



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



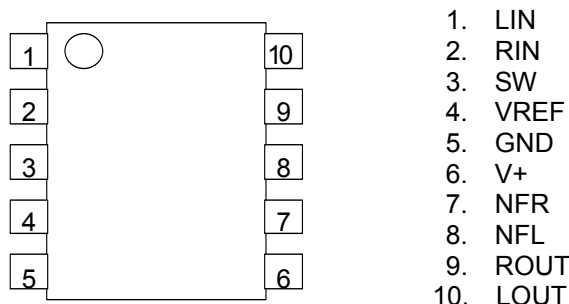
NJM2703RB2
(MSOP10 (TVSP10))

■ FEATURES

- Operating Voltage 1.8 to 6V
- Low Operating Current 0.45mA typ. (at Surround mode, VR: max.)
- Low Output Noise 10 μ V typ. (at Surround mode, VR: max.)
- Variable Surround Effect by external resistor
- Internal Mode Control Switch
- Bipolar Technology
- Package Outline MSOP10 (TVSP10)*

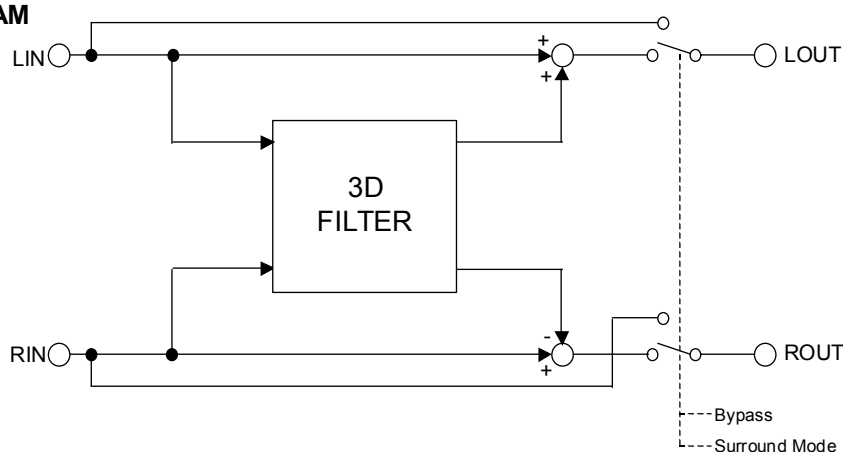
*MEET JEDEC MO-187-DA / THIN TYPE

■ PIN CONFIGURATION



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

■ BLOCK DIAGRAM



NJM2703

■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	V _{ref}	No Signal	0	0	-	-	-	1.0	1.15	1.3	V

● AC CHARACTERISTICS

(V⁺=3V, Ta=25°C, V_{IN}=-20dBV(100mVrms), f=1kHz, R_L=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}	R _g =0Ω A-Weighted	0	0	L R	Bypass	-	-	-112 (2.5)	-106 (5.0)	dBV (μVrms)
		R _g =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

($V_+ = 3V$, $T_a = 25^\circ C$, $V_{IN} = -20dBV(100mV_{rms})$, $f = 1kHz$, $R_L = 10k\Omega$, unless otherwise specified)

V _P = 0V, I _D = 25 mA, V _{IN} = 200mV (100mVrms), f = 1kHz, RE = 10kΩ, unless otherwise specified											
PARAMETER	SYMBOL		TEST CONDITION					MIN.	TYP.	MAX.	UNIT
			INPUT		OUTPUT	MODE	VR				
			L	R							
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 ($V_+ = 3V$, $T_a = 25^\circ C$ unless otherwise specified)

