3D SURROUND AUDIO PROCESSOR FOR HEADPHONE

■ GENERAL DESCRIPTION

The **NJM2703** is a high quality 3D surround audio processor designed for headphone applications.

It includes mode control switch (Surround mode / Bypass mode).

The **NJM2703** features low operating voltage, low operating current, low output noise and very small package, and is suitable for any portable audio applications.

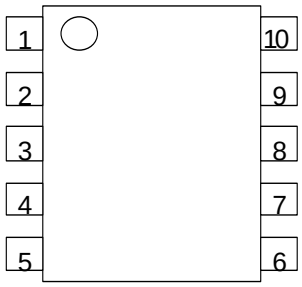
■ PACKAGE OUTLINE

NJM2703RB2

■ FEATURES

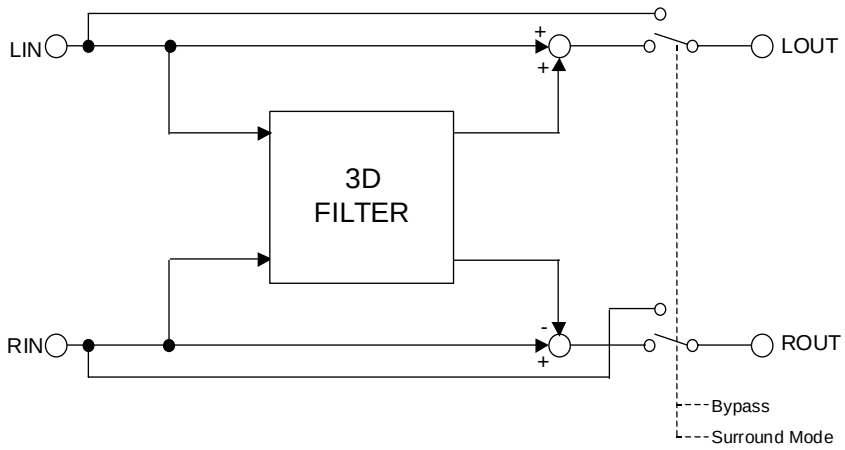
- Operating Voltage 1.8 to 6V
- Low Operating Current 0.45mA typ. (at Surround mode, VR: max.)
- Low Output Noise 10μV typ. (at Surround mode, VR: max.)
- Variable Surround Effect by external resistor
- Internal Mode Control Switch
- Bipolar Technology
- Package Outline TVSP10

■ PIN CONFIGURATION



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

■ 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	-	Bypass	-	-	0.45	0.7	mA
			0	0	-	Surround	MAX	-	0.45	0.7	
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	

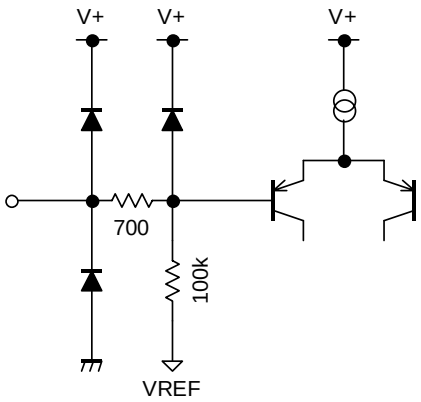
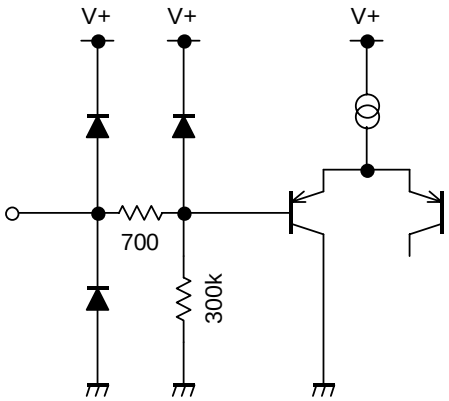
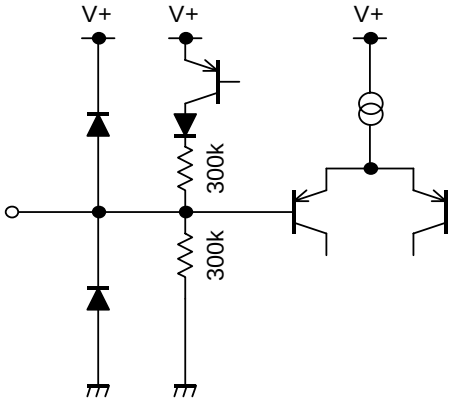
●CONTROL CHARACTERISTICS (V+=3V, Ta=25°C unless otherwise specified)

