



## Surround Audio Processor for Mobile Applications

### ■ GENERAL DESCRIPTION

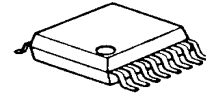
The **NJM2705** is the surround audio processor for mobile applications.

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.

### ■ PACKAGE OUTLINE

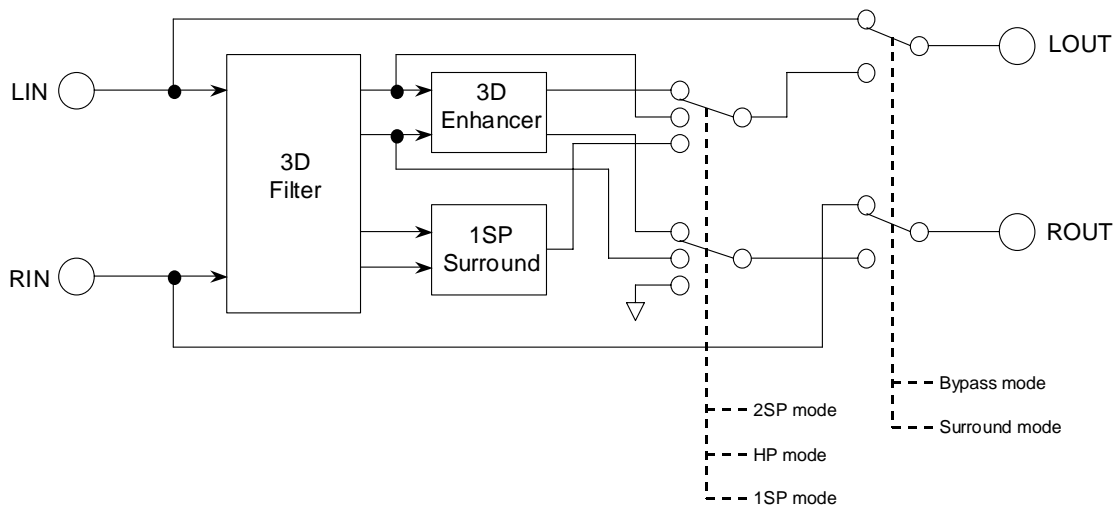


**NJM2705V**

### ■ 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

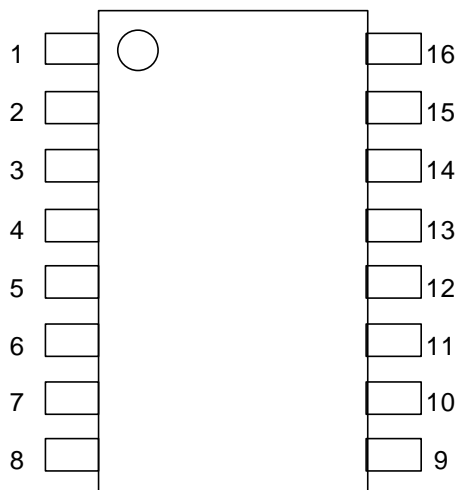
### ■ BLOCK DIAGRAM



# NJM2705

## ■ PIN CONFIGURATION

SSOP16 (Top View)