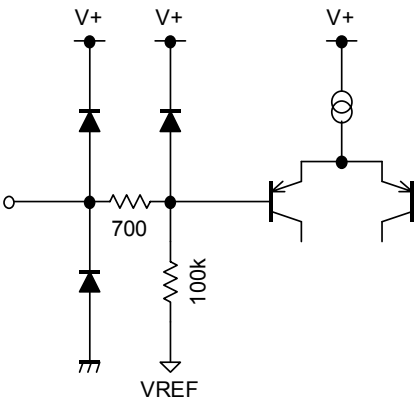
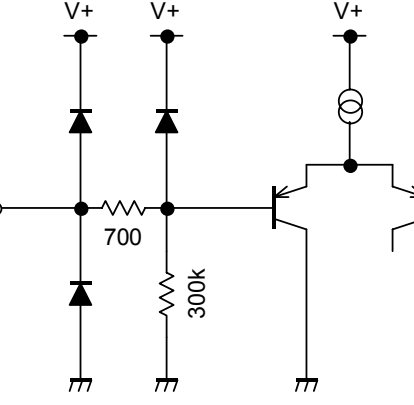
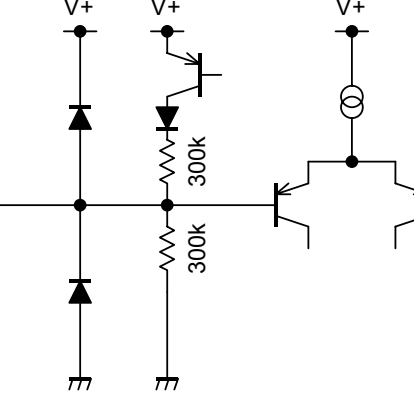
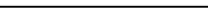
ELECTRICAL CHARACTERISTICS (V _S = 5V, I _A = 20 μA unless otherwise specified)											
PARAMETER	SYMBOL		TEST CONDITION					MIN.	TYP.	MAX.	UNIT
			INPUT		OUTPUT	MODE	VR				
			L	R							
Mode Select Control Voltage	V _{MODE}	V _{IN} = High Level	-	-	-	-	-	1.2	-	V+	V
		V _{IN} = Low Level	-	-	-	-	-	0.0	-	0.3	

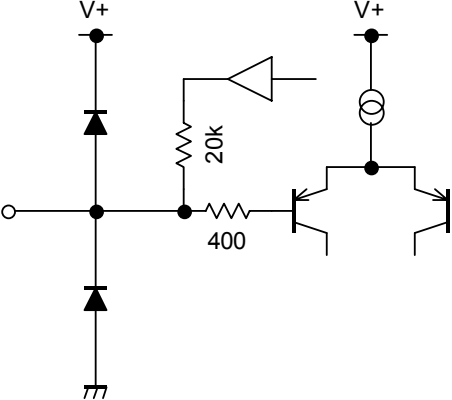
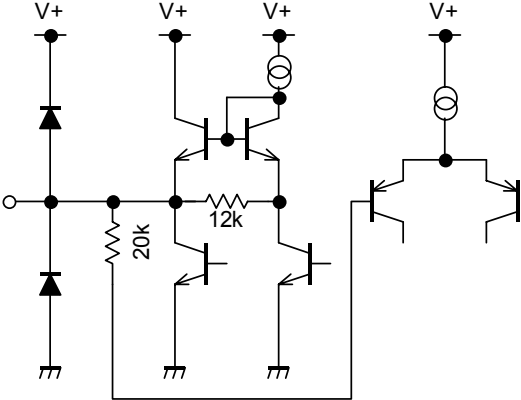
■ MODE SWITCH

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

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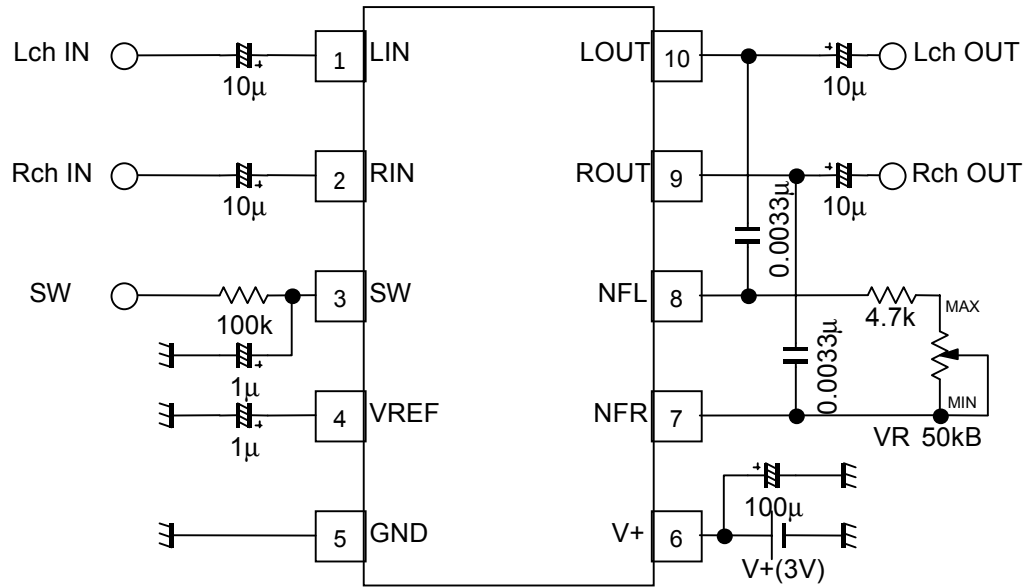
■TERMINAL DESCRIPTION