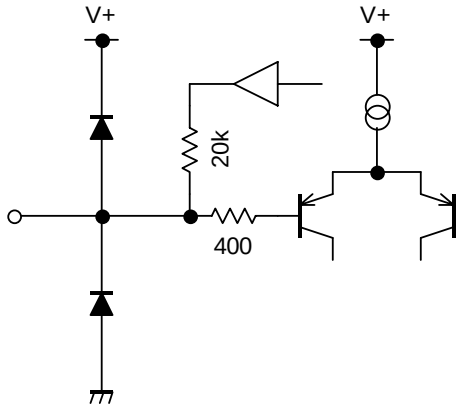
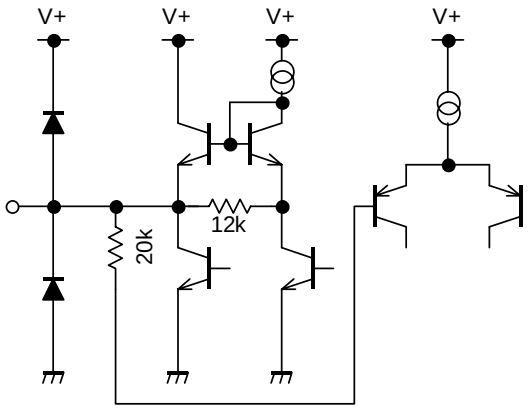
PARAMETER	SYMBOL	TEST CONDITION	INPUT L	INPUT R	OUTPUT	MODE	VR	MIN.	TYP.	MAX.	UNIT
Mode Select Control Voltage	V_{MODE}	V_{IN}= High Level	-	-	-	-	-	1.2	-	V+	V
		V_{IN}= Low Level	-	-	-	-	-	0.0	-	0.3	

■MODE SWITCH

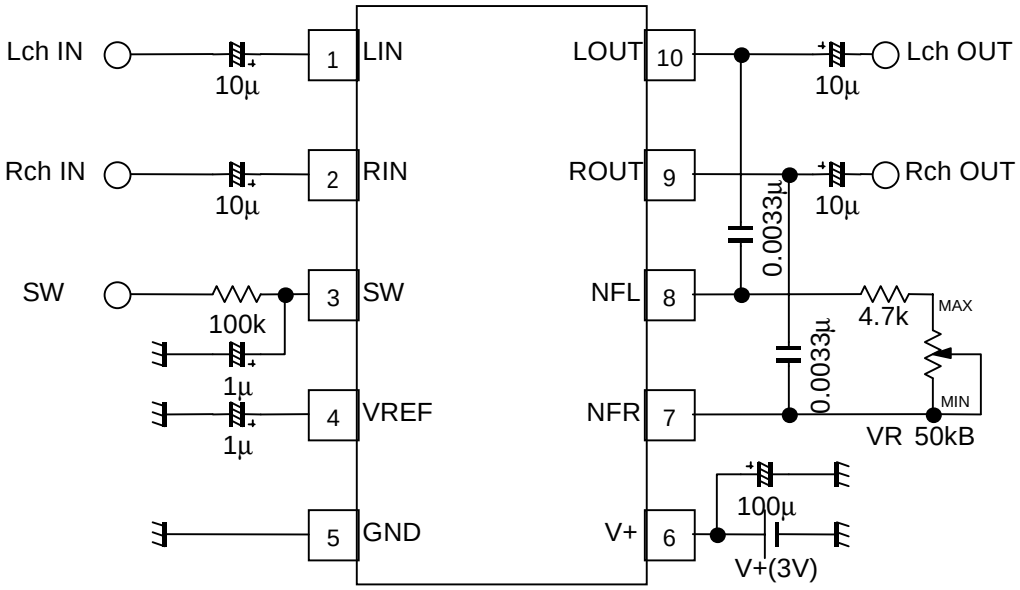
MODE	SW	NOTES
Bypass	L, open	Input Through
Surround	H	Surround Mode (Stereo Input)

