3D SURROUND AUDIO PROCESSOR FOR HEADPHONE

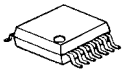
■ GENERAL DESCRIPTION

The **NJM2704** is a high quality 3D surround audio processor designed for headphone applications.

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

In addition to SSOP14, ultra small and thin package FFP12 (Flip-chip Fine Package) is applied. It is suitable for portable telephone, PDA and any portable audio applications.

■ PACKAGE OUTLINE



NJM2704V

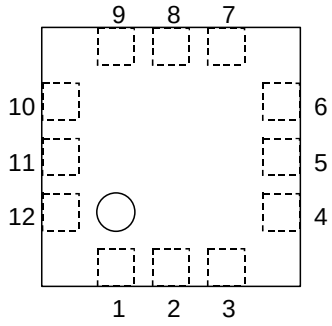


NJM2704PB1

■ FEATURES

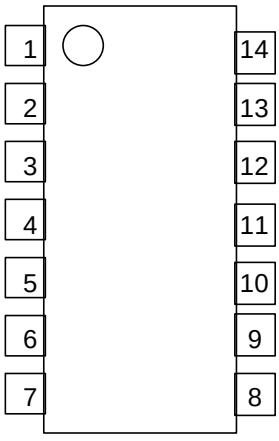
- Operating Voltage 1.8 to 6V
- Low Operating Current 0.45mA typ. (at Active mode)
  0.1μA typ. (at Standby mode)
- Low Output Noise 10μV typ. (at Surround mode, VR: max.)
- Variable Surround Effect by external resistor
- Internal Mode Control Switch
- Bipolar Technology
- Package Outline SSOP14, FFP12

■ PIN CONFIGURATION



(FFP12)

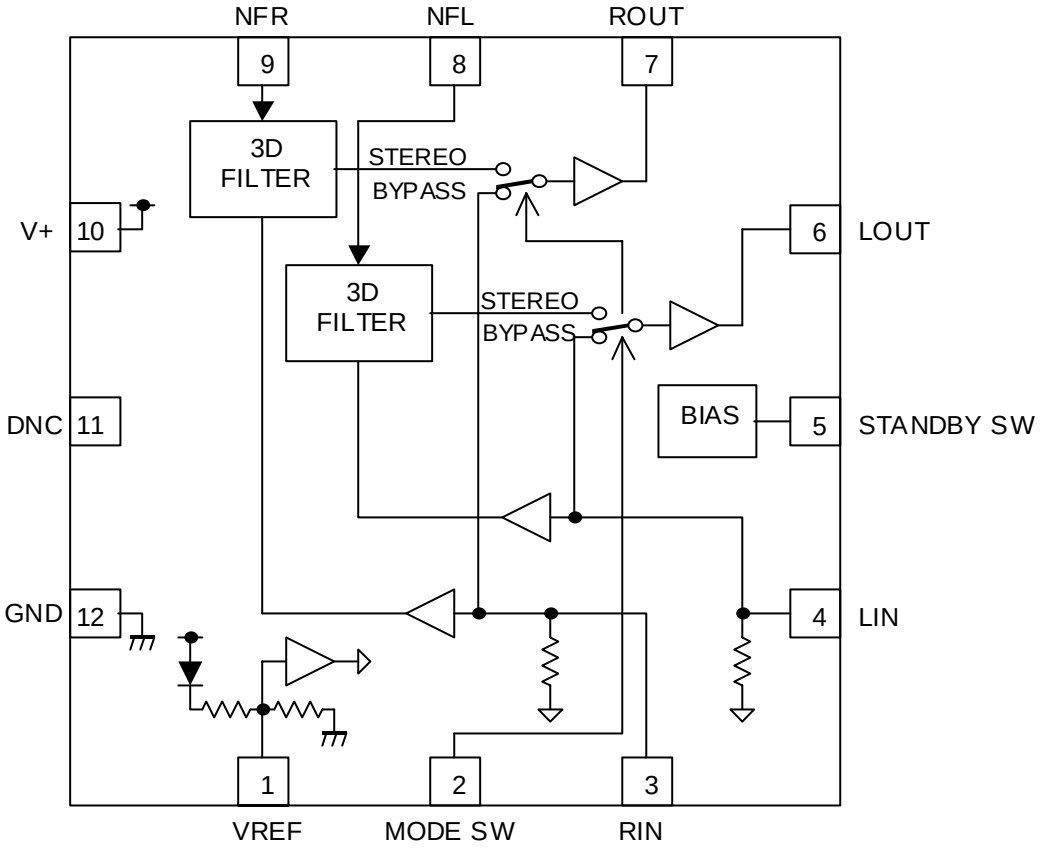
1. VREF
2. MODE SW
3. RIN
4. LIN
5. STANDBY SW
6. LOUT
7. ROUT
8. NFL
9. NFR
10. V+
11. DNC
12. GND