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

NJM2703

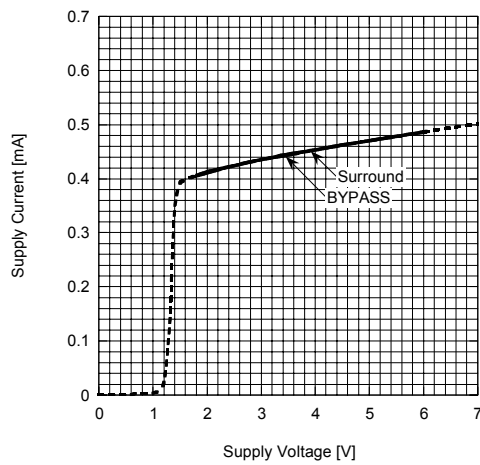
■ APPLICATION CIRCUIT



■ TYPICAL CHARACTERISTICS

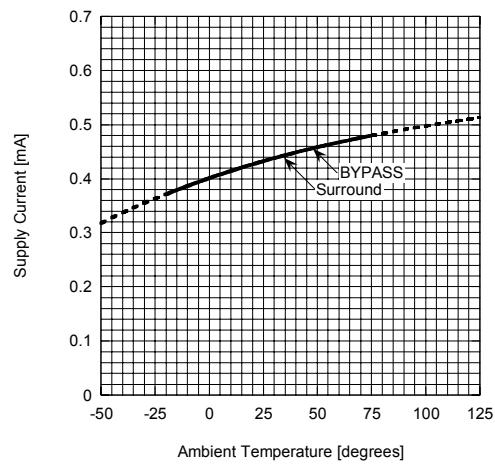
Supply Current vs. Supply Voltage

Ta=25degrees



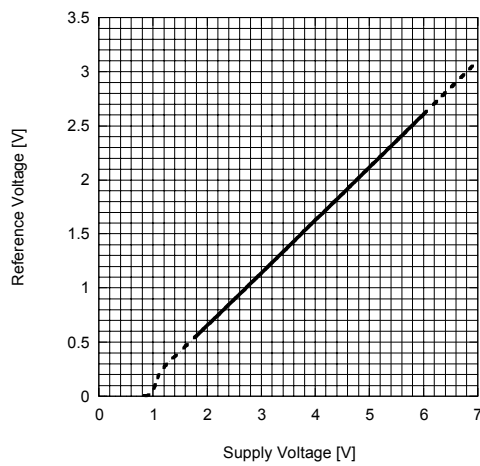
Supply Current vs. Ambient Temperature

V+=3V



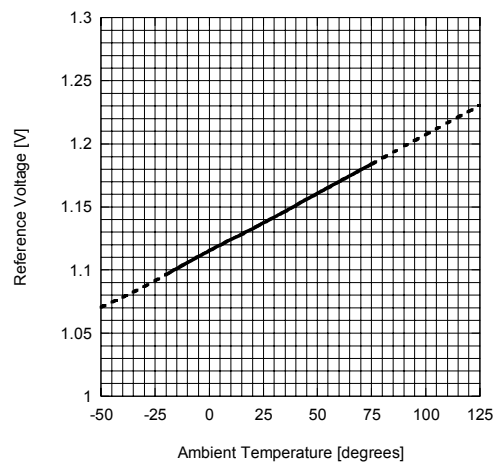
Reference Voltage vs. Supply Voltage

Ta=25degrees



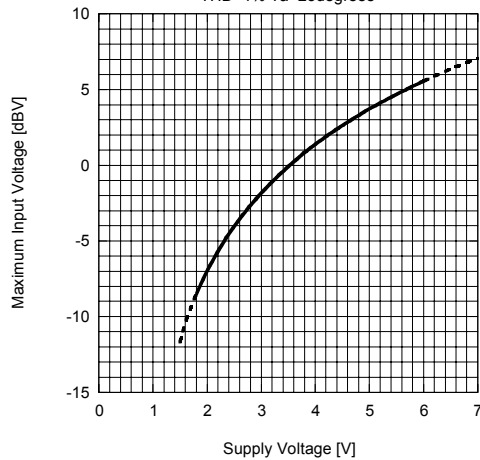
Reference Voltage vs. Ambient Temperature