- |          |           |
|----------|-----------|
| 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 <sup>+</sup>   | 7           | V    |
| Power Dissipation           | P <sub>D</sub>   | 300         | 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 | TEST CONDITION |   |            |         |          |          | MIN | TYP  | MAX | UNIT |
|-------------------|------------------|----------------|----------------|---|------------|---------|----------|----------|-----|------|-----|------|
|                   |                  |                | INPUT          |   | OUT<br>PUT | MODE    | SP<br>VR | HP<br>VR |     |      |     |      |
|                   |                  |                | L              | R |            |         |          |          |     |      |     |      |
| Operating Current | I <sub>cc</sub>  | No Signal      | 0              | 0 | -          | Active  |          |          | -   | 450  | 700 | μA   |
|                   |                  |                | 0              | 0 | -          | Standby |          |          | -   | 0.1  | 1.0 |      |
| 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                          | TEST CONDITION       |                      |            |        |          |          | MIN            | TYP            | MAX          | UNIT           |
|-----------------------|-------------------|---|----------------------|----------------------|------------|--------|----------|----------|----------------|----------------|--------------|----------------|
|                       |                   |   | INPUT                |                      | OUT<br>PUT | MODE   | SP<br>VR | HP<br>VR |                |                |              |                |
|                       |                   |   | L                    | R                    |            |        |          |          |                |                |              |                |
| Maximum Input Voltage | V <sub>IM1</sub>  | f=1kHz<br>THD=1%                        | V <sub>IN</sub><br>0 | 0<br>V <sub>IN</sub> | L<br>R     | Bypass | -        | -        | -              | -2.0<br>(790)  | -            | dBV<br>(mVrms) |
|                       | V <sub>IM2</sub>  | f=100Hz<br>THD=1%                       | V <sub>IN</sub><br>0 | 0<br>V <sub>IN</sub> | L<br>R     | 2SP    | MAX      | -        | -              | -16.0<br>(160) | -            |                |
|                       | V <sub>IM3</sub>  | f=100Hz<br>THD=1%                       | V <sub>IN</sub><br>0 | 0<br>V <sub>IN</sub> | L<br>R     | HP     | -        | MAX      | -              | -16.0<br>(160) | -            |                |
|                       | V <sub>IM4</sub>  | f=100Hz<br>THD=1%                       | V <sub>IN</sub>      | 0                    | L          | 1SP    | MAX      | -        | -              | -16.0<br>(160) | -            |                |
|                       | V <sub>IM5</sub>  | f=100Hz<br>THD=1%                       | 0                    | V <sub>IN</sub>      | L          | 1SP    | MAX      | -        | -              | -14.5<br>(190) | -            |                |
|                       | V <sub>IM6</sub>  | V <sup>+</sup> =1.8V, f=1kHz<br>THD=1%  | V <sub>IN</sub><br>0 | 0<br>V <sub>IN</sub> | L<br>R     | Bypass | -        | -        | -10.5<br>(300) | -8.5<br>(380)  | -            |                |
|                       | V <sub>IM7</sub>  | V <sup>+</sup> =1.8V, f=100Hz<br>THD=1% | V <sub>IN</sub><br>0 | 0<br>V <sub>IN</sub> | L<br>R     | 2SP    | MAX      | -        | -24.5<br>(60)  | -22.5<br>(75)  | -            |                |
|                       | V <sub>IM8</sub>  | V <sup>+</sup> =1.8V, f=100Hz<br>THD=1% | V <sub>IN</sub><br>0 | 0<br>V <sub>IN</sub> | L<br>R     | HP     | -        | MAX      | -24.5<br>(60)  | -22.5<br>(75)  | -            |                |
|                       | V <sub>IM9</sub>  | V <sup>+</sup> =1.8V, f=100Hz<br>THD=1% | V <sub>IN</sub>      | 0                    | L          | 1SP    | MAX      | -        | -24.5<br>(60)  | -22.5<br>(75)  | -            |                |
|                       | V <sub>IM10</sub> | V <sup>+</sup> =1.8V, f=100Hz<br>THD=1% | 0                    | V <sub>IN</sub>      | L          | 1SP    | MAX      | -        | -23.0<br>(70)  | -21.0<br>(90)  | -            |                |
| Output Noise          | V <sub>NO1</sub>  | R <sub>g</sub> =∞<br>A-Weighted         | 0                    | 0                    | L<br>R     | Bypass | -        | -        | -              | -112<br>(25)   | -106<br>(50) | dBV<br>(μVrms) |
|                       | V <sub>NO2</sub>  | R <sub>g</sub> =∞<br>A-Weighted         | 0                    | 0                    | L<br>R     | 1SP    | MAX      | -        | -              | -100<br>(10)   | -94<br>(20)  |                |
|                       | V <sub>NO3</sub>  | R <sub>g</sub> =∞<br>A-Weighted         | 0                    | 0                    | L<br>R     | HP     | -        | MAX      | -              | -100<br>(10)   | -94<br>(20)  |                |
|                       | V <sub>NO4</sub>  | R <sub>g</sub> =∞<br>A-Weighted         | 0                    | 0                    | L          | 1SP    | MAX      | -        | -              | -100<br>(10)   | -94<br>(20)  |                |

