eala MOBILE

Surround Audio Processor for Mobile Applications

■ GENERAL DESCRIPTION

The **NJM2705** is the surround audio processor for mobile applications.

It regenerates the 3D surround sound with extremely narrow space two speakers (2SP mode), headphone surround with normal headphone (HP mode) and reverberation sound with only one speaker (1SP mode).

It includes mode control switches for surround function and standby function and realizes low consumption power design by standby function.

It is suitable for PDA and portable game.
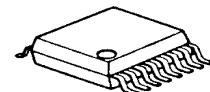
■ FEATURES

|	
● Operating Voltage	1.8 to 6V
● Operating Current	0.7mA typ. at Active mode
	1µA max. at Standby mode
● Low Output Noise	10µVrms typ
	(2SP/HP/1SP mode, VR : max.)

● Variable Surround Effect by external resistor
  (Adjustable for speaker and headphone independently.)
● Standby Function
● Internal Mode Control Switch
● Bipolar Technology
● Package Outline   SSOP16

■ PACKAGE OUTLINE

NJM2705V

■ BLOCK DIAGRAM
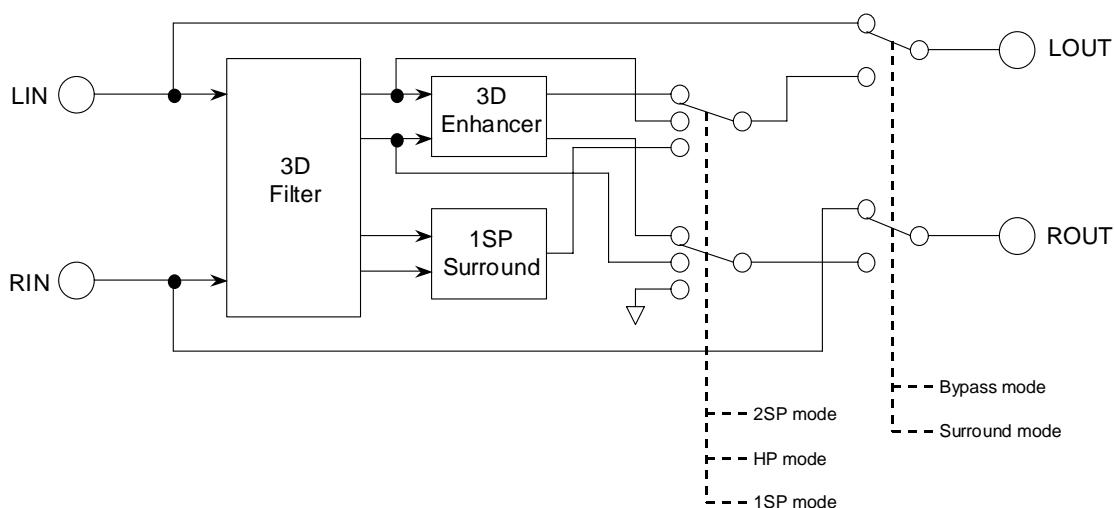
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■ **PIN CONFIGURATION**

SSOP16 (Top View)

Pin	Name	Pin	Name
1.	NFHPR	9.	V+
2.	NFSPR	10.	STBY
3.	ROUT	11.	SW1
4.	LOUT	12.	SW2
5.	RIN	13.	PS
6.	LIN	14.	LMON
7.	VREF	15.	NFHPL
8.	GND	16.	NFSPL
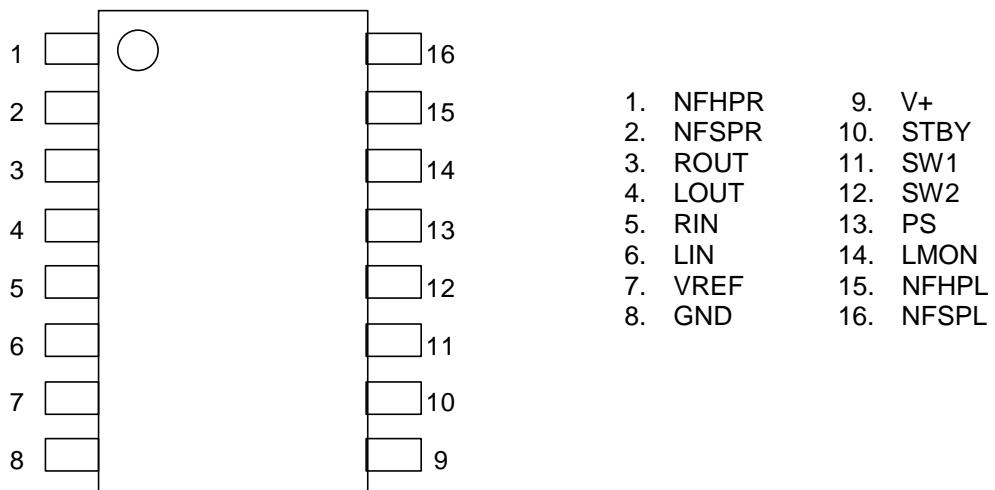
■ABSOLUTE MAXIMUM RATING (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	7	V
Power Dissipation	P_D	300	mW
Operating Temperature Range	T_{opr}	-20 to +75	°C
Storage Temperature Range	T_{stg}	-40 to +125	°C

■OPERATING VOLTAGE

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Voltage	V^+	-	1.8	3.0	6.0	V

■ELECTRICAL CHARACTERISTICS (V+=3V, Ta=25°C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION							MIN	TYP	MAX	UNIT
			INPUT		OUT PUT	MODE	SP VR	HP VR				
			L	R								
Operating Current	I_{CC}	No Signal	0	0	-	Active			-	450	700	μA
			0	0	-	Standby			-	0.1	1.0	
Reference Voltage	Vref	No Signal	0	0	-	-			1.0	1.15	1.3	V

