



## 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



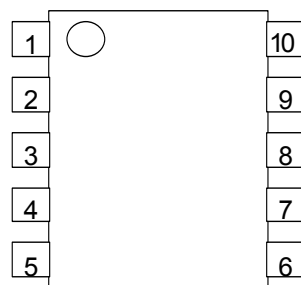
**NJM2703RB2**  
(MSOP10 (TVSP10) )

### ■ FEATURES

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

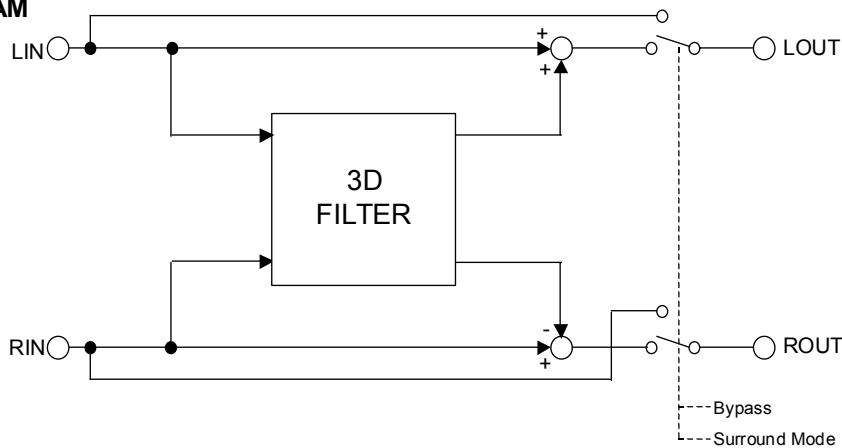
\*MEET JEDEC MO-187-DA / THIN TYPE

### ■ 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 <sup>+</sup>	7	V
Power Dissipation	P <sub>D</sub>	320	mW
Operating Temperature Range	T <sub>opr</sub>	-20 to +75	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +125	°C

## ■OPERATING VOLTAGE

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V <sup>+</sup>	-	1.8	3.0	6.0	V

## ■ELECTRICAL CHARACTERISTICS (V<sup>+</sup>=3V, Ta=25°C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION						MIN.	TYP.	MAX.	UNIT
		INPUT		OUTPUT	MODE	VR					
		L	R								
Operating Current	I <sub>cc</sub>	No Signal	0	0	-	Bypass	-	-	0.45	0.7	mA
			0	0	-	Surround	MAX	-	0.45	0.7	
Reference Voltage	V <sub>ref</sub>	No Signal	0	0	-	-	-	1.0	1.15	1.3	V

## ● AC CHARACTERISTICS

(V<sup>+</sup>=3V, Ta=25°C, V<sub>IN</sub>=-20dBV(100mVrms), f=1kHz, R<sub>L</sub>=10kΩ, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION						MIN.	TYP.	MAX.	UNIT
		INPUT		OUTPUT	MODE	VR					
		L	R								
Maximum Input Voltage	V <sub>IM</sub>	f=1kHz T.H.D.=1%	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Bypass	-	-	-2.0 (790)	-	dBV (mVrms)
		f=100Hz T.H.D.=1%	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Surround	MAX	-	-16.0 (160)	-	
		V <sup>+</sup> =1.8V f=1kHz T.H.D.=1%	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Bypass	-	-10.5 (300)	-8.5 (380)	-	
		V <sup>+</sup> =1.8V f=100Hz T.H.D.=1%	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Surround	MAX	-24.5 (60)	-22.5 (75)	-	
Output Noise	V <sub>NO</sub>	R <sub>g</sub> =0Ω A-Weighted	0	0	L R	Bypass	-	-	-112 (2.5)	-106 (5.0)	dBV (μVrms)
		R <sub>g</sub> =0Ω A-Weighted	0	0	L R	Surround	MAX	-	-100 (10)	-94 (20)	
Total Harmonic Distortion	T.H.D.	f=1kHz	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Bypass	-	-	0.02	0.05	%
		f=1kHz	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Surround	MAX	-	0.1	0.5	