(SSOP14)

1. STANDBY SW
2. LIN
3. RIN
4. MODE SW
5. VREF
6. GND
7. NC
8. DNC
9. V+
10. NFR
11. NFL
12. ROUT
13. LOUT
14. NC

■ **BLOCK DIAGRAM**



■ABSOLUTE MAXIMUM RATING (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	7	V
Power Dissipation	P_D	320	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		OUTPUT	MODE	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		OUTPUT	MODE	VR				
			L	R							
Maximum Input Voltage	V_{IM}	f=1kHz T.H.D.=1%	V_{IN} 0	0 V_{IN}	L R	Bypass	-	-	-2.0 (790)	-	dBV (mVrms)
		f=100Hz T.H.D.=1%	V_{IN} 0	0 V_{IN}	L R	Surround	MAX	-	-16.0 (160)	-	
		V+=1.8V f=1kHz T.H.D.=1%	V_{IN} 0	0 V_{IN}	L R	Bypass	-	-10.5 (300)	-8.5 (380)	-	
		V+=1.8V f=100Hz T.H.D.=1%	V_{IN} 0	0 V_{IN}	L R	Surround	MAX	-24.5 (60)	-22.5 (75)	-	
Output Noise	V_{NO}	Rg=0Ω A-Weighted	0	0	L R	Bypass	-	-	-112 (2.5)	-106 (5.0)	dBV (μVrms)
		Rg=0Ω A-Weighted	0	0	L R	Surround	MAX	-	-100 (10)	-94 (20)	
Total Harmonic Distortion	T.H.D	f=1kHz	V_{IN} 0	0 V_{IN}	L R	Bypass	-	-	0.02	0.05	%
		f=1kHz	V_{IN} 0	0 V_{IN}	L R	Surround	MAX	-	0.1	0.5	

●AC CHARACTERISTICS

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

PARAMETER	SYMBOL	TEST CONDITION	INPUT L	INPUT R	OUTPUT	MODE	VR	MIN.	TYP.	MAX.	UNIT
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_{VSUR}	f=100Hz	V_{IN} 0	0 V_{IN}	L R	Surround	MAX	12.5	14.5	16.5	dB
		f=100Hz	0 V_{IN}	V_{IN} 0	L R	Surround	MAX	10.5	12.5	14.5	
		f=100Hz	V_{IN} 0	0 V_{IN}	L R	Surround	MIN	0.5	2.5	4.5	

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

PARAMETER	SYMBOL	TEST CONDITION	INPUT L	INPUT R	OUTPUT	MODE	VR	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

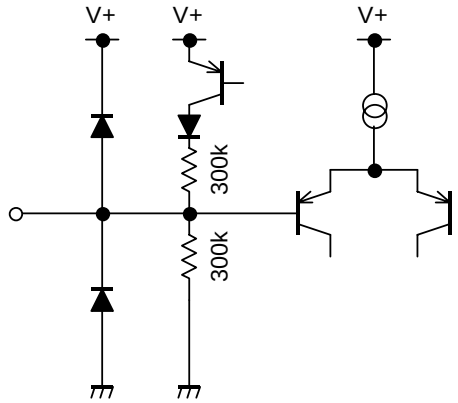
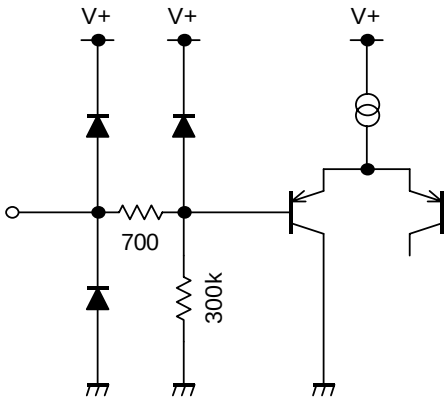
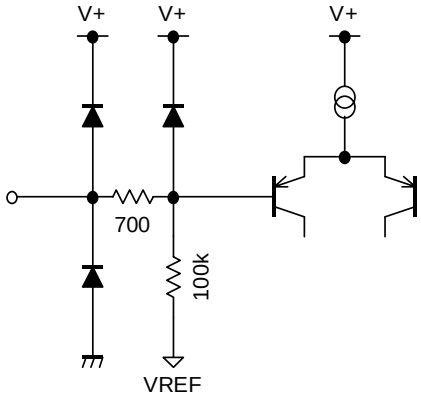
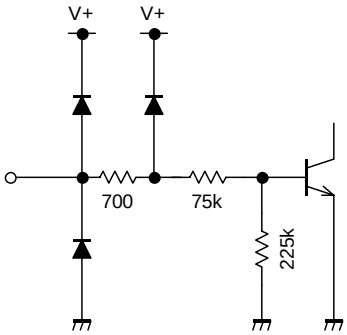
MODE SW

