, BW=400Hz-30kHz$



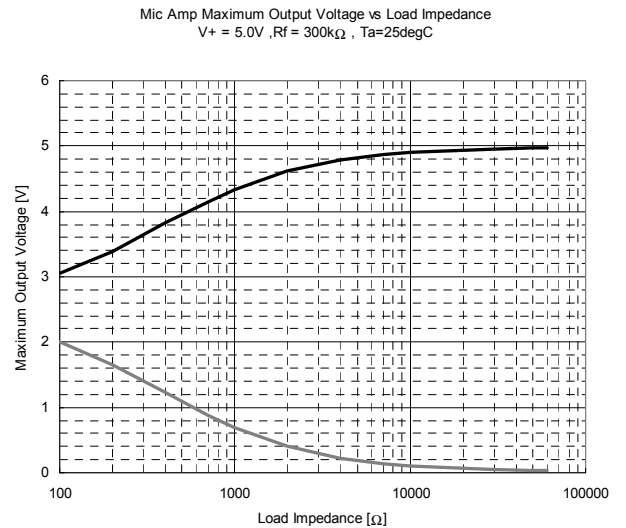
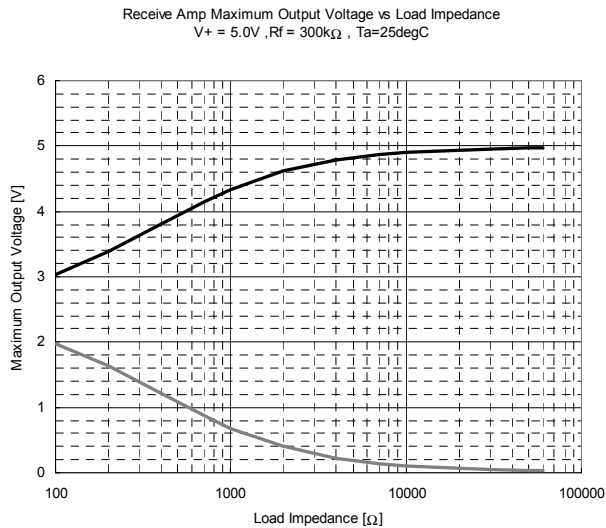
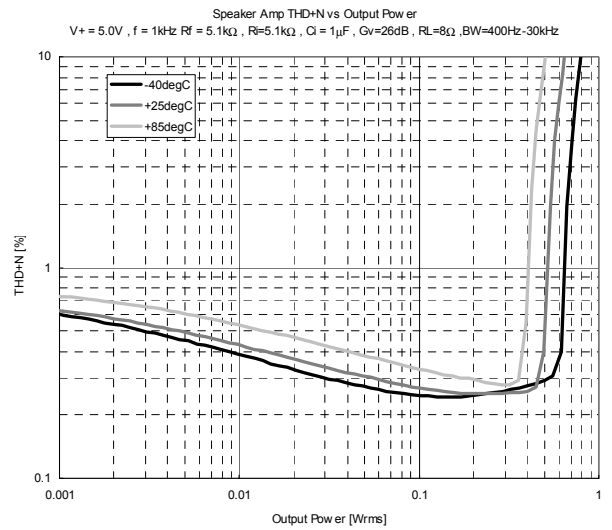
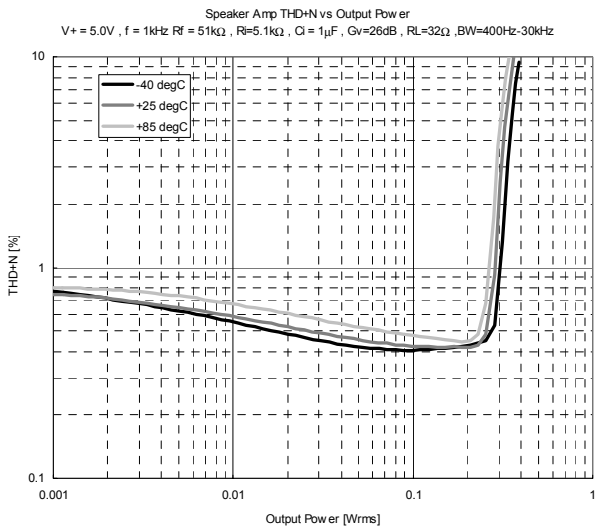
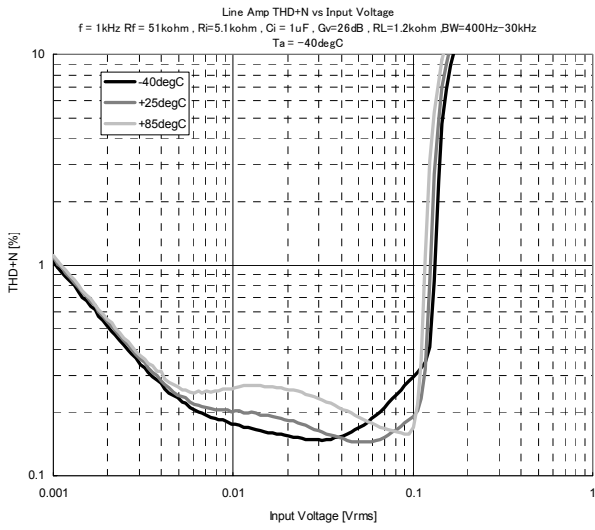
Mic Amp THD+N vs Input Voltage
 $f = 1kHz, Rf = 3k\Omega, Ri = 3k\Omega, Ci = 1\mu F, Gv = 0dB, RL = 5.1k\Omega, BW=400Hz-30kHz, Ta = -40degC$