●AC CHARACTERISTICS

(V+=3V, Ta=25°C, V_{IN}=-20dBV(100mVrms), f=1kHz, RL=10kΩ, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION							MIN	TYP	MAX	UNIT
			INPUT		OUT PUT	MODE	SP VR	HP VR				
			L	R								
Maximum Input Voltage	V_{IM1}	f=1kHz THD=1%	V_{IN} 0	0 V_{IN}	L R	Bypass	-	-	-	-2.0 (790)	-	dBV (mVrms)
	V_{IM2}	f=100Hz THD=1%	V_{IN} 0	0 V_{IN}	L R	2SP	MAX	-	-	-16.0 (160)	-	
	V_{IM3}	f=100Hz THD=1%	V_{IN} 0	0 V_{IN}	L R	HP	-	MAX	-	-16.0 (160)	-	
	V_{IM4}	f=100Hz THD=1%	V_{IN}	0	L	1SP	MAX	-	-	-16.0 (160)	-	
	V_{IM5}	f=100Hz THD=1%	0	V_{IN}	L	1SP	MAX	-	-	-14.5 (190)	-	
	V_{IM6}	V^+=1.8V,f=1kHz THD=1%	V_{IN} 0	0 V_{IN}	L R	Bypass	-	-	-10.5 (300)	-8.5 (380)	-	
	V_{IM7}	V^+=1.8V,f=100Hz THD=1%	V_{IN} 0	0 V_{IN}	L R	2SP	MAX	-	-24.5 (60)	-22.5 (75)	-	
	V_{IM8}	V^+=1.8V,f=100Hz THD=1%	V_{IN} 0	0 V_{IN}	L R	HP	-	MAX	-24.5 (60)	-22.5 (75)	-	
	V_{IM9}	V^+=1.8V,f=100Hz THD=1%	V_{IN}	0	L	1SP	MAX	-	-24.5 (60)	-22.5 (75)	-	
	V_{IM10}	V^+=1.8V,f=100Hz THD=1%	0	V_{IN}	L	1SP	MAX	-	-23.0 (70)	-21.0 (90)	-	
Output Noise	V_{NO1}	Rg=0Ω A-Weighted	0	0	L R	Bypass	-	-	-	-112 (2.5)	-106 (5.0)	dBV (μVrms)
	V_{NO2}	Rg=0Ω A-Weighted	0	0	L R	1SP	MAX	-	-	-100 (10)	-94 (20)	
	V_{NO3}	Rg=0Ω A-Weighted	0	0	L R	HP	-	MAX	-	-100 (10)	-94 (20)	
	V_{NO4}	Rg=0Ω A-Weighted	0	0	L	1SP	MAX	-	-	-100 (10)	-94 (20)	

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● AC CHARACTERISTICS

(V$^+$=3V, Ta=25°C, V$_{IN}$=-20dBV(100mVrms), f=1kHz, RL=10kΩ, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION							MIN	TYP	MAX	UNIT
			INPUT		OUT PUT	MODE	SP VR	HP VR				
			L	R								
Total Harmonic Distortion	THD1	f=1kHz	V$_{IN}$ 0	0 V$_{IN}$	L R	Bypass	-	-	-	0.02	0.05	%
	THD2	f=1kHz	V$_{IN}$ 0	0 V$_{IN}$	L R	2SP	MAX	-	-	0.1	0.5	
	THD3	f=1kHz	V$_{IN}$ 0	0 V$_{IN}$	L R	HP	-	MAX	-	0.1	0.5	
	THD4	f=1kHz	V$_{IN}$ 0	0 V$_{IN}$	L R	1SP	MAX	-	-	0.1	0.5	
BYPASS Gain	G$_{VBYP}$	f=1kHz	V$_{IN}$ 0	0 V$_{IN}$	L R	Bypass	-	-	-1.0	0.0	1.0	dB
Surround Gain	G$_{VSUR1}$	f=100Hz	V$_{IN}$ 0	0 V$_{IN}$	L R	2SP	MAX	-	12.5	14.5	16.5	dB
	G$_{VSUR2}$	f=100Hz	V$_{IN}$ 0	0 V$_{IN}$	L R	2SP	MIN	-	0.5	2.5	4.5	
	G$_{VSUR3}$	f=100Hz	V$_{IN}$ 0	0 V$_{IN}$	L R	HP	-	MAX	12.5	14.5	16.5	
	G$_{VSUR4}$	f=100Hz	V$_{IN}$ 0	0 V$_{IN}$	L R	HP	-	MIN	0.5	2.5	4.5	
	G$_{VSUR5}$	f=100Hz	V$_{IN}$	0	L	1SP	MAX	-	6.5	8.5	10.5	
	G$_{VSUR6}$	f=100Hz	0	V$_{IN}$	L	1SP	MAX	-	2.0	4.0	6.0	
	G$_{VSUR7}$	f=100Hz	V$_{IN}$	0	L	1SP	MIN	-	-5.5	-3.5	-1.5	
	G$_{VSUR8}$	f=100Hz	0	V$_{IN}$	L	1SP	MIN	-	-12.0	-10.0	-8.0	

● CONTROL CHARACTERISTICS (V$^+$=3V, Ta=25°C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
MODE Select Control Voltage	V$_{MODE}$	V$_{IN}$=High Level	1.2	-	V$^+$	V
		V$_{IN}$=Low Level	0.0	-	0.3	

■ SWITCH FUNCTION

SURROUND FUNCTION SW

MODE	SW1	SW2	NOTES
Bypass	L, OPEN	L, OPEN	Input Through
2SP mode	L, OPEN	H	Surround mode for narrow space two speakers
HP mode	H	L, OPEN	Surround mode for Headphone
1SP mode	H	H	Surround mode for monaural speaker (Surround signal from LOUT)

STANDBY SW

MODE	STBY	NOTES
Standby	L, open	IC is non-active
Active	H	IC is active

■TERMINAL DESCRIPTION

| PIN No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	Voltage
5 6	LIN RIN	Lch Input Rch Input		1.15V
4 3 14	LOUT ROUT LMON	Lch Output Rch Output Filter terminal		1.15V
2 1 16 15	NFSPR NFHPR NFSPL NFHPL	Filter terminal Filter terminal Filter terminal Filter terminal		1.15V
13	PS	Filter terminal		1.15V