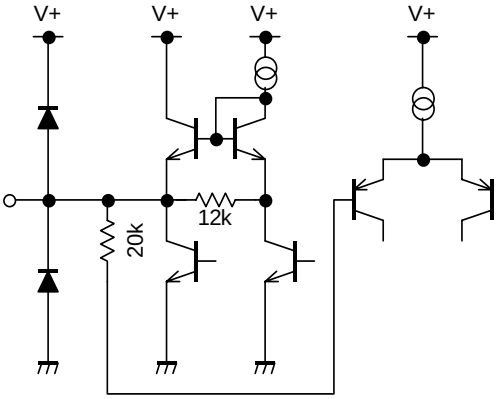
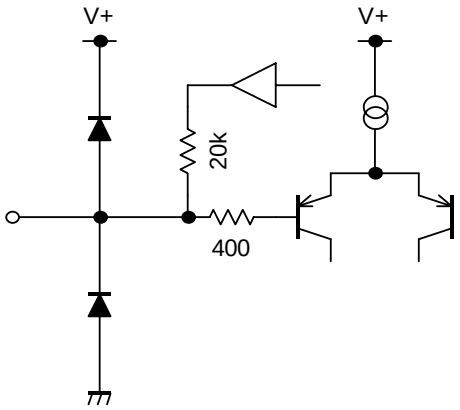
MODE	Terminal Status	NOTES
Bypass	L, open	Input Through
Surround	H	Surround Mode (Stereo Input)

STANDBY SW

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

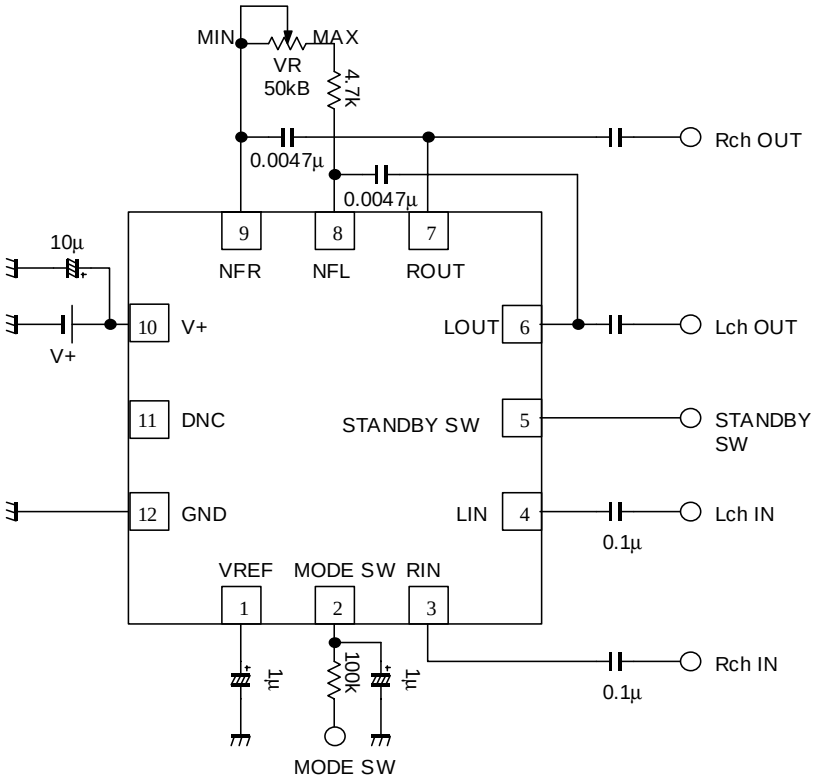
■TERMINAL DESCRIPTION

PIN No. FFP12	PIN No. SSOP14	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	Voltage
1	5	VREF	Reference voltage		1.15V
2	4	MODE SW	Mode control switch		0V
3 4	3 2	RIN LIN	Rch Input Lch Input		1.15V
5	1	STANDBY SW	Standby switch		0V