V+=3V



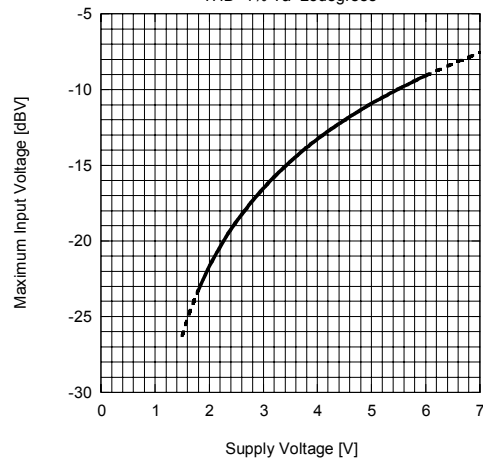
Maximum Input Voltage vs. Supply Voltage (BYPASS)

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



Maximum Input Voltage vs. Supply Voltage (Surround)

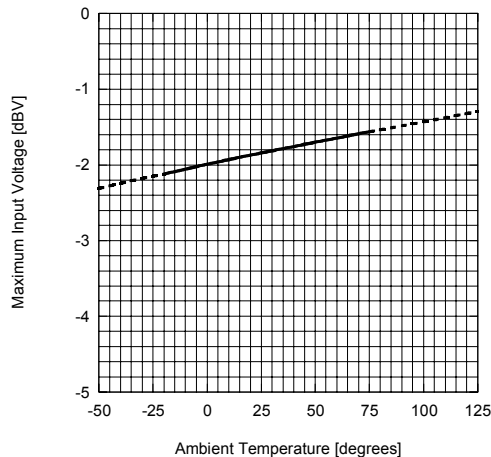
Vin=Lch f=100Hz Vout=Lch RL=10kohm VR=MAX
THD=1% Ta=25degrees



■ TYPICAL CHARACTERISTICS

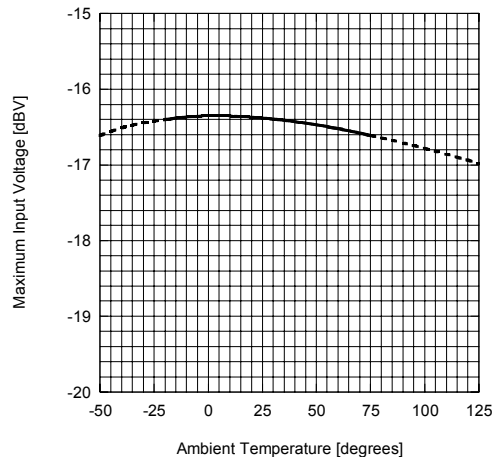
Maximum Input Voltage vs. Ambient Temperature (BYPASS)

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



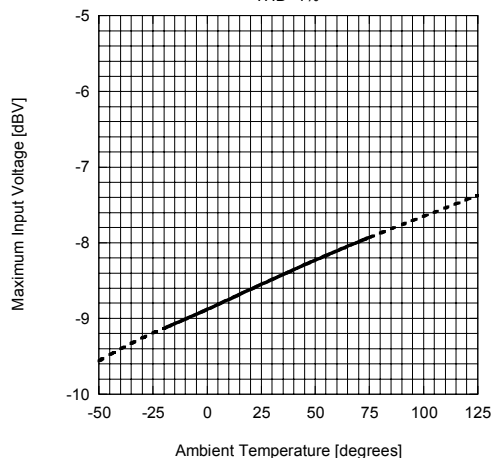
Maximum Input Voltage vs. Ambient Temperature (Surround)

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



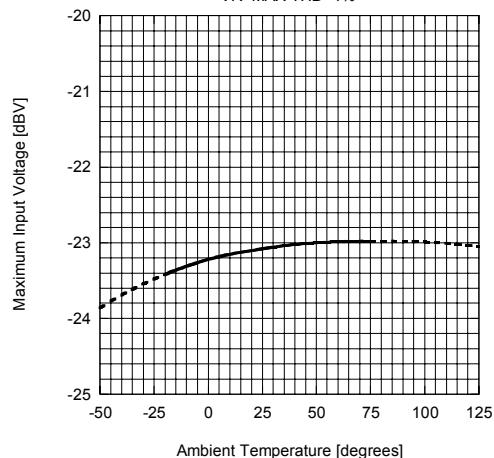
Maximum Input Voltage vs. Ambient Temperature (BYPASS)