■TERMINAL DESCRIPTION

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
1 2	LIN RIN	Rch Input Lch Input		1.15V
3	SW	Mode control switch		0V
4	VREF	Reference voltage		1.15V
5	GND	GND	———	0V

PIN NO.	SYMBOL	FUNCTION	EQUIVALENT CIRCUIT	VOLTAGE
5	V+	Power Supply	———	V+
7 8	NFL NFR	Filter terminal Filter terminal		1.15V
9 10	ROUT LOUT	Rch Output Lch Output		1.15V

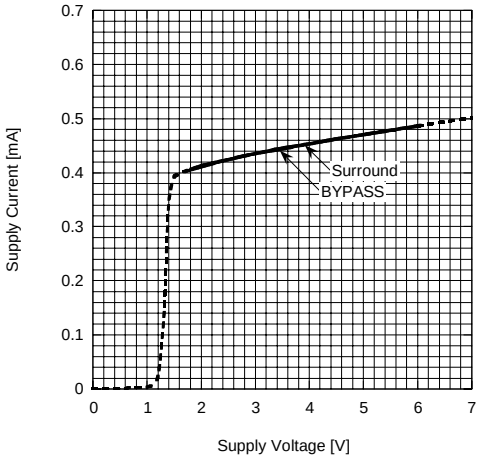
■APPLICATION CIRCUIT



■TYPICAL CHARACTERISTICS

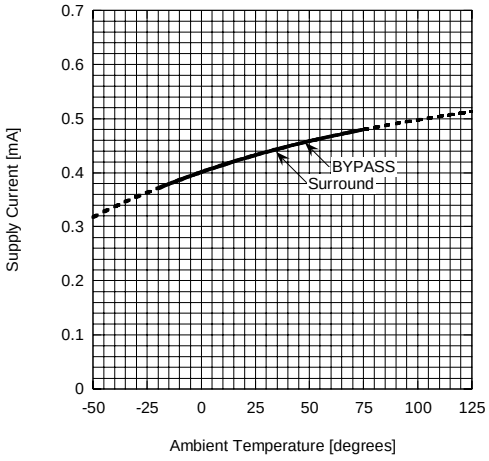
Supply Current vs. Supply Voltage

Ta=25degrees



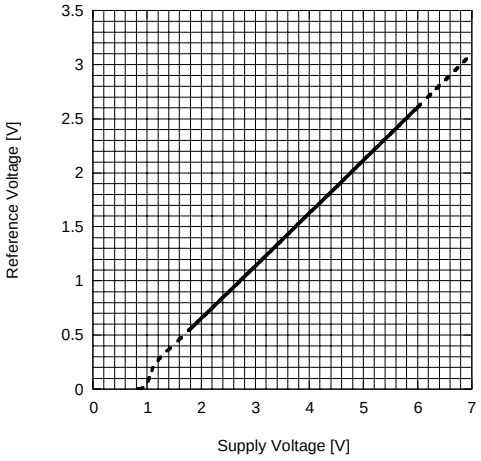
Supply Current vs. Ambient Temperature

V+=3V



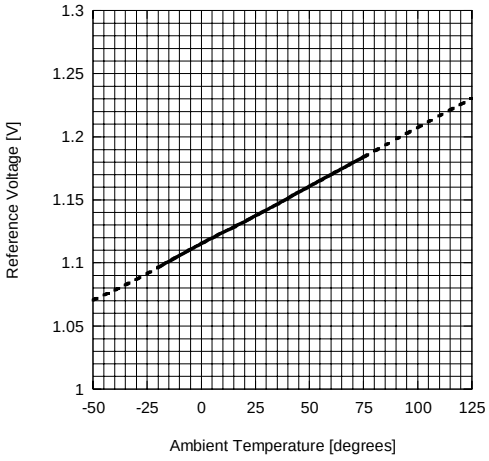
Reference Voltage vs. Supply Voltage

Ta=25degrees



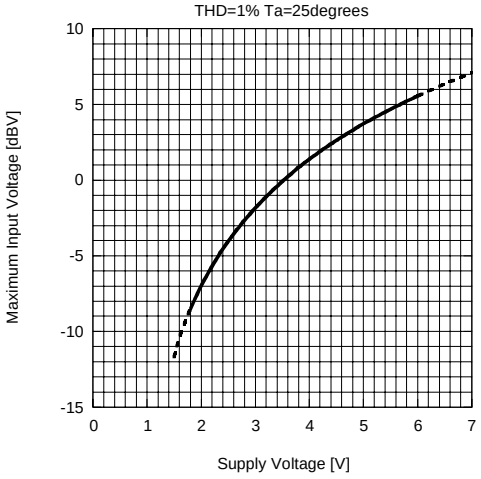
Reference Voltage vs. Ambient Temperature