# NJM2705

## ● AC CHARACTERISTICS

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

| PARAMETER                 | SYMBOL      | TEST CONDITION |               |               |        |          |          |     | MIN   | TYP   | MAX  | UNIT |
|---------------------------|-------------|----------------|---------------|---------------|--------|----------|----------|-----|-------|-------|------|------|
|                           |             | INPUT          |               | OUT<br>PUT    | MODE   | SP<br>VR | HP<br>VR |     |       |       |      |      |
|                           |             | L              | R             |               |        |          |          |     |       |       |      |      |
| Total Harmonic Distortion | THD1        | f=1kHz         | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>R | Bypass   | -        | -   | -     | 0.02  | 0.05 | %    |
|                           | THD2        | f=1kHz         | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>R | 2SP      | MAX      | -   | -     | 0.1   | 0.5  |      |
|                           | THD3        | f=1kHz         | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>R | HP       | -        | MAX | -     | 0.1   | 0.5  |      |
|                           | THD4        | f=1kHz         | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>R | 1SP      | MAX      | -   | -     | 0.1   | 0.5  |      |
| BYPASS Gain               | $G_{VBYP}$  | f=1kHz         | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>R | Bypass   | -        | -   | -1.0  | 0.0   | 1.0  | dB   |
| Surround Gain             | $G_{VSUR1}$ | f=100Hz        | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>R | 2SP      | MAX      | -   | 12.5  | 14.5  | 16.5 | dB   |
|                           | $G_{VSUR2}$ | f=100Hz        | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>R | 2SP      | MIN      | -   | 0.5   | 2.5   | 4.5  |      |
|                           | $G_{VSUR3}$ | f=100Hz        | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>R | HP       | -        | MAX | 12.5  | 14.5  | 16.5 |      |
|                           | $G_{VSUR4}$ | f=100Hz        | $V_{IN}$<br>0 | 0<br>$V_{IN}$ | L<br>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 ( $V^+=3V$ , $T_a=25^\circ C$ 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<br>6             | LIN<br>RIN                       | Lch Input<br>Rch Input   |                    | 1.15V   |
| 4<br>3<br>14       | LOUT<br>ROUT<br>LMON             | Lch Output<br>Rch Output<br>Filter terminal                              |                    | 1.15V   |
| 2<br>1<br>16<br>15 | NFSPR<br>NFHPR<br>NFSPL<br>NFHPL | Filter terminal<br>Filter terminal<br>Filter terminal<br>Filter terminal |                    | 1.15V   |
| 13                 | PS                               | Filter terminal  |                    | 1.15V   |