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

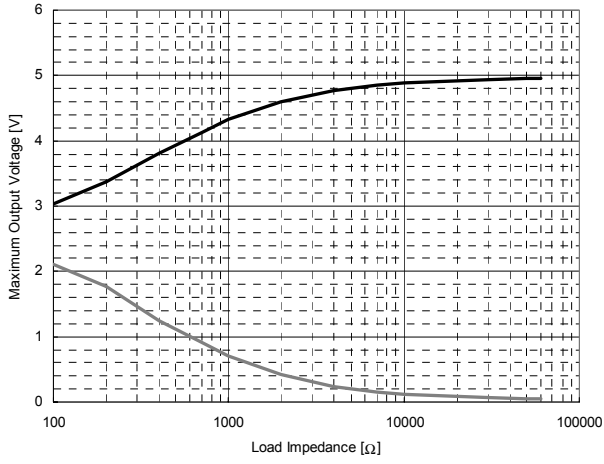


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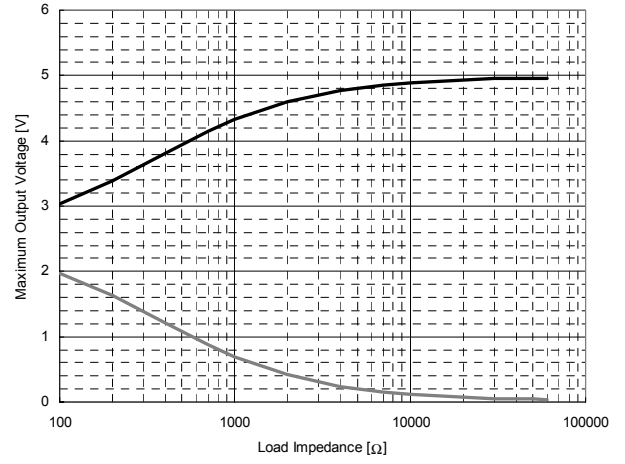