V+=3V



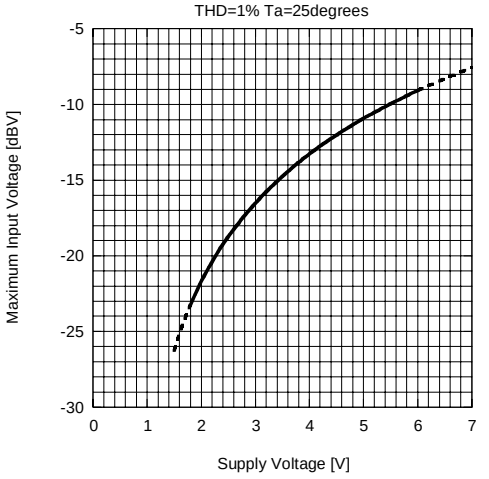
Maximum Input Voltage vs. Supply Voltage (BYPASS)

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



Maximum Input Voltage vs. Supply Voltage (Surround)

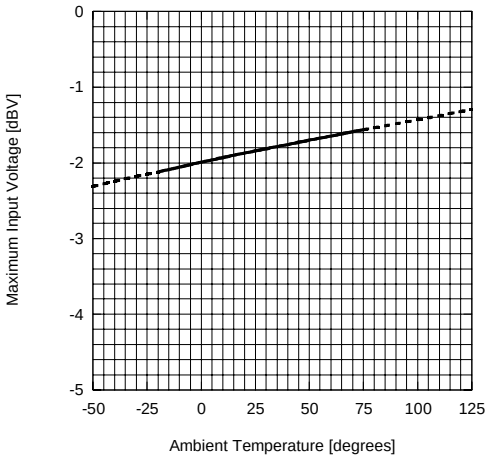
Vin=Lch f=100Hz Vout=Lch RL=10kohm VR=MAX
THD=1% Ta=25degrees



■TYPICAL CHARACTERISTICS

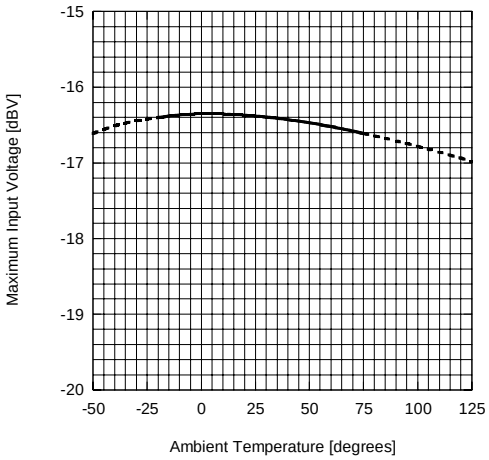
Maximum Input Voltage vs. Ambient Temperature (BYPASS)

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



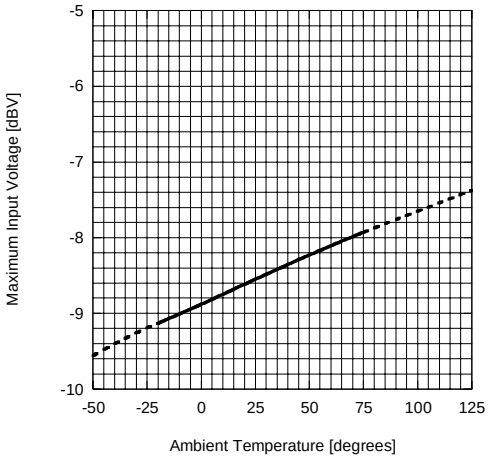
Maximum Input Voltage vs. Ambient Temperature (Surround)