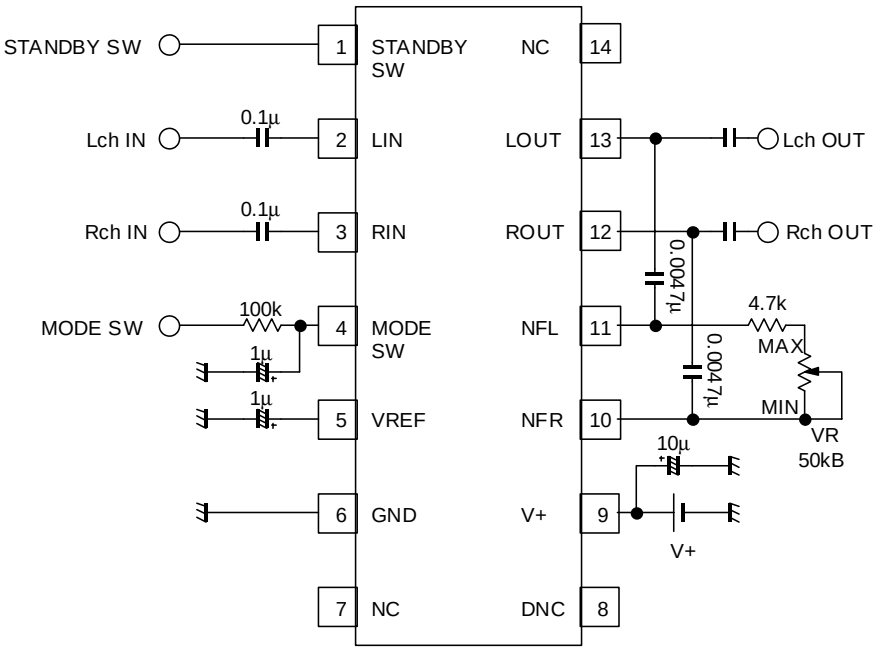
PIN No. FFP12	PIN No. SSOP14	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	Voltage
6 7	13 12	LOUT ROUT	Lch Output Rch Output		1.15V
8 9	11 10	NFL NFR	Filter terminal Filter terminal		1.15V
10	9	V+	Power Supply	———	V+
-	7 14	NC	No Connect	———	-
11	8	DNC	Do Not Connect	———	-