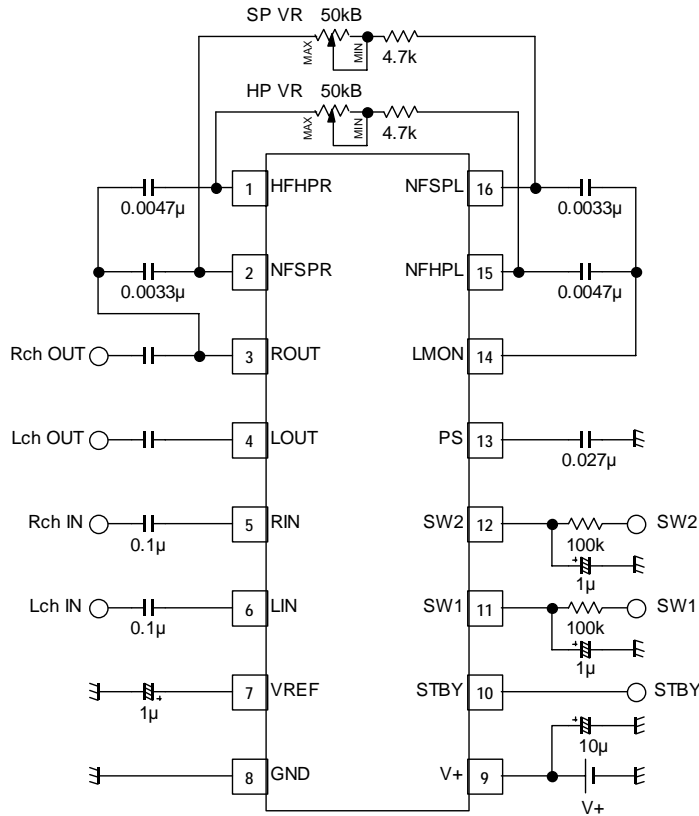
# NJM2705

## ■ TERMINAL DESCRIPTION

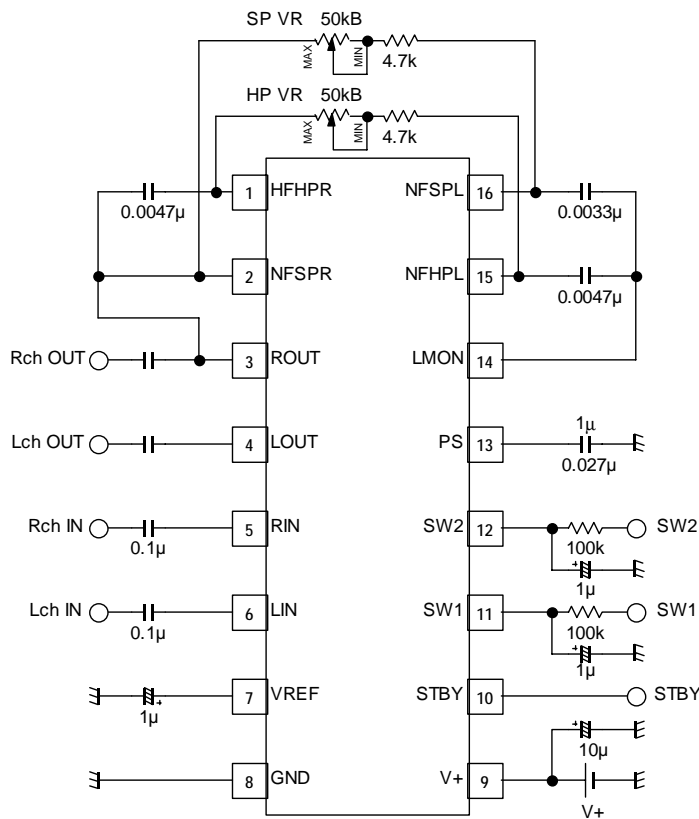
| PIN No.  | SYMBOL     | FUNCTION                                   | EQUIVALENT CIRCUIT | Voltage |
|----------|------------|--|--------------------|---------|
| 12<br>11 | SW2<br>SW1 | Mode control switch<br>Mode control switch |                    | 0V      |
| 10       | STBY       | Standby switch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