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■TERMINAL DESCRIPTION

PIN No.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	Voltage
12 11	SW2 SW1	Mode control switch Mode control switch		0V
10	STBY	Standby switch		0V
9	V+	Power Supply	——————	V+
8	GND	GND	——————	0V
7	VREF	Reference voltage		1.15V

■**APPLICATION CIRCUIT**

1) 2SP mode, HP mode
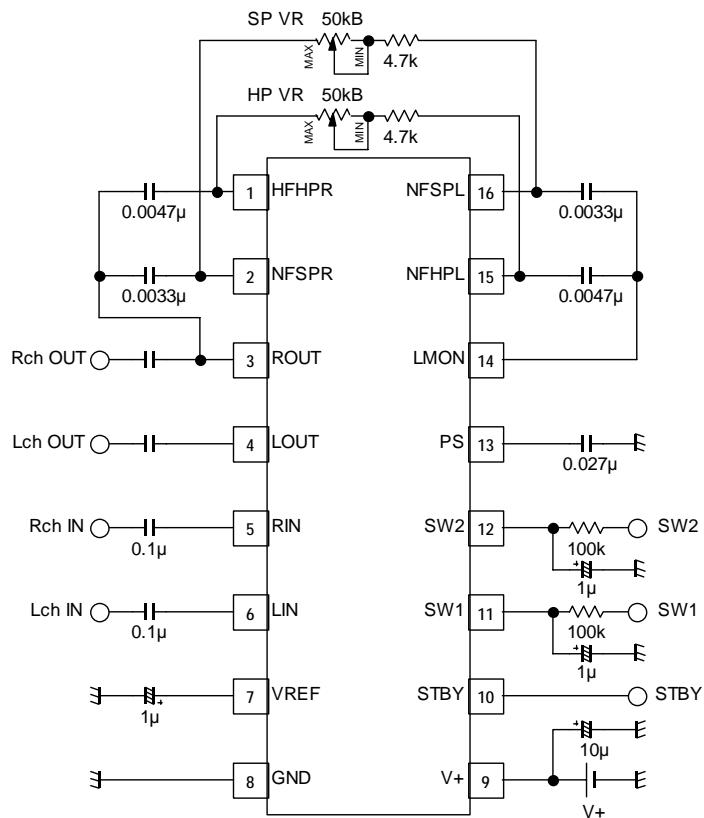
2) 1SP mode, HP mode
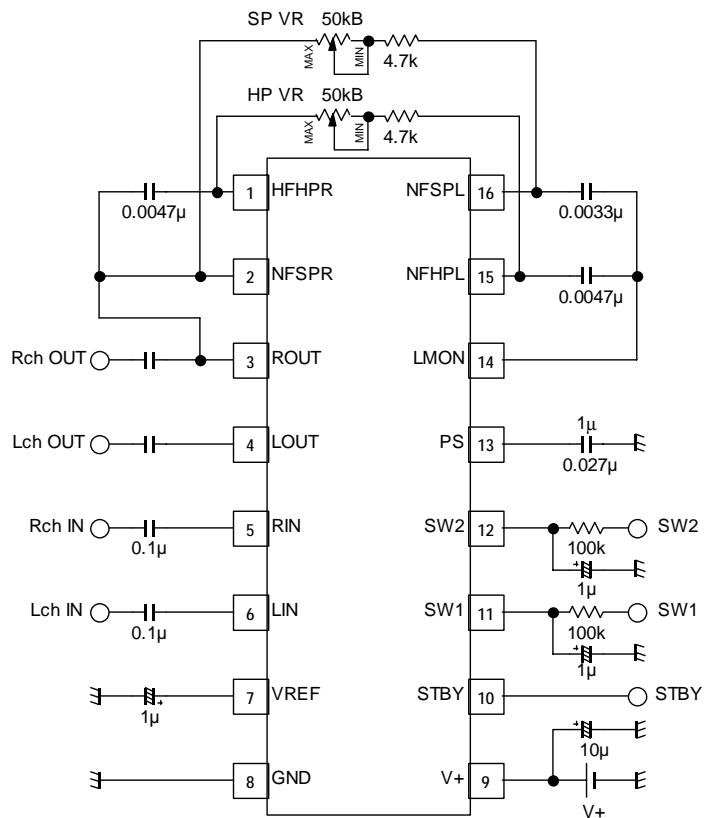
Surround signal is outputted from LOUT terminal at 1SP mode.

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■TYPICAL CHARACTERISTICS

Operating Current vs. Operating Voltage (STANDBY)

Ta=25°C
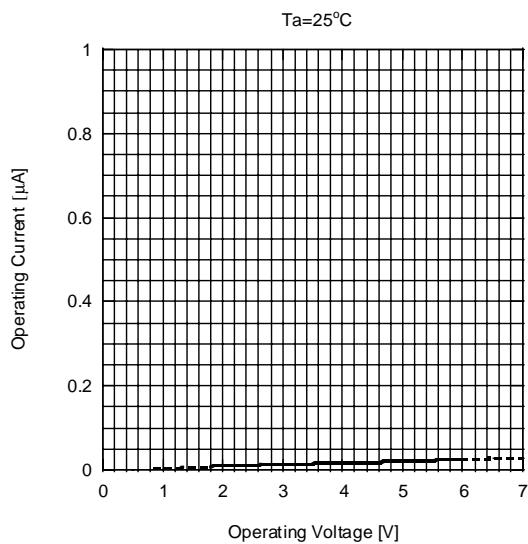
Operating Current vs. Temperature (STANDBY)