■APPLICATION CIRCUIT

FFP12



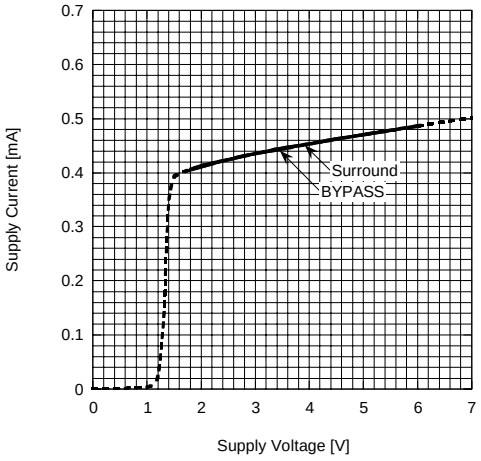
SSOP14



■TYPICAL CHARACTERISTICS

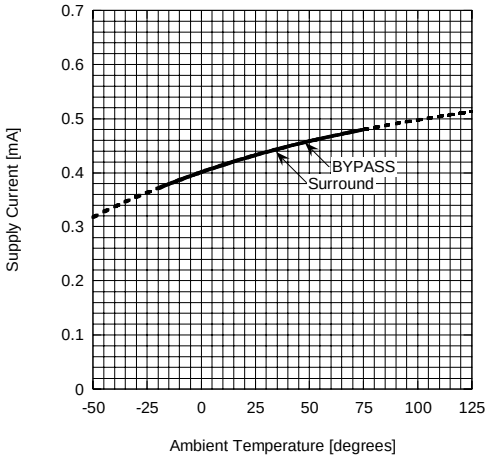
Supply Current vs. Supply Voltage

Ta=25degrees



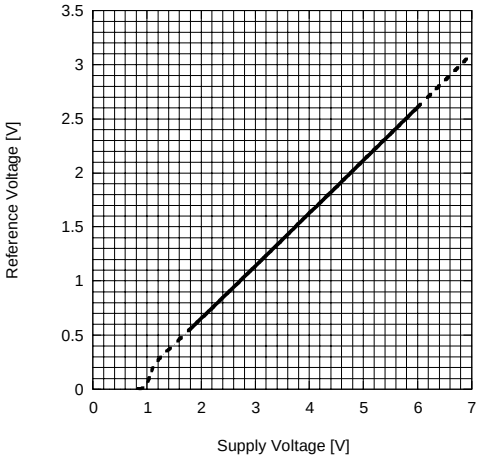
Supply Current vs. Ambient Temperature

V+=3V



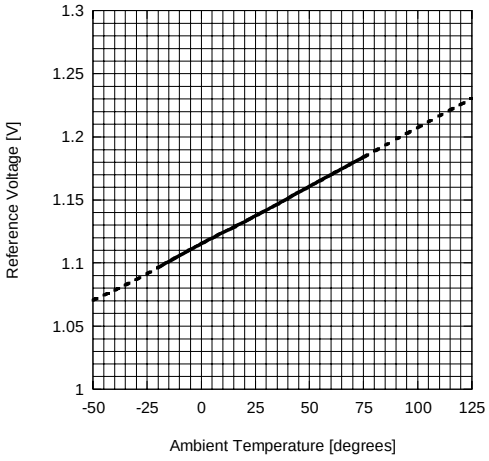
Reference Voltage vs. Supply Voltage

Ta=25degrees



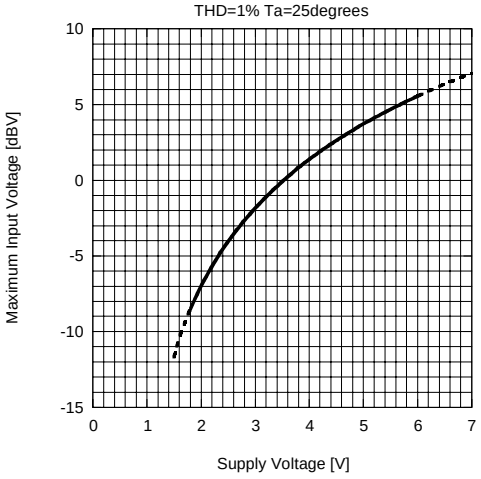
Reference Voltage vs. Ambient Temperature

V+=3V



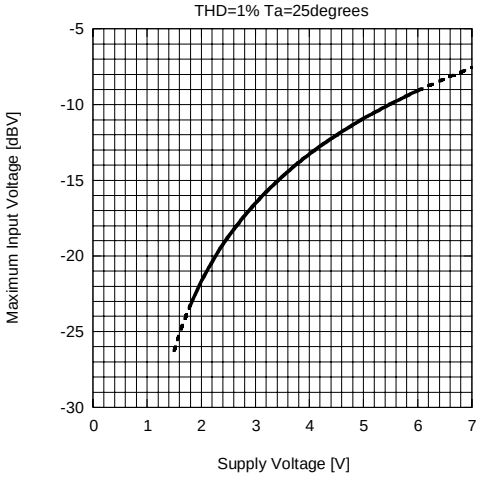
Maximum Input Voltage vs. Supply Voltage (BYPASS)

Vin=Lch f=1kHz Vout=Lch RL=10kohm
THD=1% Ta=25degrees



Maximum Input Voltage vs. Supply Voltage (Surround)

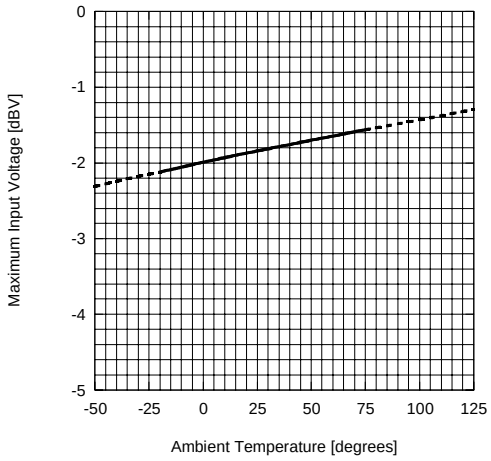
Vin=Lch f=100Hz Vout=Lch RL=10kohm VR=MAX
THD=1% Ta=25degrees