**● AC CHARACTERISTICS**

(V+=3V, Ta=25°C, V<sub>IN</sub>=-20dBV(100mVrms), f=1kHz, RL=10kΩ, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION						MIN.	TYP.	MAX.	UNIT
		INPUT		OUTPUT	MODE	VR					
		L	R								
Bypass Gain	G <sub>VBY</sub> P	f=1kHz	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Bypass	-	-1.0	0.0	1.0	dB
Surround Gain	G <sub>V</sub> SUR	f=100Hz	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Surround	MAX	12.5	14.5	16.5	dB
		f=100Hz	0 V <sub>IN</sub>	V <sub>IN</sub> 0	L R	Surround	MAX	10.5	12.5	14.5	
		f=100Hz	V <sub>IN</sub> 0	0 V <sub>IN</sub>	L R	Surround	MIN	0.5	2.5	4.5	

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

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


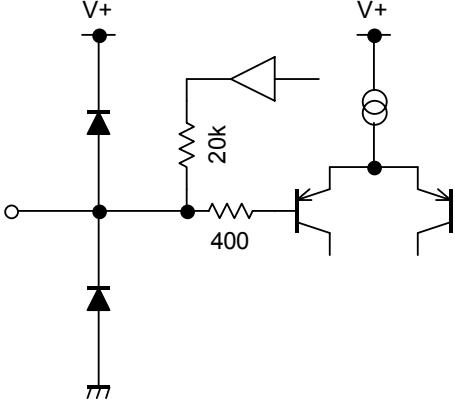
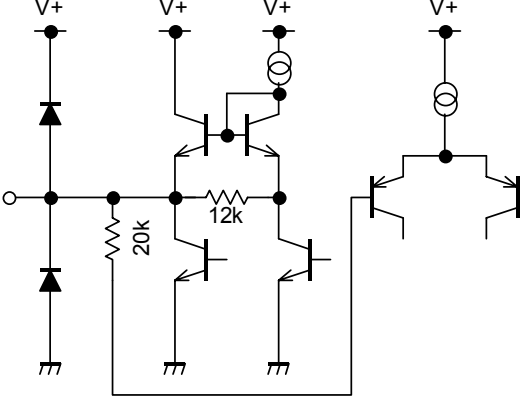
**■ MODE SWITCH**

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

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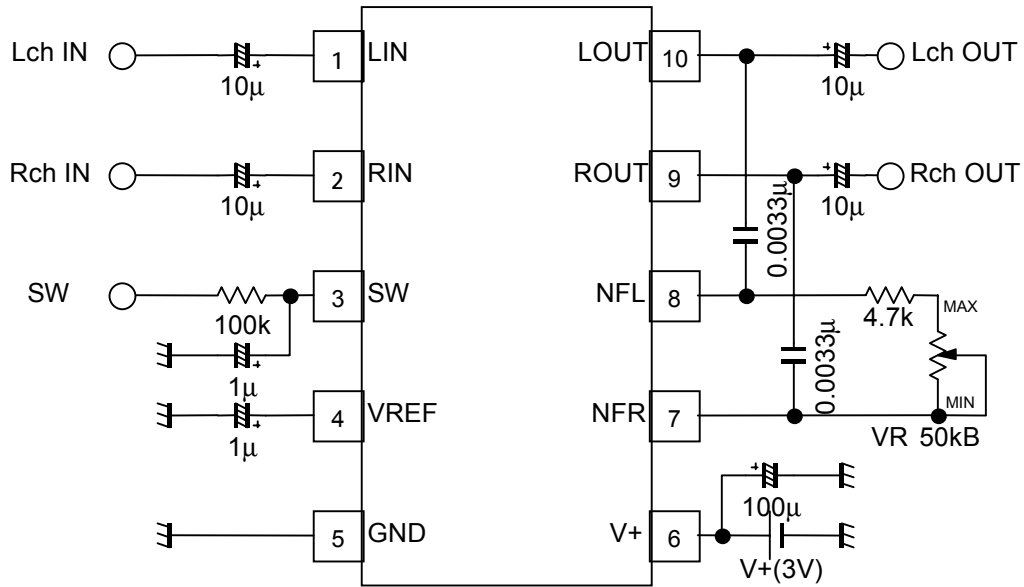
## ■ TERMINAL DESCRIPTION