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



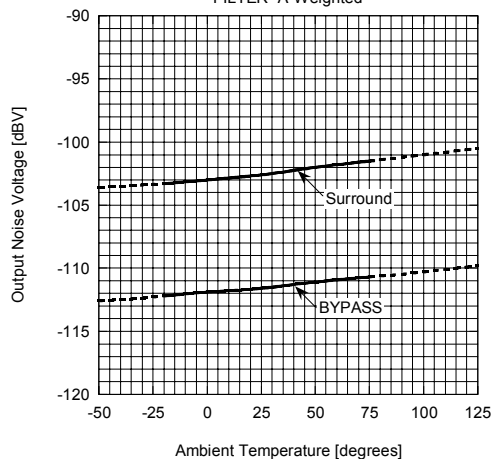
Maximum Input Voltage vs. Ambient Temperature (Surround)

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



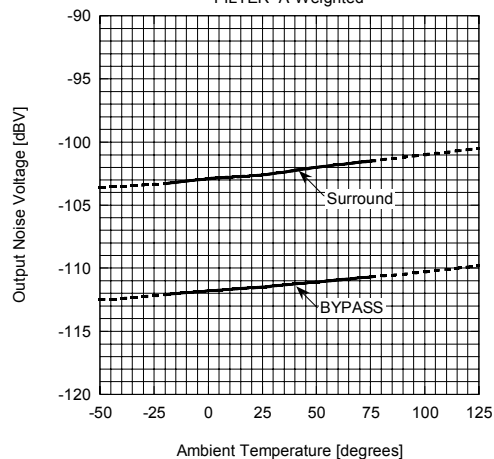
Output Noise Voltage vs. Ambient Temperature

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



Output Noise Voltage vs. Ambient Temperature

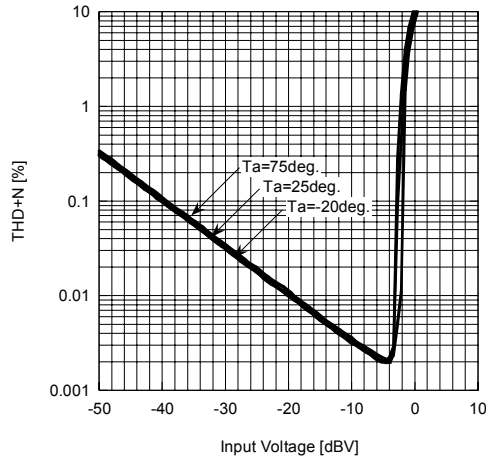
V+=3V Rg=0ohm Vout=Rch VR=MAX
FILTER=A-Weighted



TYPICAL CHARACTERISTICS

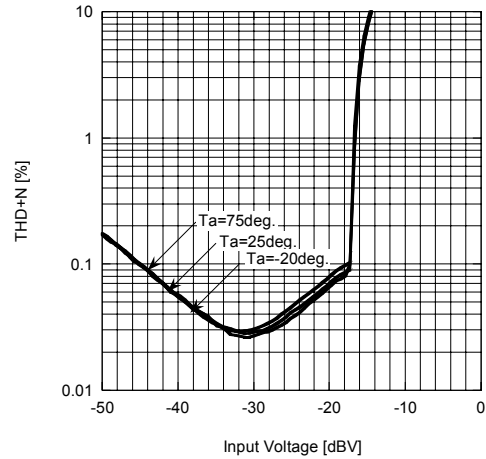
Total Harmonic Distortion vs. Input Voltage (BYPASS)

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



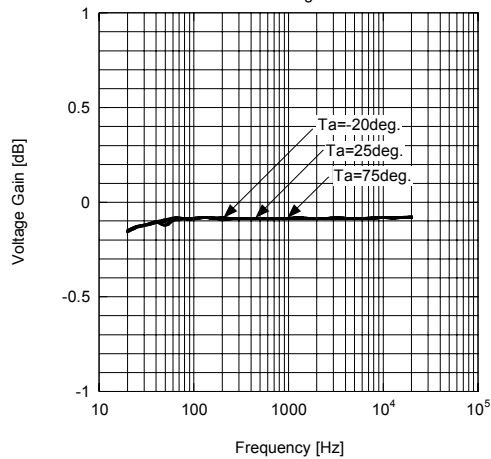
Total Harmonic Distortion vs. Input Voltage (Surround)