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



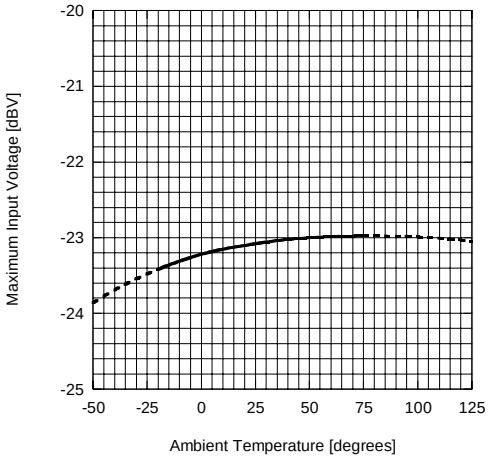
Maximum Input Voltage vs. Ambient Temperature (BYPASS)

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



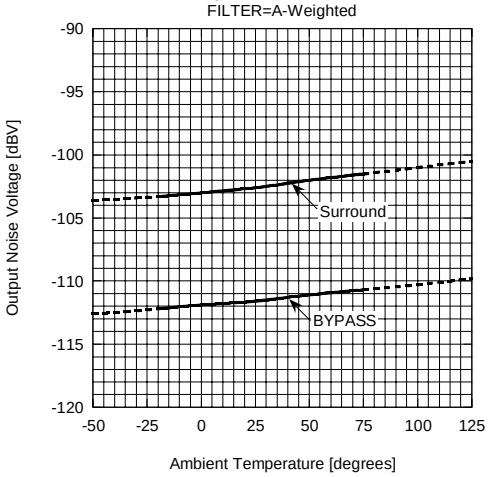
Maximum Input Voltage vs. Ambient Temperature (Surround)

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



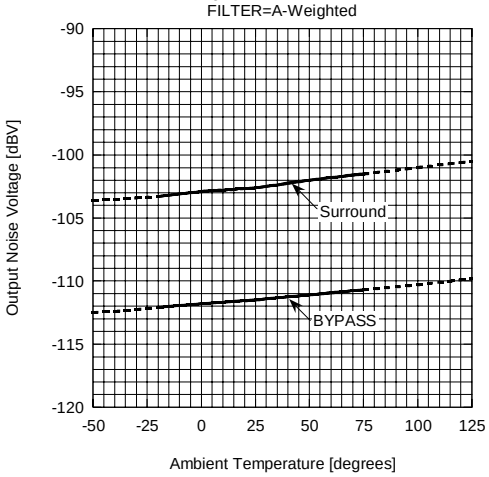
Output Noise Voltage vs. Ambient Temperature

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



Output Noise Voltage vs. Ambient Temperature

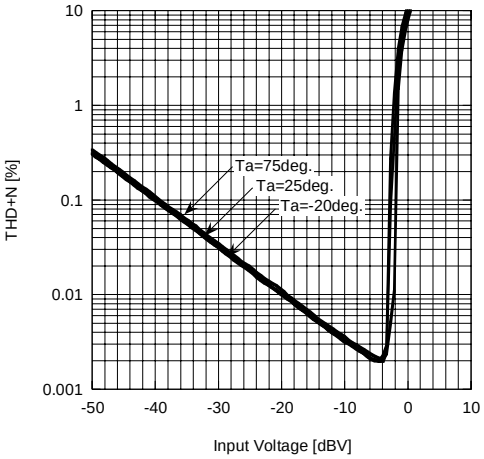
V+=3V Rg=0ohm Vout=Rch VR=MAX
FILTER=A-Weighted



■TYPICAL CHARACTERISTICS

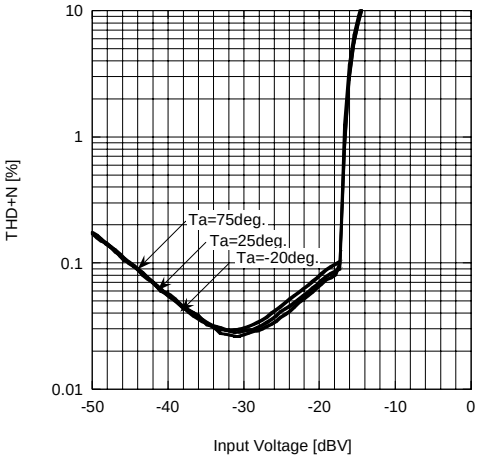
Total Harmonic Distortion vs. Input Voltage (BYPASS)