V+=3V
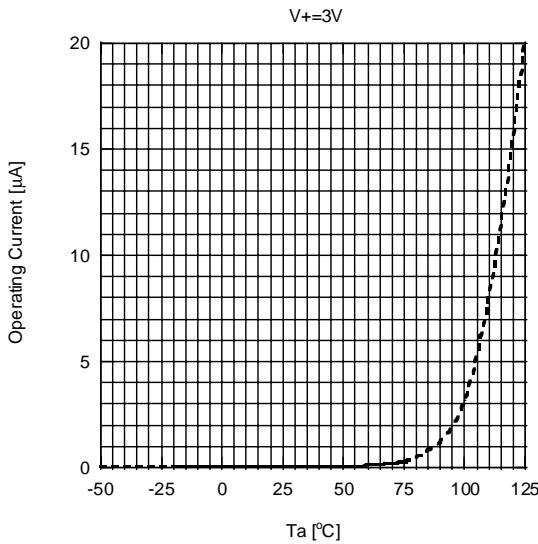
Operating Current vs. Operating Voltage (ACTIVE)

Ta=25°C

Bypass,2SP,HP,1SP mode
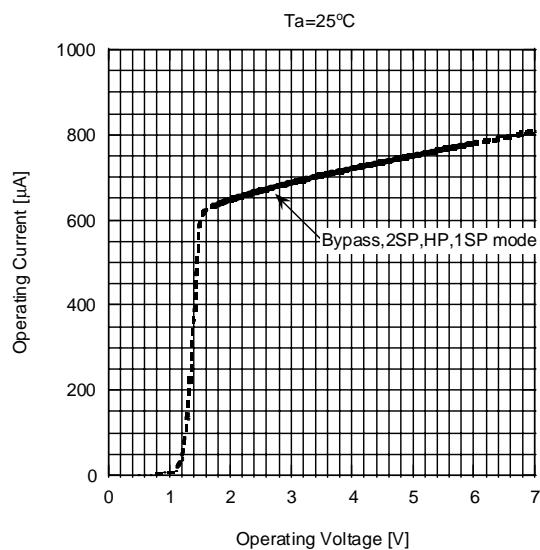
Operating Current vs. Temperature (ACTIVE)

V+=3V

Bypass,2SP,HP,1SP mode
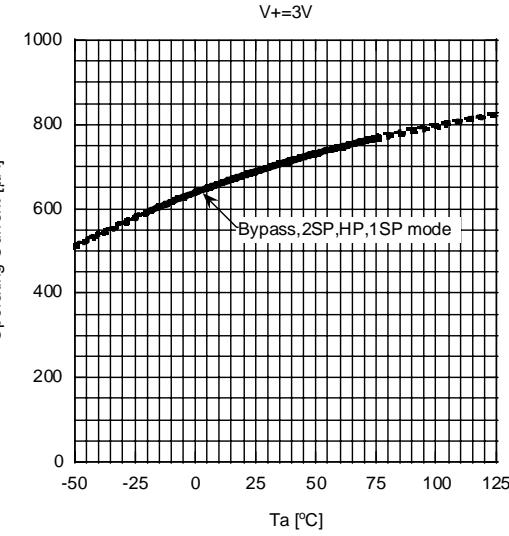
Reference Voltage vs. Operating Voltage

Ta=25°C
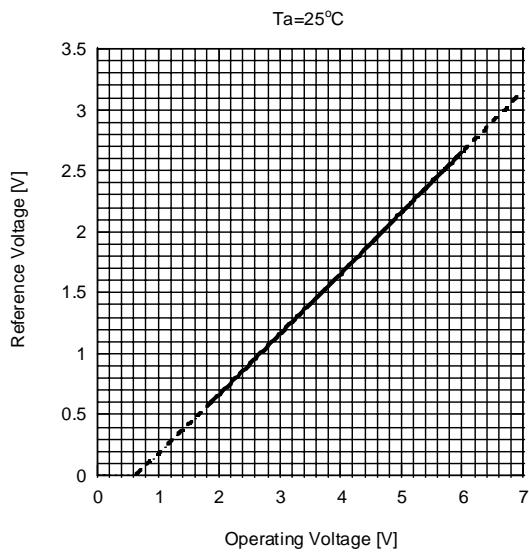
Reference Voltage vs. Temperature

V+=3V

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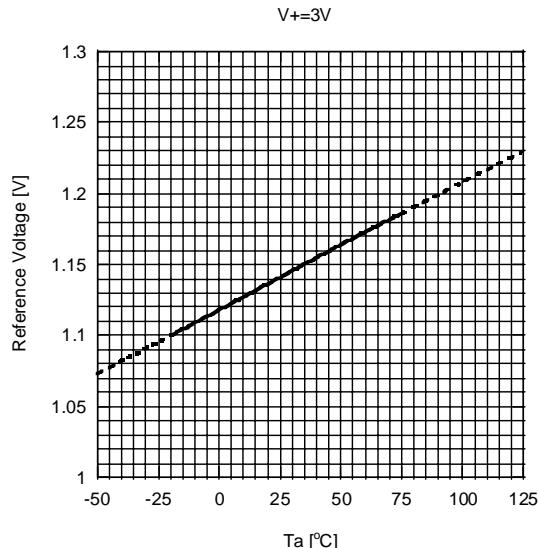
■**TYPICAL CHARACTERISTICS**

Maximum Input Voltage vs. Operating Voltage (BYPASS)
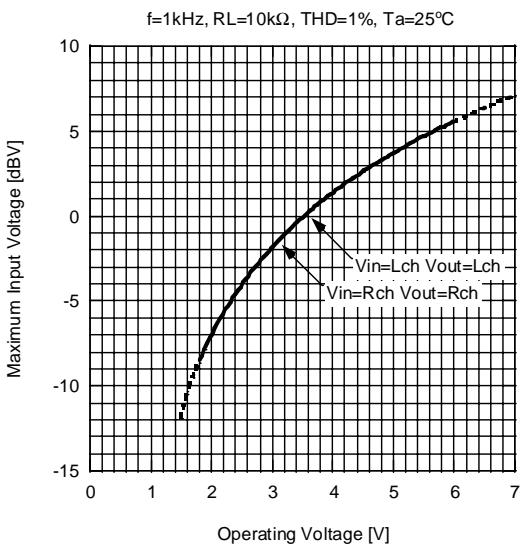
f=1kHz, RL=10kΩ, THD=1%, Ta=25°C