## APPLICATION CIRCUIT

### 1) 2SP mode, HP mode



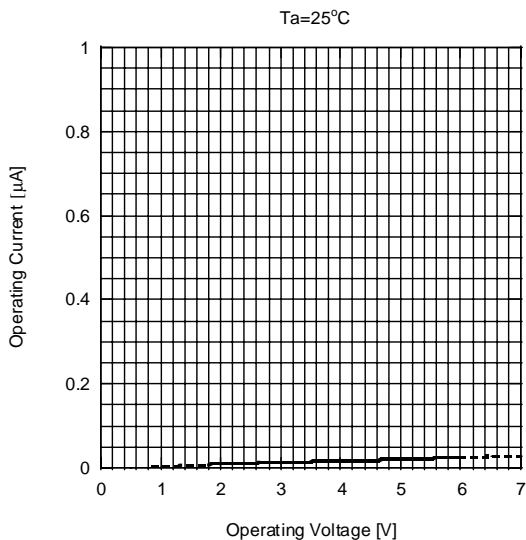
### 2) 1SP mode, HP mode



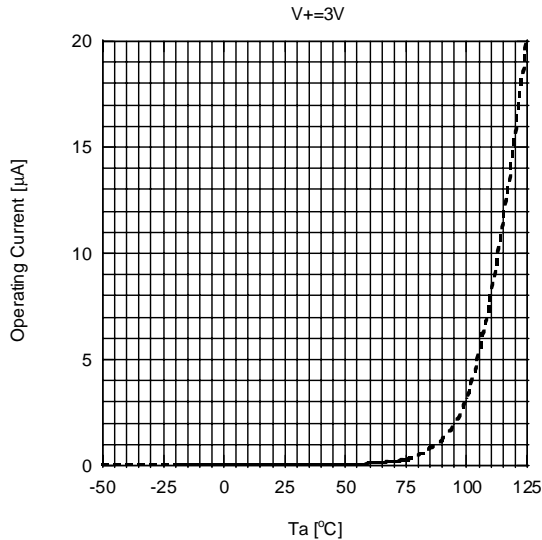
Surround signal is outputted from LOUT terminal at 1SP mode.

## TYPICAL CHARACTERISTICS

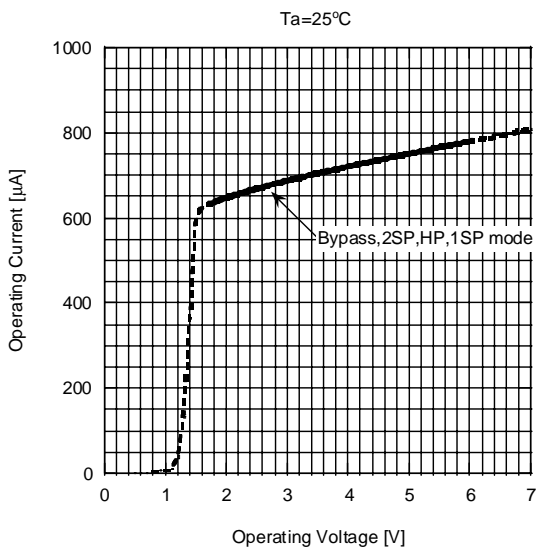
Operating Current vs. Operating Voltage (STANDBY)



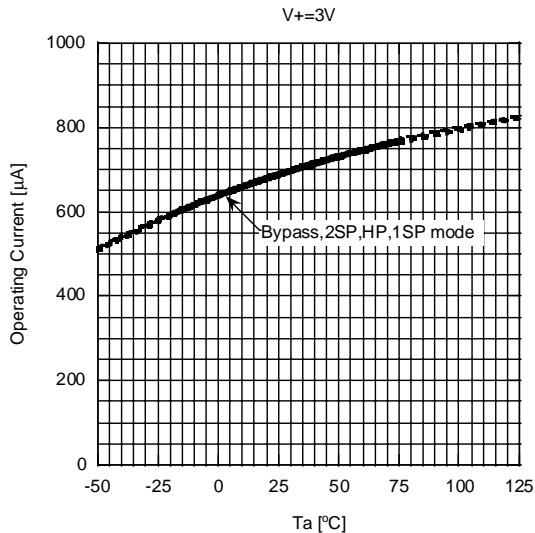
Operating Current vs. Temperature (STANDBY)



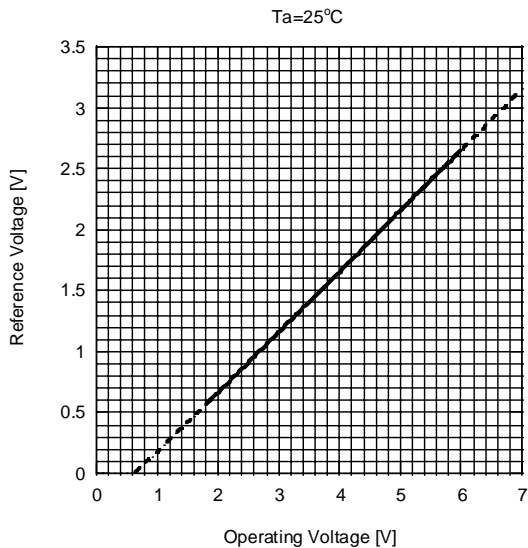
Operating Current vs. Operating Voltage (ACTIVE)