■TYPICAL CHARACTERISTICS

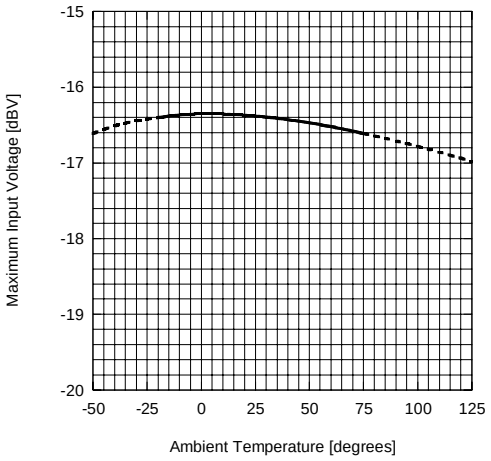
Maximum Input Voltage vs. Ambient Temperature (BYPASS)

V+=3V Vin=Lch f=1kHz Vout=Lch RL=10kohm
THD=1%



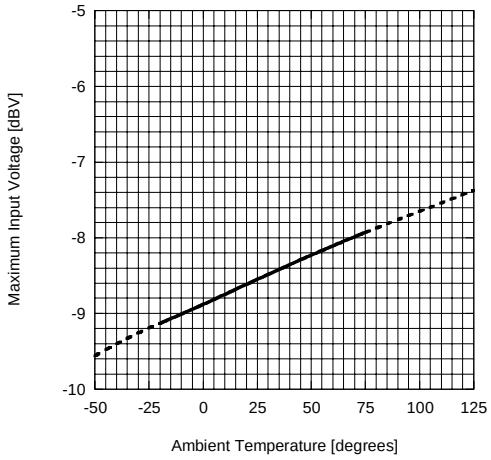
Maximum Input Voltage vs. Ambient Temperature (Surround)

V+=3V Vin=Lch f=100Hz Vout=Lch RL=10kohm
VR=MAX THD=1%



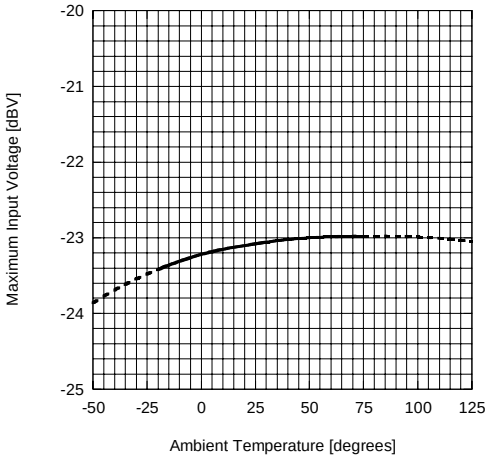
Maximum Input Voltage vs. Ambient Temperature (BYPASS)

V+=1.8V Vin=Lch f=1kHz Vout=Lch RL=10kohm
THD=1%



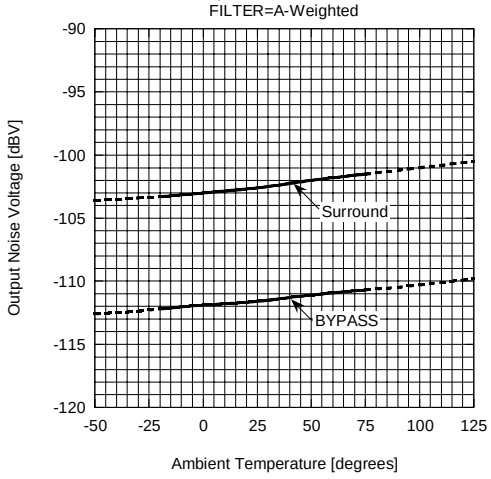
Maximum Input Voltage vs. Ambient Temperature (Surround)