■ TYPICAL CHARACTERISTICS

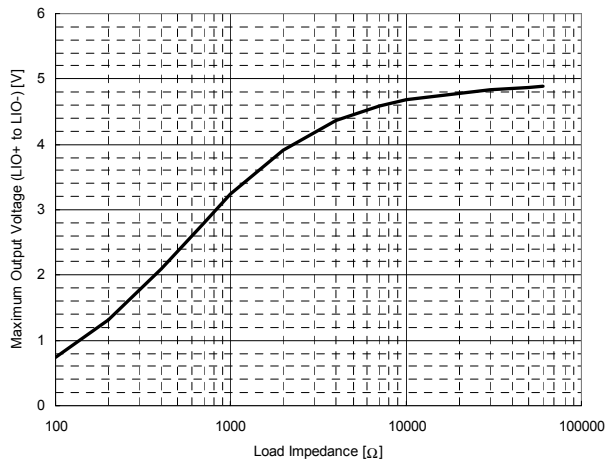
Rx Att Maximum Output Voltage vs Load Impedance
V+=5.0V, Ta=25degC



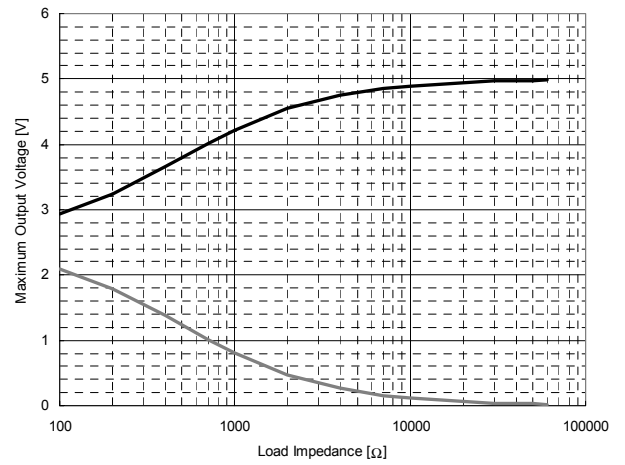
Tx Att Maximum Output Voltage vs Load Impedance
V+=5.0V, Ta=25degC