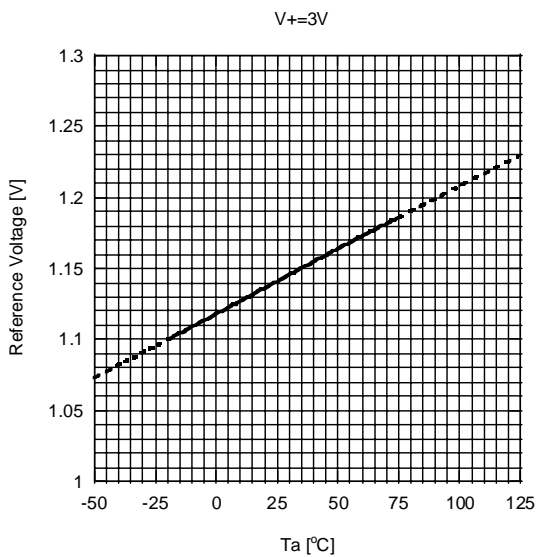
Operating Current vs. Temperature (ACTIVE)



Reference Voltage vs. Operating Voltage



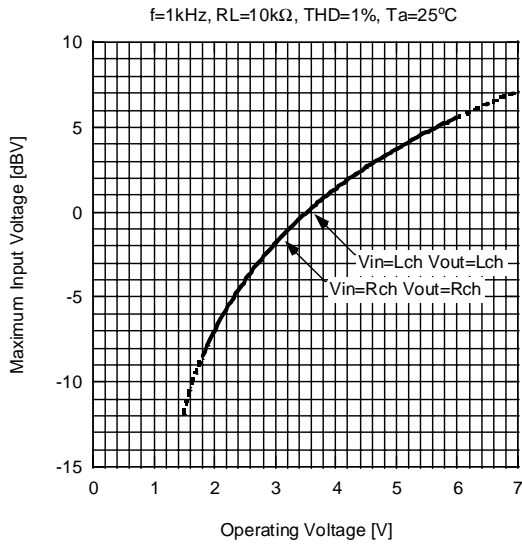
Reference Voltage vs. Temperature



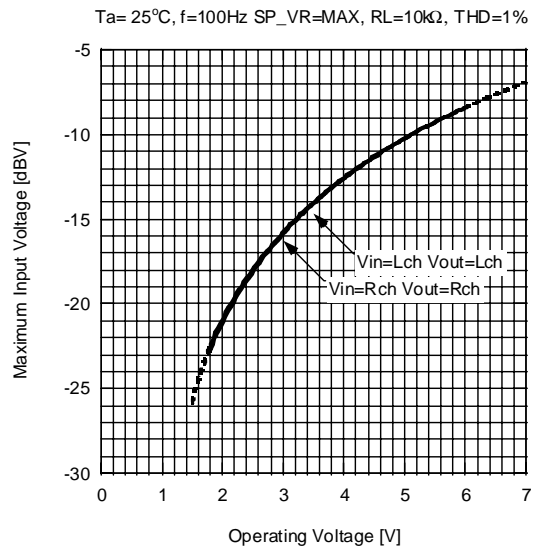


## TYPICAL CHARACTERISTICS

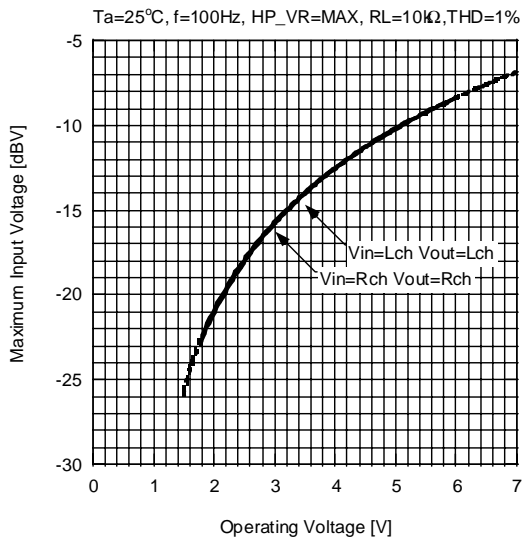