Maximum Input Voltage vs. Operating Voltage (2SP)
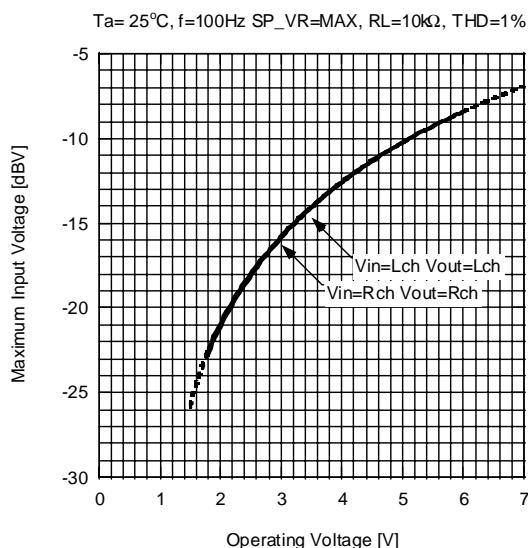
Ta= 25°C, f=100Hz SP_VR=MAX, RL=10kΩ, THD=1%

Maximum Input Voltage vs. Operating Voltage (HP)

Ta=25°C, f=100Hz, HP_VR=MAX, RL=10kΩ,THD=1%

Maximum Input Voltage vs. Temperature (1SP)

Ta= 25°C, f=100Hz, SP_VR=MAX, RL=10kΩ, THD=1%
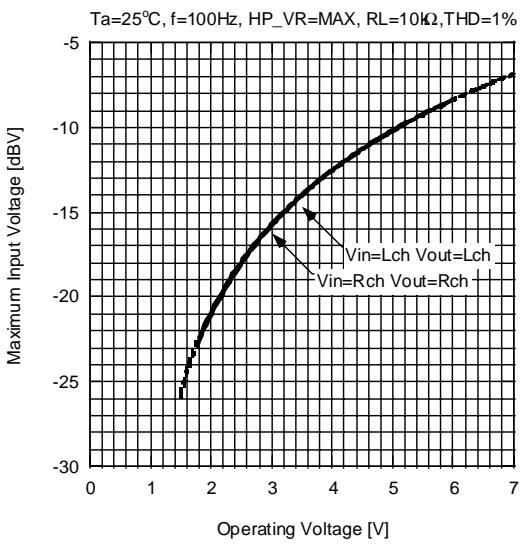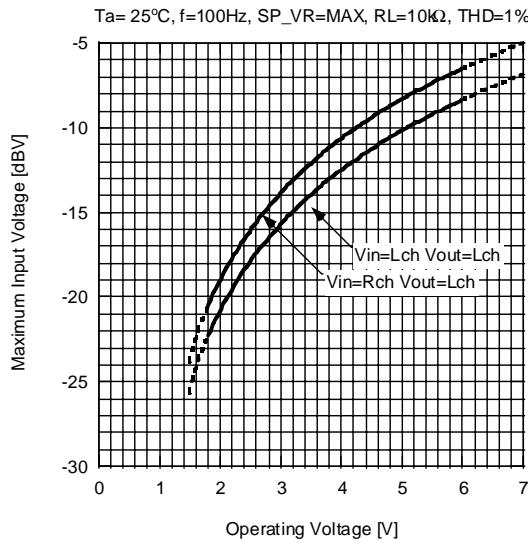
Maximum Input Voltage vs. Temperature (BYPASS)
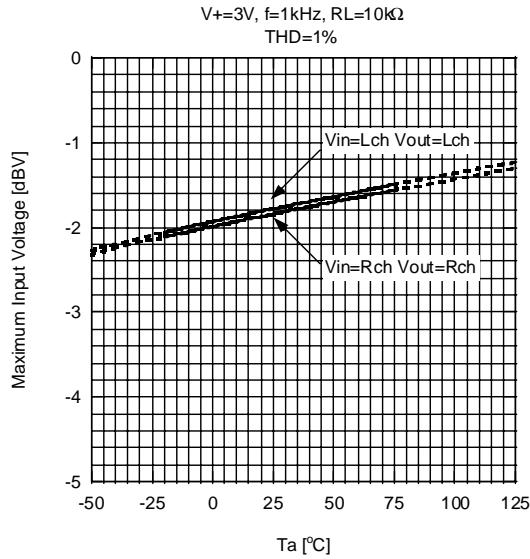
V+=3V, f=1kHz, RL=10kΩ
THD=1%

Maximum Input Voltage vs. Temperature (2SP)

V+=3V, f=100Hz, RL=10kΩ
SP_VR=MAX, THD=1%
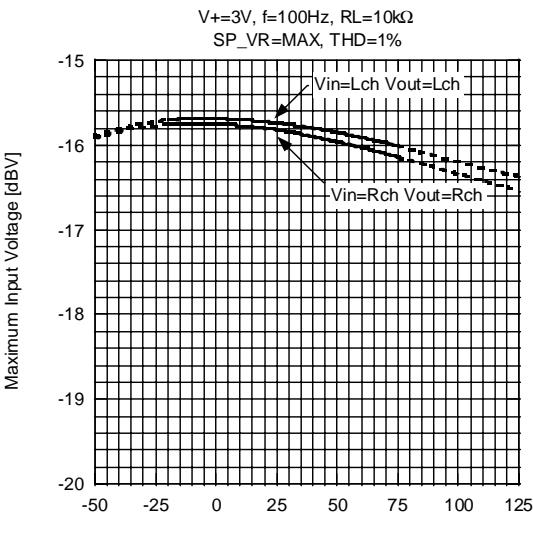
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■**TYPICAL CHARACTERISTICS**

Maximum Input Voltage vs. Temperrature (HP)