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



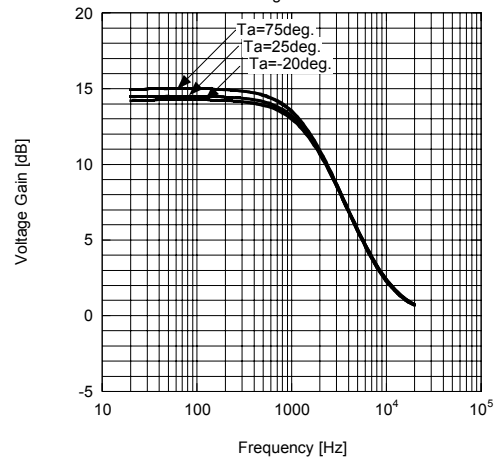
Voltage Gain vs. Frequency (BYPASS)

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



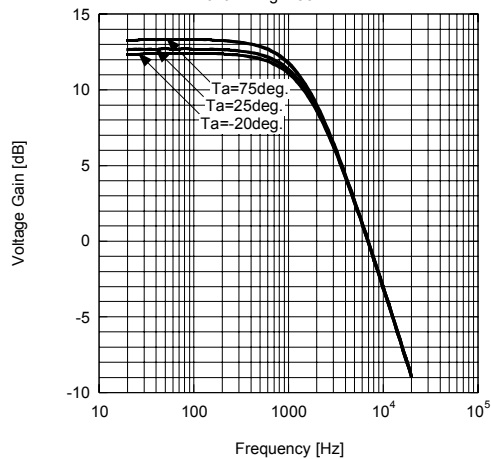
Voltage Gain vs. Frequency (Surround)

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



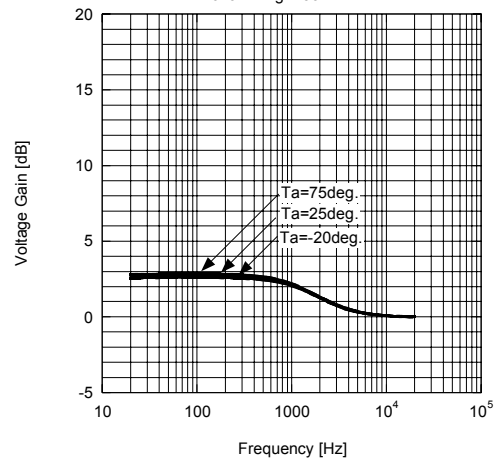
Voltage Gain vs. Frequency (Surround)

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

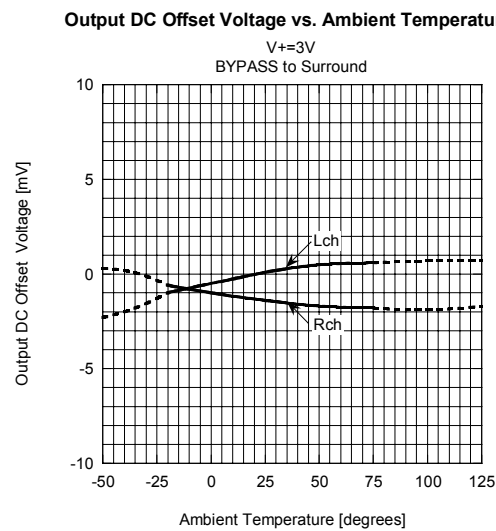
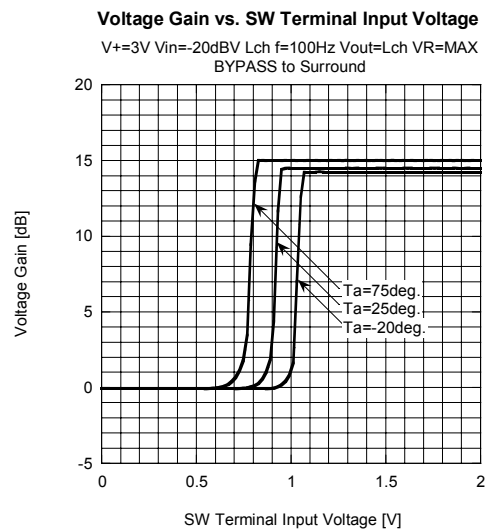


Voltage Gain vs. Frequency (Surround)

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



■ TYPICAL CHARACTERISTICS



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