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



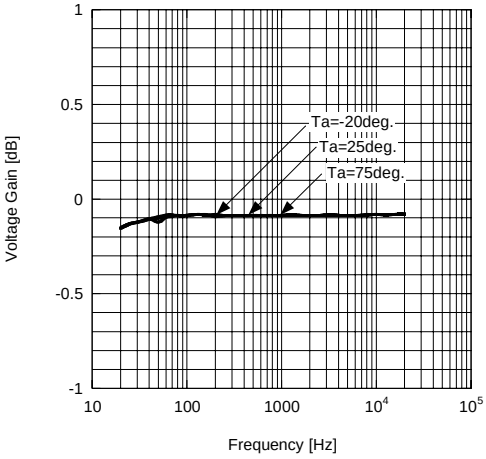
Total Harmonic Distortion vs. Input Voltage (Surround)

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



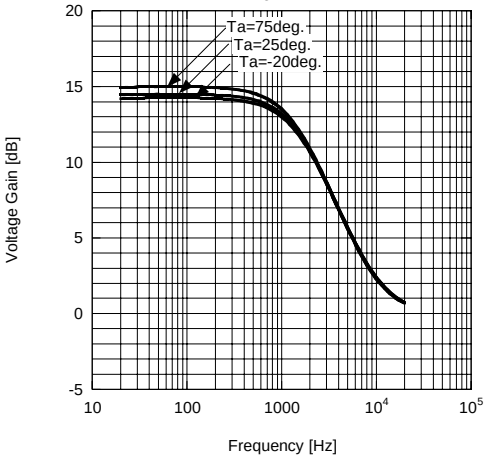
Voltage Gain vs. Frequency (BYPASS)

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



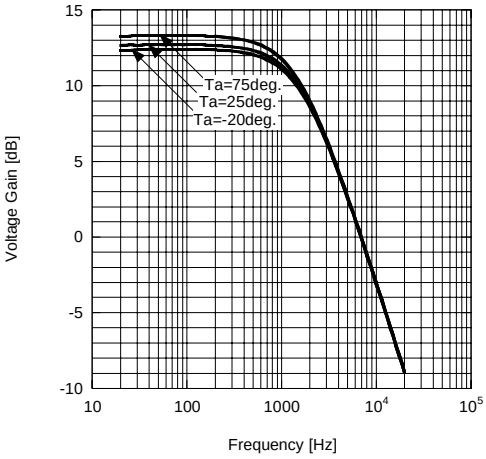
Voltage Gain vs. Frequency (Surround)

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



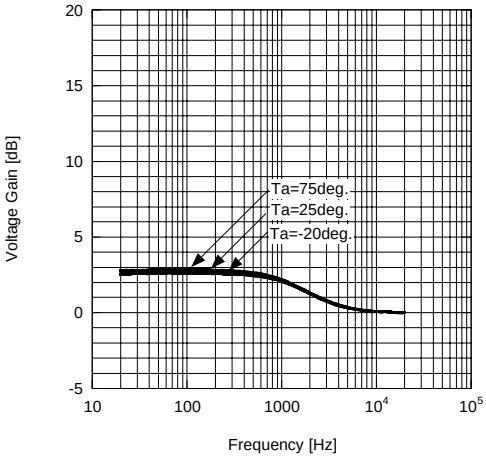
Voltage Gain vs. Frequency (Surround)

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



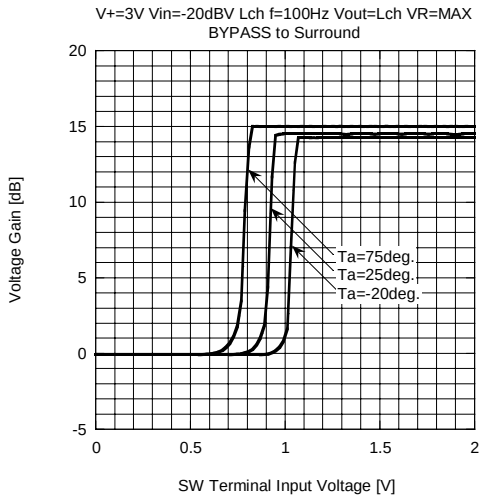
Voltage Gain vs. Frequency (Surround)

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