V+=3V, f=100Hz, RL=10kΩ
HP_VR=MAX, THD=1%
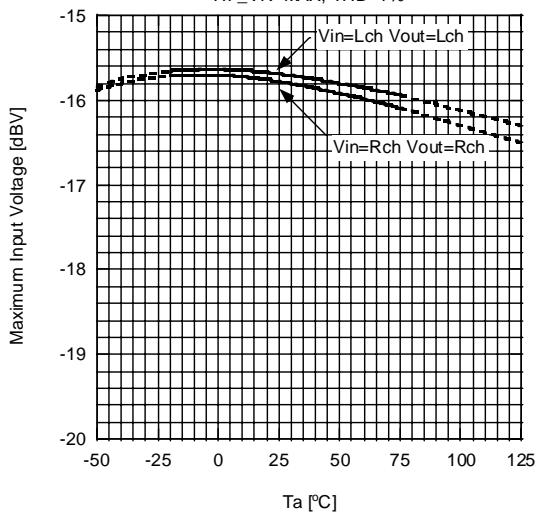
Maximum Input Voltage vs. Temperature (1SP)

V+=3V, f=100Hz, RL=10kΩ
SP_VR=MAX, THD=1%
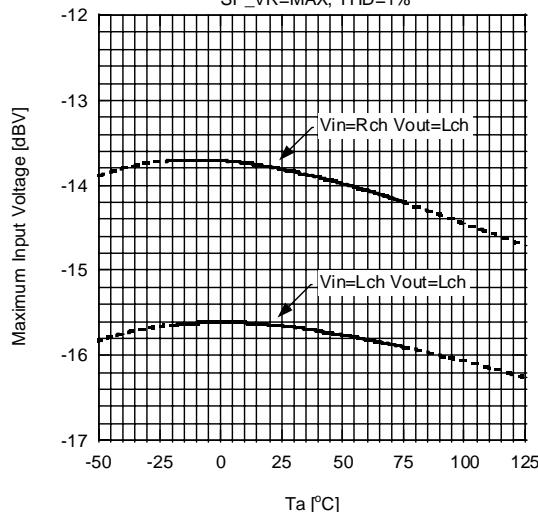
Output Noise Voltage vs. Temperature

V+=3V, Rg=0Ω, Vout=Lch
SP_VR=MAX, HP_VR=MAX, FILTER=A-Weighted
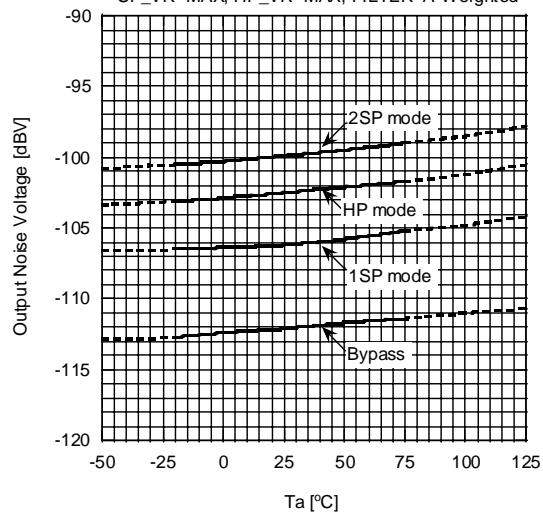
Output Noise Voltage vs. Temperature

V+=3V, Rg=0Ω, Vout=Rch
SP_VR=MAX, HP_VR=MAX, FILTER=A-Weighted
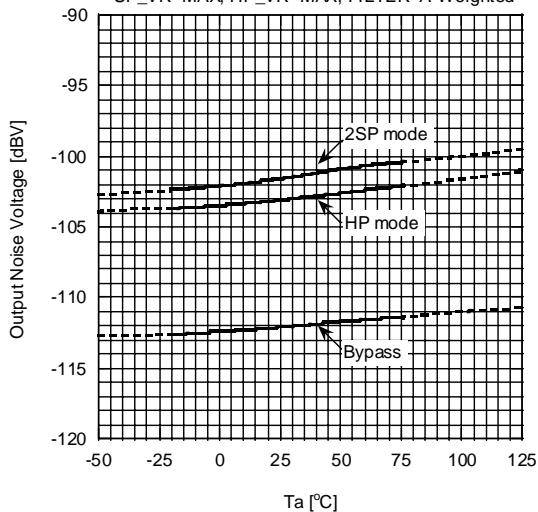
Total Harmonic Distortion vs. Input Voltage (BYPASS)

V+=3V, Vin=Lch, f=1kHz, Vout=Lch
RL=10kΩ, BW=10Hz-80kHz
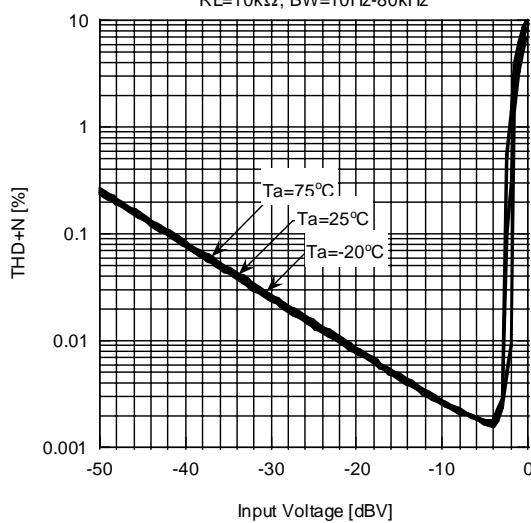
Total Harmonic Distortion vs. Input Voltage (2SP)

V+=3V, Vin=Lch, f=100Hz, Vout=Lch
RL=10kΩ, BW=10Hz-80kHz, SP_VR=MAX
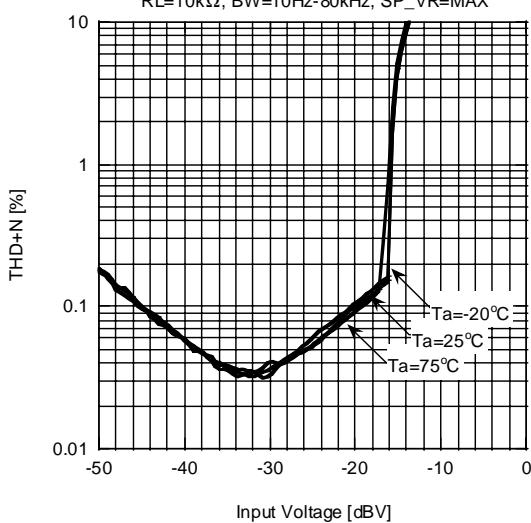
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■TYPICAL CHARACTERISTICS