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

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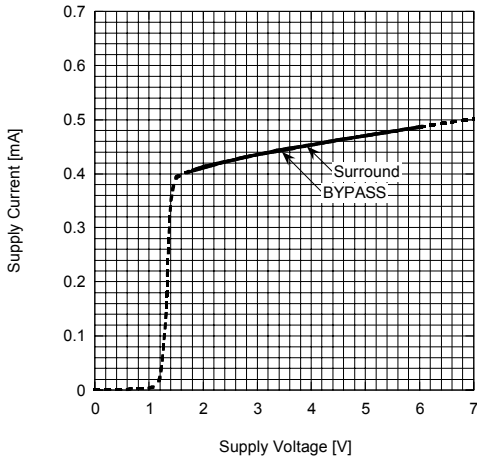
## ■ APPLICATION CIRCUIT



## ■ TYPICAL CHARACTERISTICS

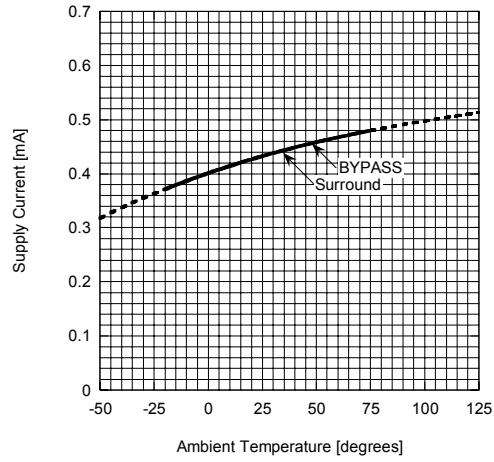
**Supply Current vs. Supply Voltage**

Ta=25degrees



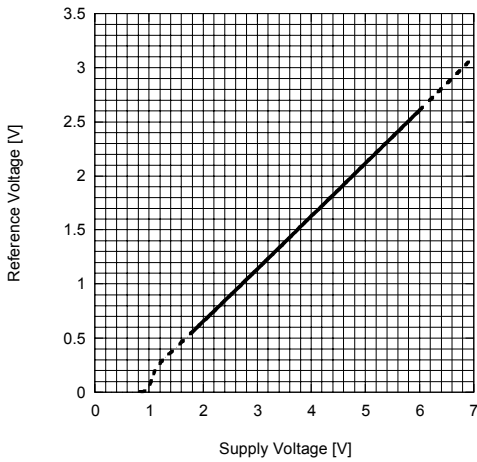
**Supply Current vs. Ambient Temperature**

V+=3V



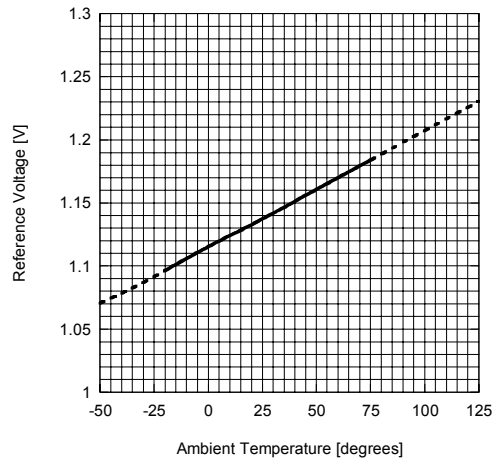
**Reference Voltage vs. Supply Voltage**

Ta=25degrees



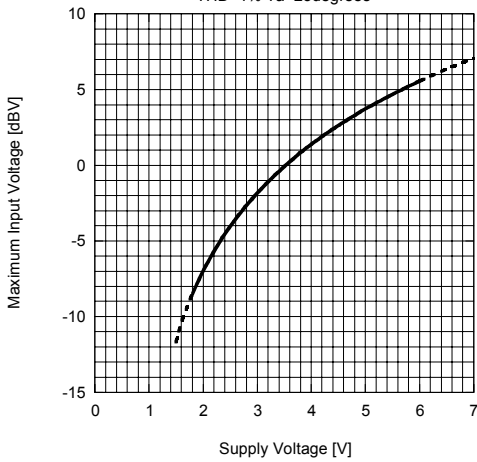
**Reference Voltage vs. Ambient Temperature**

V+=3V



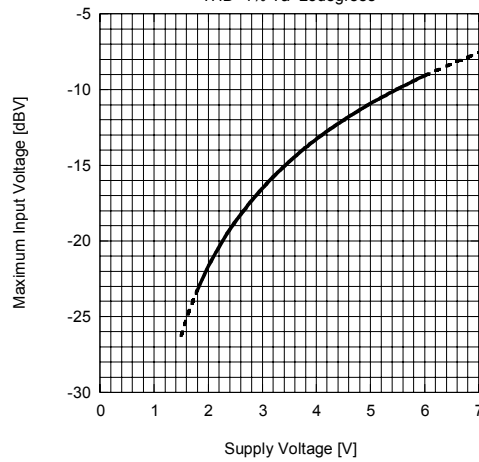
**Maximum Input Voltage vs. Supply Voltage (BYPASS)**