V+=1.8V Vin=Lch f=100Hz Vout=Lch RL=10kohm
VR=MAX THD=1%



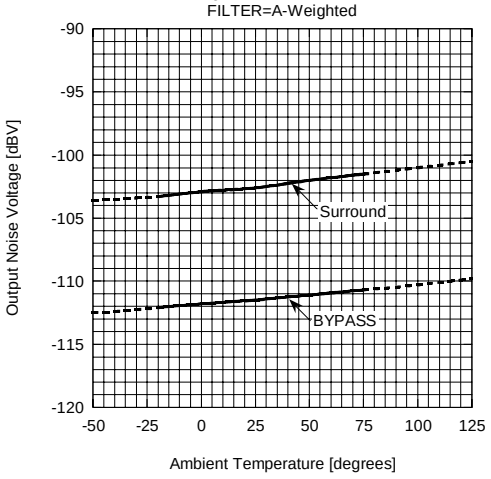
Output Noise Voltage vs. Ambient Temperature

V+=3V Rg=0ohm Vout=Lch VR=MAX
FILTER=A-Weighted



Output Noise Voltage vs. Ambient Temperature

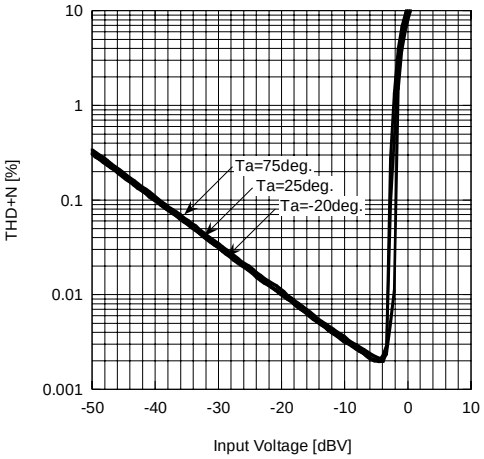
V+=3V Rg=0ohm Vout=Rch VR=MAX
FILTER=A-Weighted



■TYPICAL CHARACTERISTICS

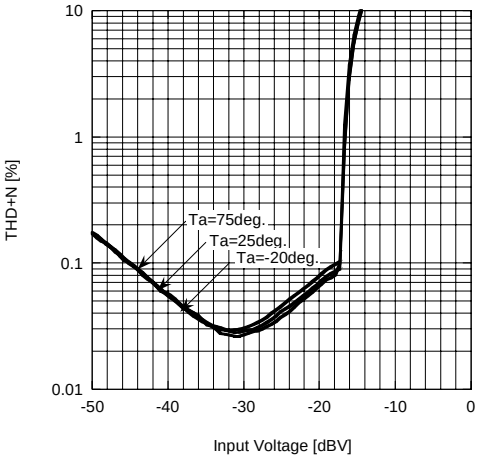
Total Harmonic Distortion vs. Input Voltage (BYPASS)

V+=3V Vin=Lch f=1kHz Vout=Lch
RL=10kohm BW=10Hz to 80kHz



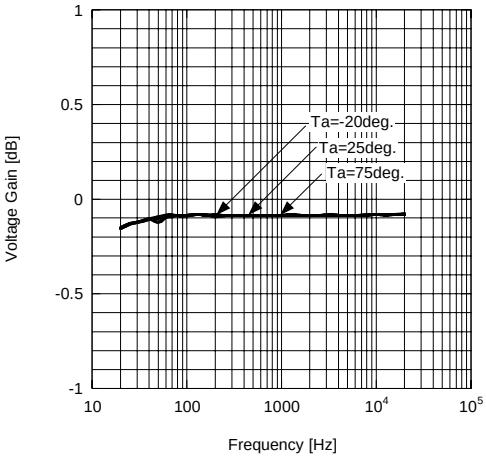
Total Harmonic Distortion vs. Input Voltage (Surround)

V+=3V Vin=Lch f=100Hz Vout=Lch
RL=10kohm BW=10Hz to 80kHz VR=MAX



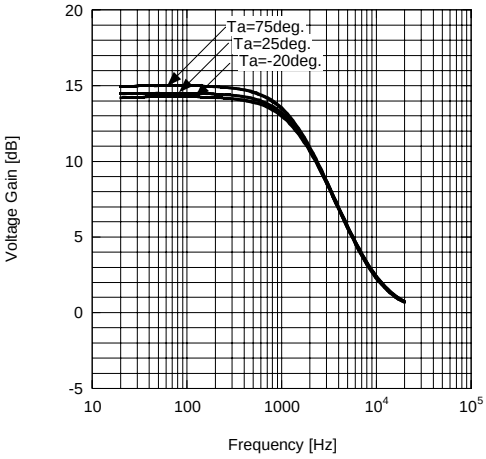
Voltage Gain vs. Frequency (BYPASS)