Total Harmonic Distortion vs. Input Voltage (HP)
V+=3V, Vin=Lch, f=100Hz, Vout=Lch
RL=10kΩ, BW=10Hz-80kHz, HP_VR=MAX
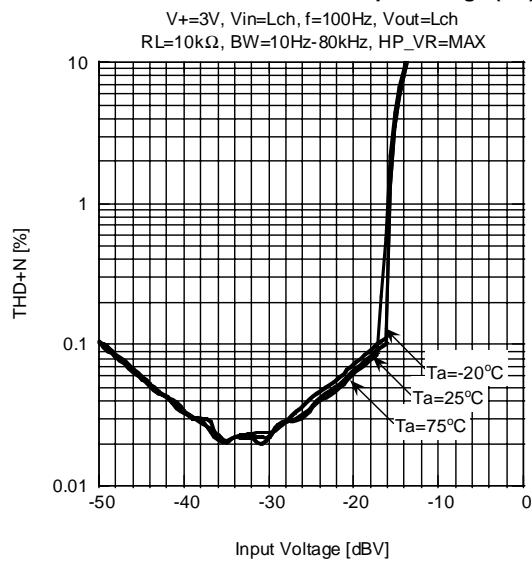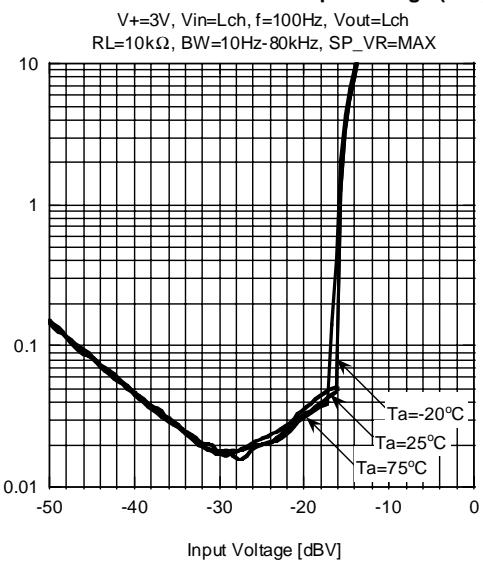
Total Harmonic Distortion vs. Input Voltage (1SP)
V+=3V, Vin=Lch, f=100Hz, Vout=Lch
RL=10kΩ, BW=10Hz-80kHz, SP_VR=MAX

Frequency Responce (BYPASS)
V+=3V, Vin=-20dBV Lch, Vout=Lch
RL=10kΩ, Rg=25Ω

Frequency Responce (2SP)
V+=3V, Vin=-20dBV Lch, Vout=Lch
RL=10kΩ, Rg=25Ω, SP_VR=MAX

Frequency Responce (2SP)
V+=3V, Vin=-20dBV Lch, Vout=Lch
RL=10kΩ, Rg=25Ω, SP_VR=MIN
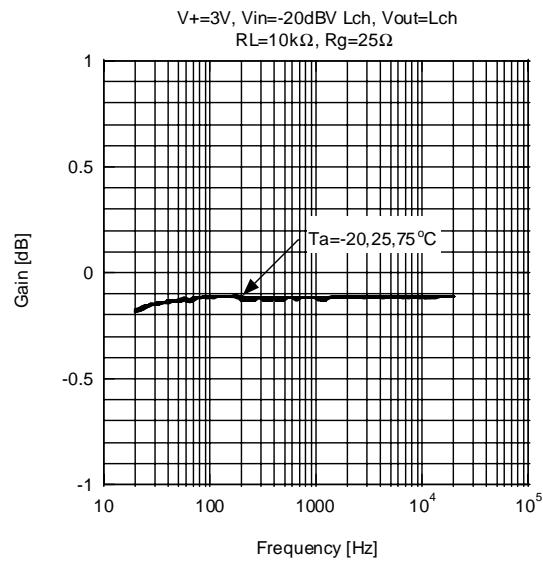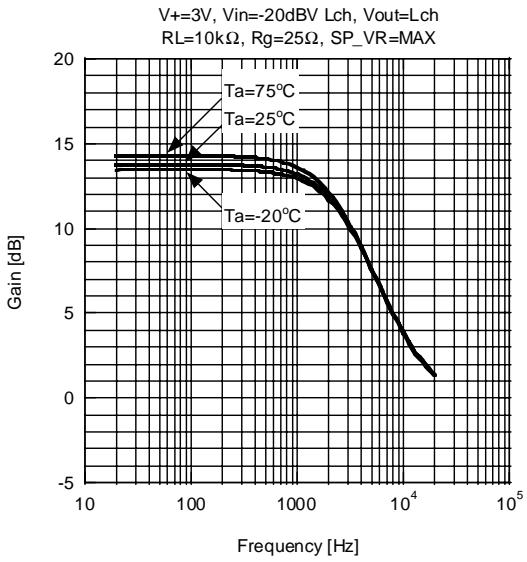
Phase vs. Frequency (2SP)
V+=3V, Vin=-20dBV, Lch+Rch
RL=10kΩ, Rg=25Ω, SP_VR=MAX
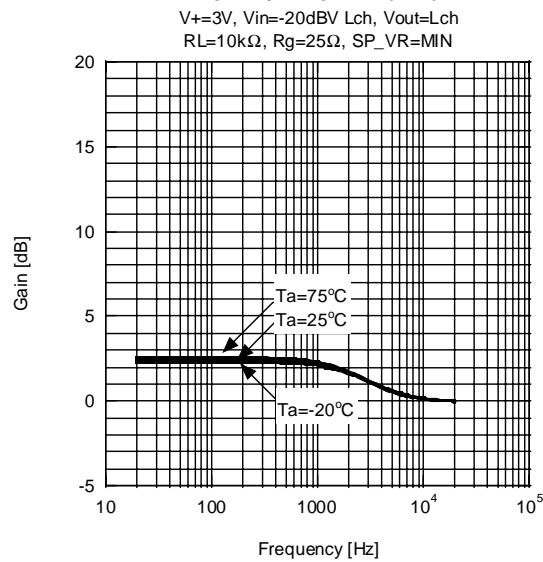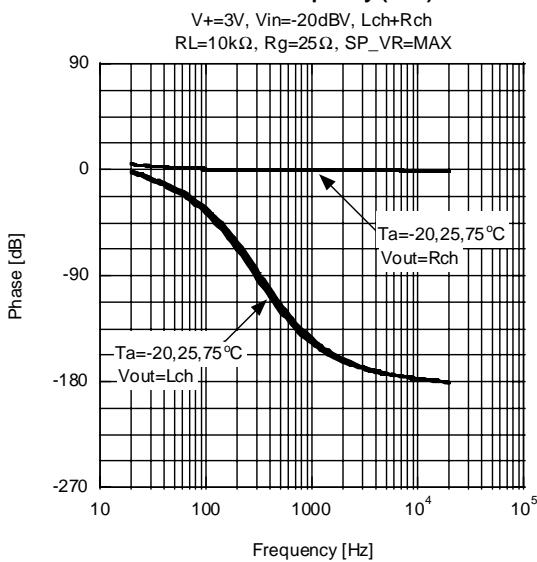
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■**TYPICAL CHARACTERISTICS**