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



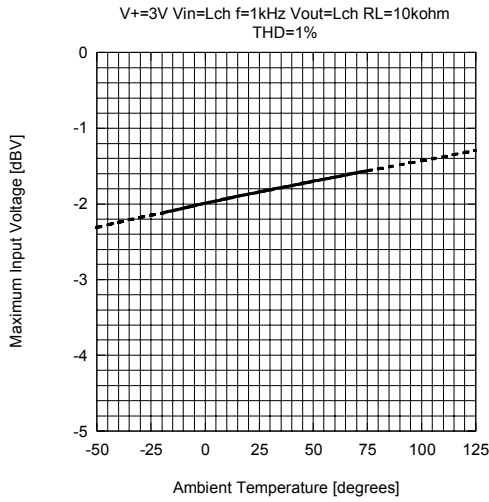
**Maximum Input Voltage vs. Supply Voltage (Surround)**

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

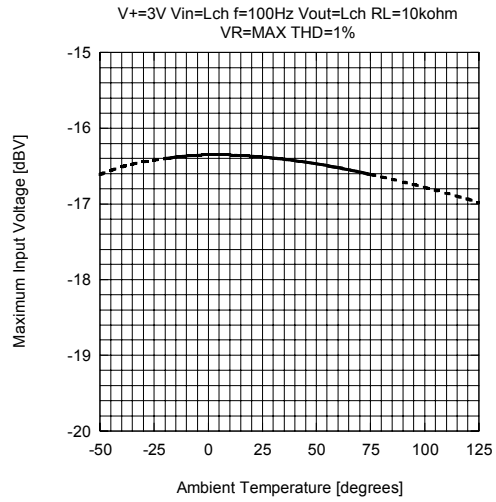


## ■ TYPICAL CHARACTERISTICS

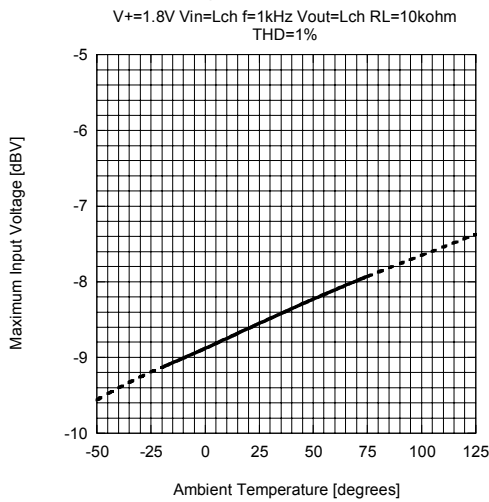
**Maximum Input Voltage vs. Ambient Temperature (BYPASS)**



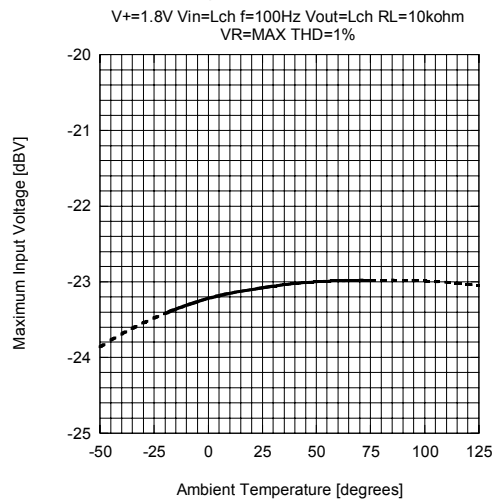
**Maximum Input Voltage vs. Ambient Temperature (Surround)**