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

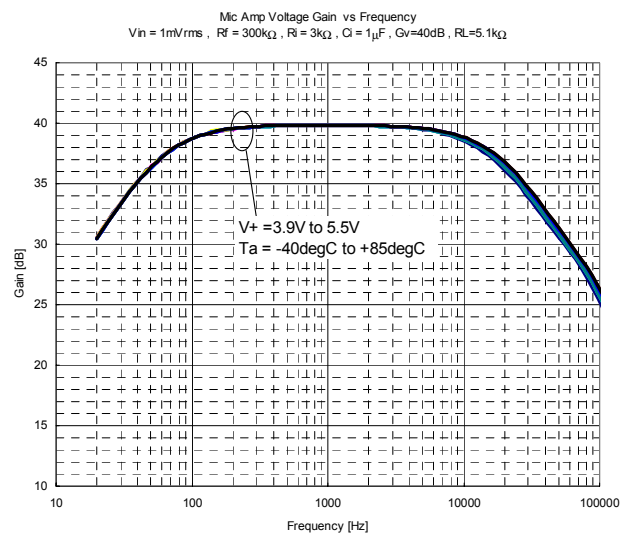
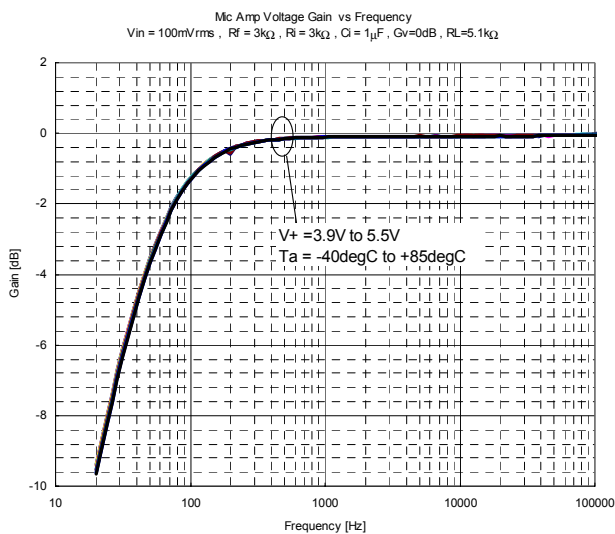
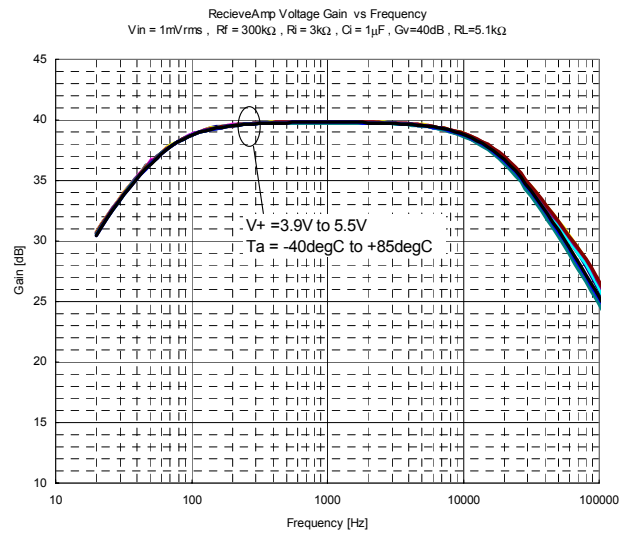
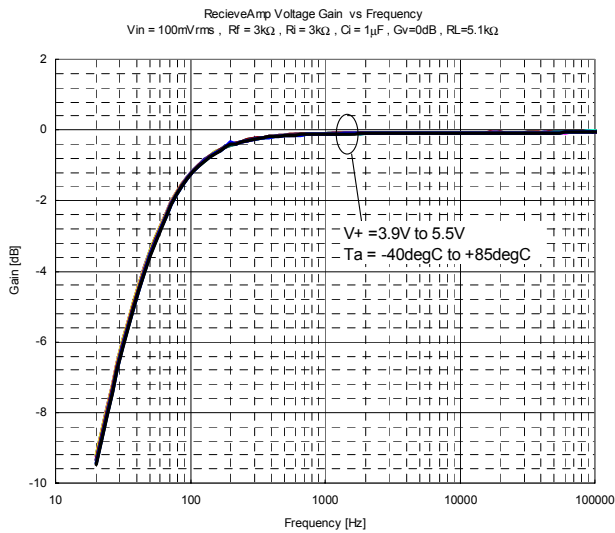
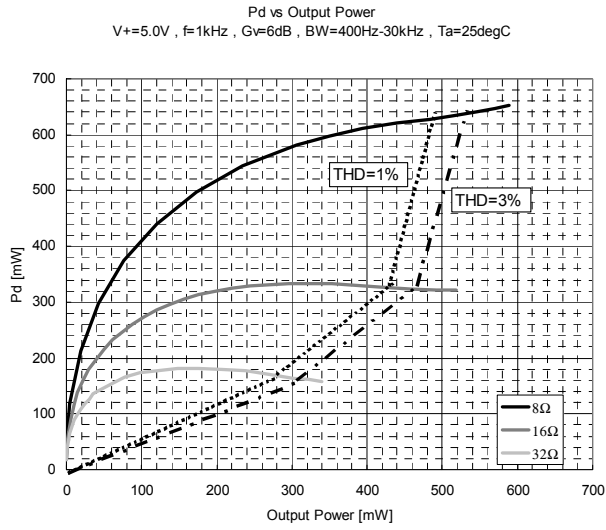