### Frequency Responce (HP)
V+=3V, Vin=-20dBV Lch, Vout=Lch
RL=10kΩ, Rg=25Ω, HP_VR=MAX
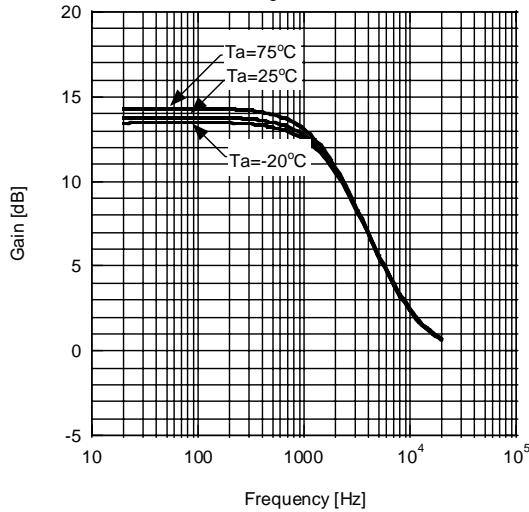
Frequency Responce (HP)
V+=3V, Vin=-20dBV Lch, Vout=Lch
RL=10kΩ, Rg=25Ω, HP_VR=MIN
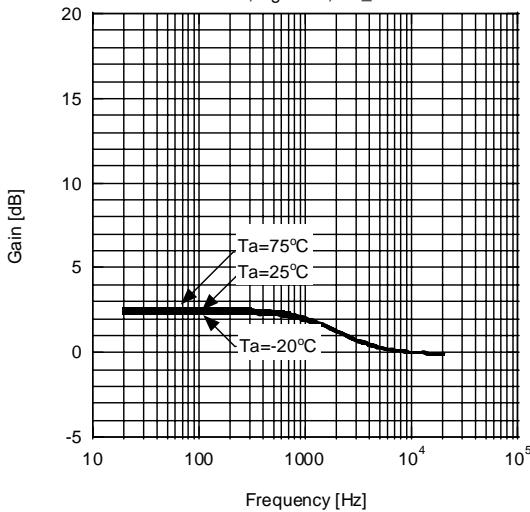
Frequency Responce (1SP)
V+=3V, Vin=-20dBV, Vout=Lch
RL=10kΩ, Rg=25Ω, SP_VR=MAX
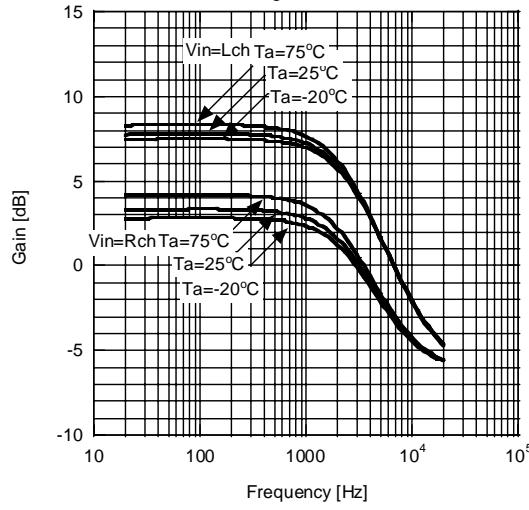
Frequency Responce (1SP)
V+=3V, Vin=-20dBV, Vout=Lch
RL=10kΩ, Rg=25Ω, VR=MIN
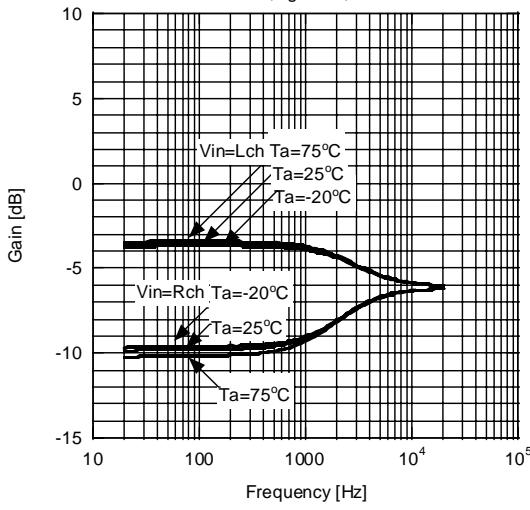
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