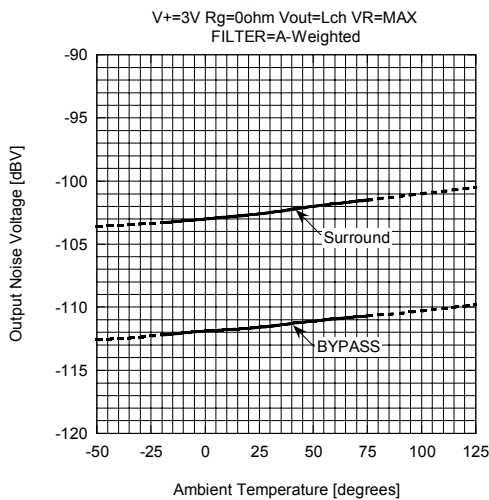
**Maximum Input Voltage vs. Ambient Temperature (BYPASS)**



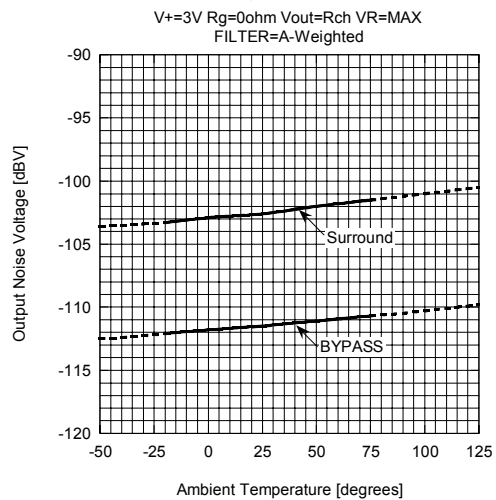
**Maximum Input Voltage vs. Ambient Temperature (Surround)**



**Output Noise Voltage vs. Ambient Temperature**



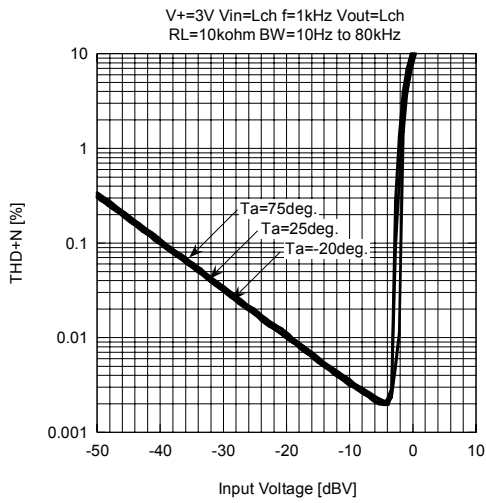
**Output Noise Voltage vs. Ambient Temperature**



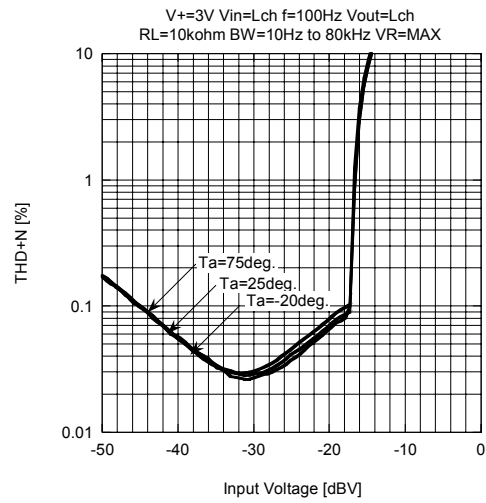


## ■ TYPICAL CHARACTERISTICS

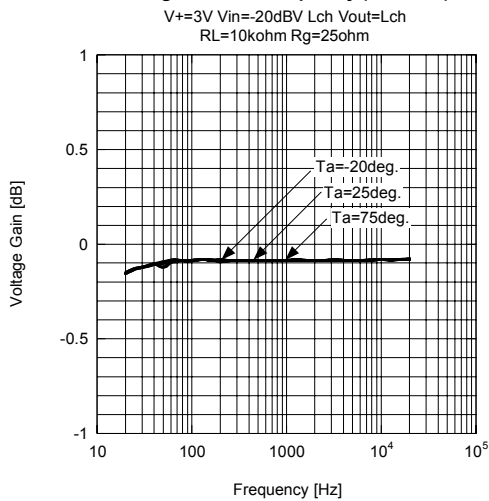
**Total Harmonic Distortion vs. Input Voltage (BYPASS)**