Monitor out Maximum Output Voltage vs Load Impedance
V+=5.0V, Ta=25degC

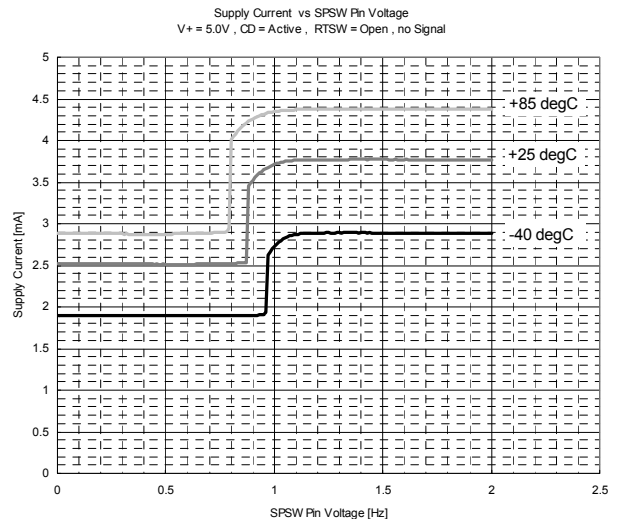
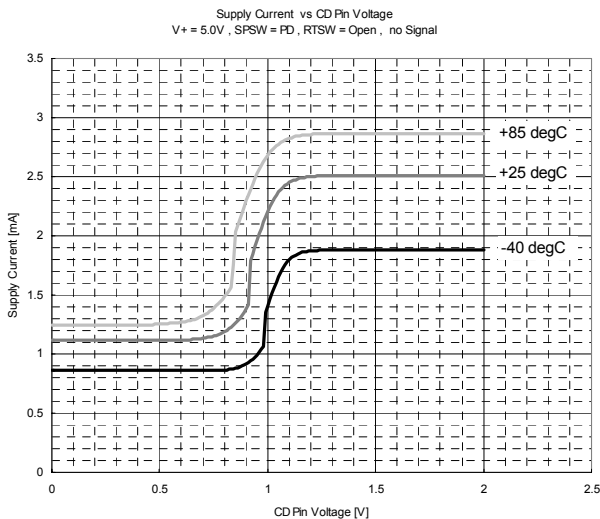
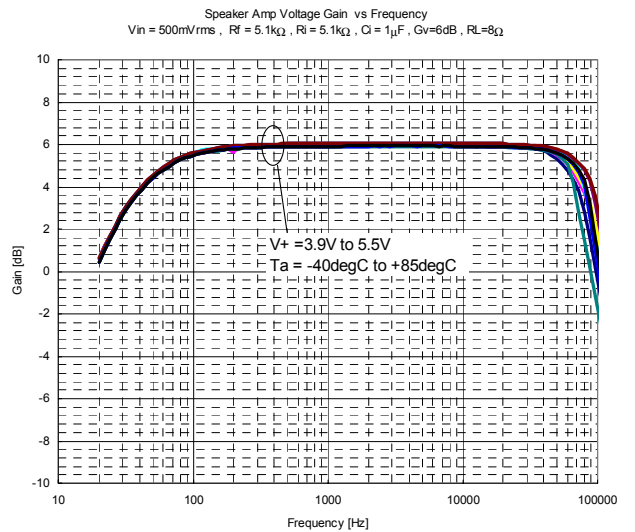
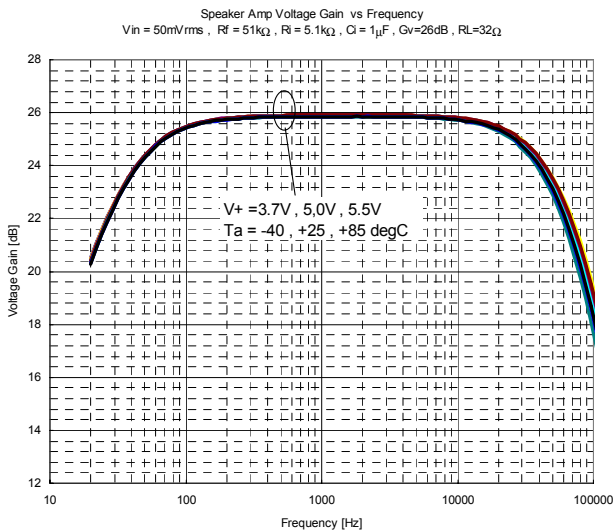
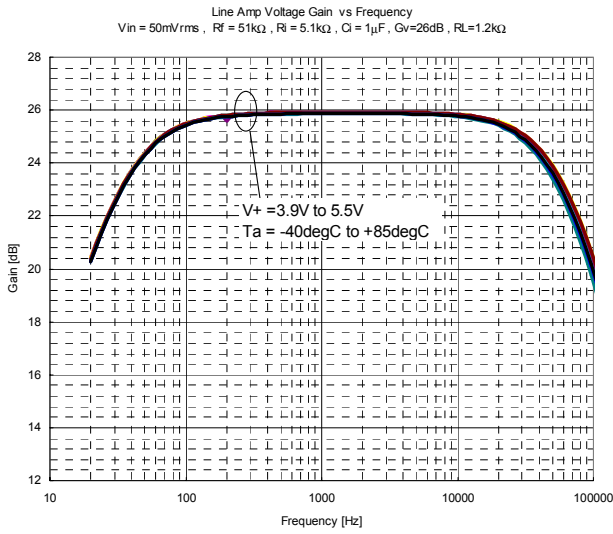