V+=3V Vin=-20dBV Lch Vout=Lch
RL=10kohm Rg=25ohm



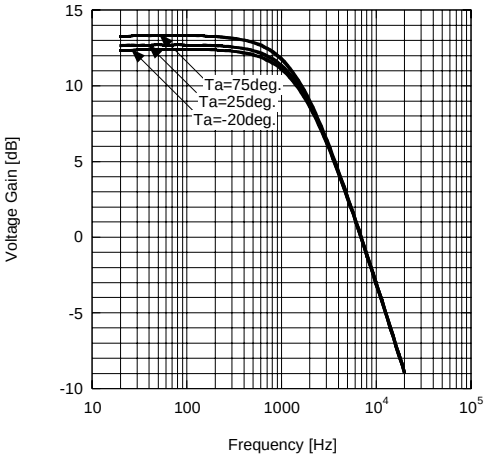
Voltage Gain vs. Frequency (Surround)

V+=3V Vin=-20dBV Lch Vout=Lch
RL=10kohm Rg=25ohm VR=MAX



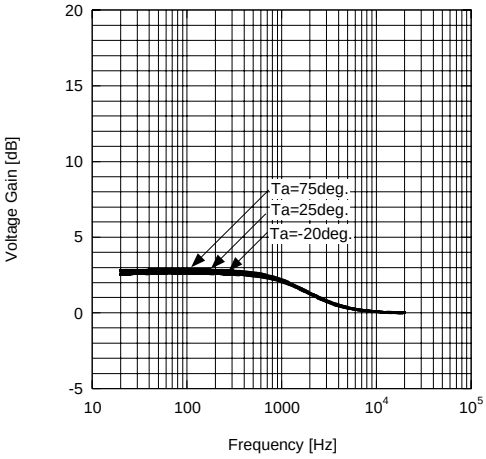
Voltage Gain vs. Frequency (Surround)

V+=3V Vin=-20dBV Rch Vout=Lch
RL=10kohm Rg=25ohm VR=MAX



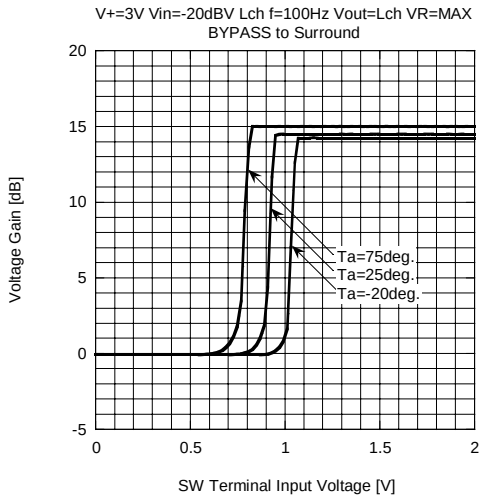
Voltage Gain vs. Frequency (Surround)

V+=3V Vin=-20dBV Lch Vout=Lch
RL=10kohm Rg=25ohm VR=MIN

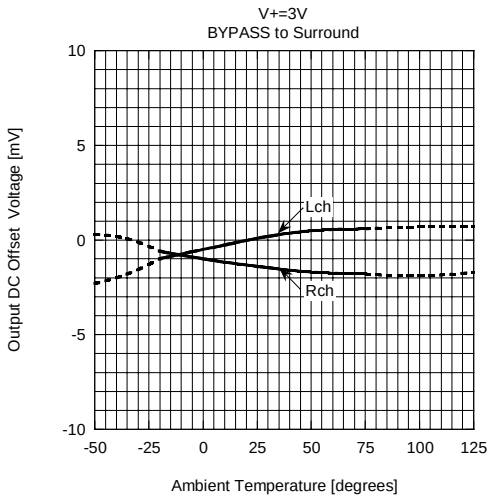


■TYPICAL CHARACTERISTICS

Voltage Gain vs. SW Terminal Input Voltage



Output DC Offset Voltage vs. Ambient Temperature



[CAUTION]
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