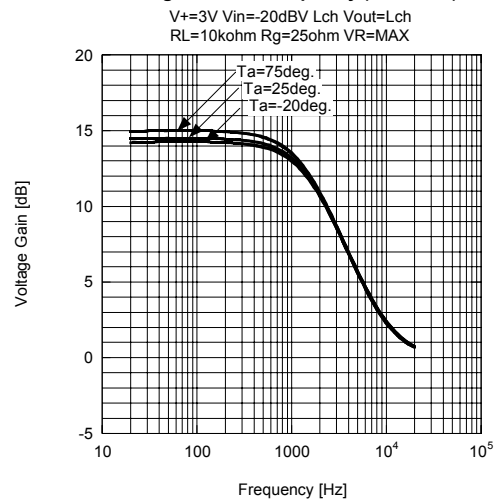
**Total Harmonic Distortion vs. Input Voltage (Surround)**



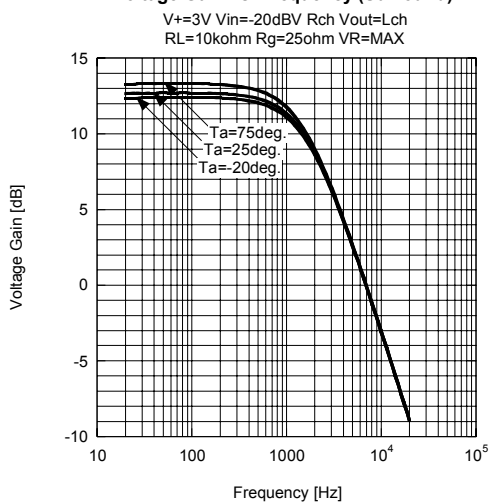
**Voltage Gain vs. Frequency (BYPASS)**



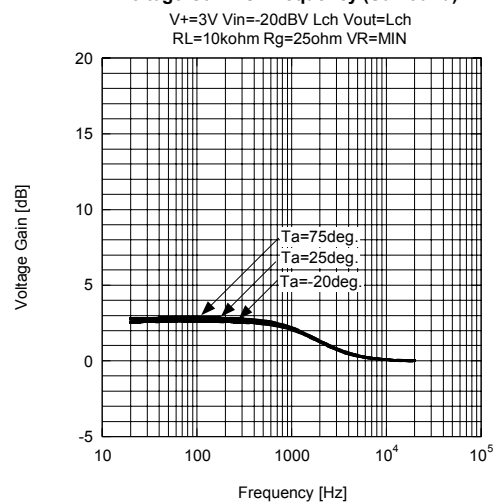
**Voltage Gain vs. Frequency (Surround)**



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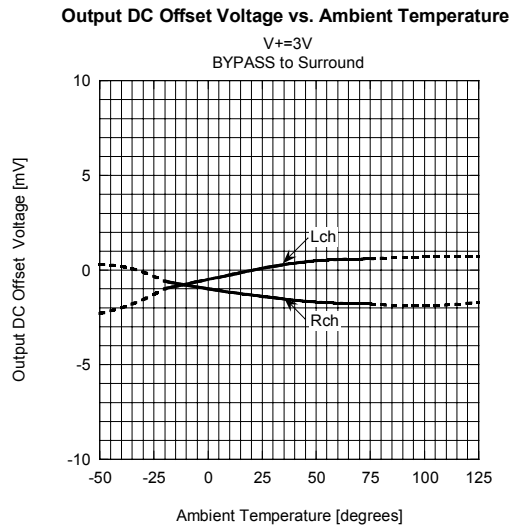
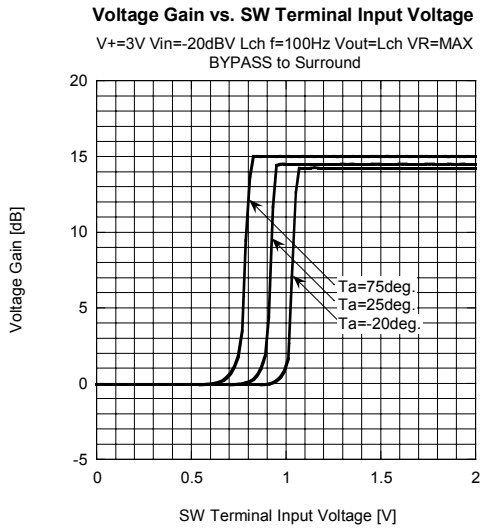


**Voltage Gain vs. Frequency (Surround)**



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## ■ TYPICAL CHARACTERISTICS



**[CAUTION]**

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Тел: +7 (812) 336 43 04 (многоканальный)  
Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)