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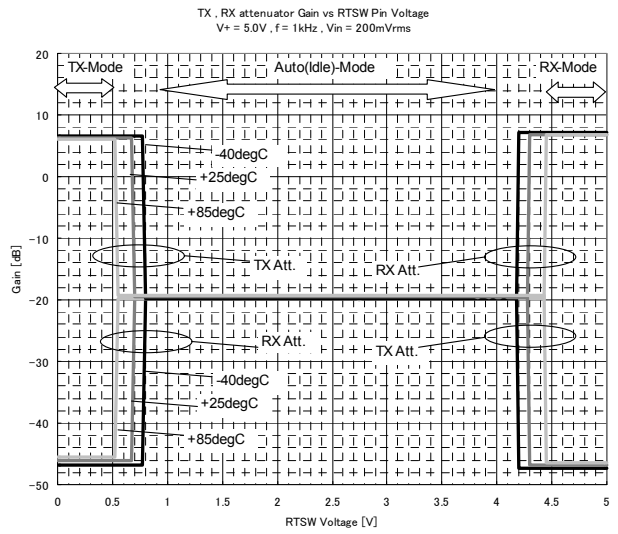
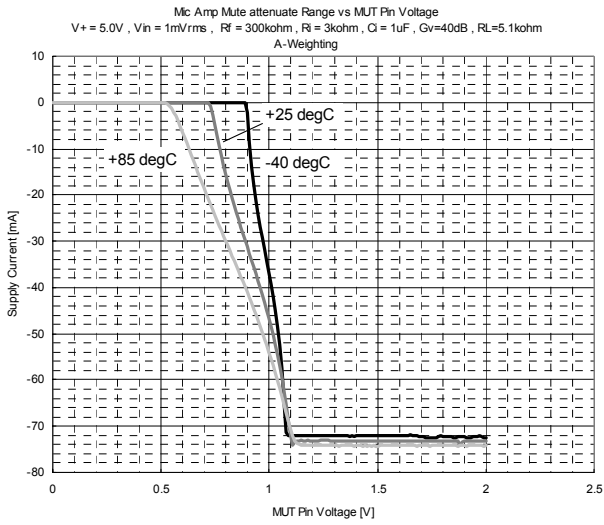
TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS



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