**Maximum Input Voltage vs. Operating Voltage (BYPASS)**



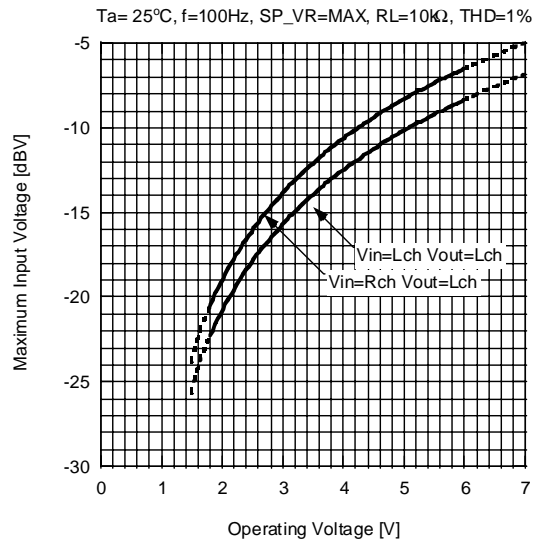
**Maximum Input Voltage vs. Operating Voltage (2SP)**



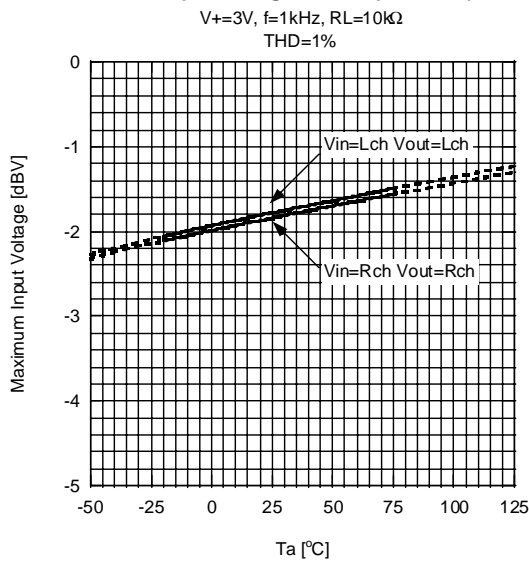
**Maximum Input Voltage vs. Operating Voltage (HP)**



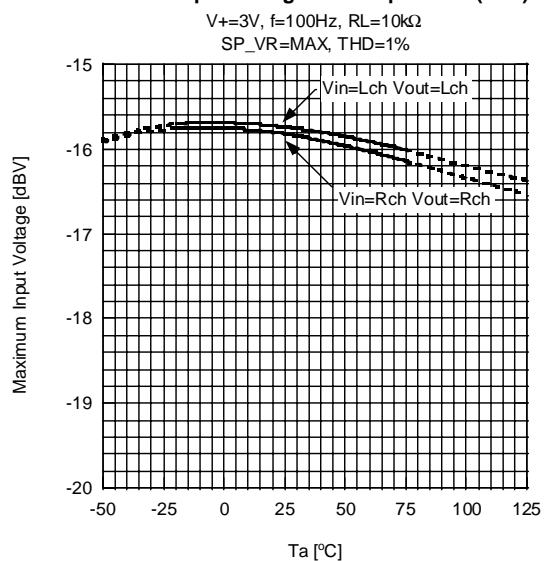
**Maximum Input Voltage vs. Temperature (1SP)**



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

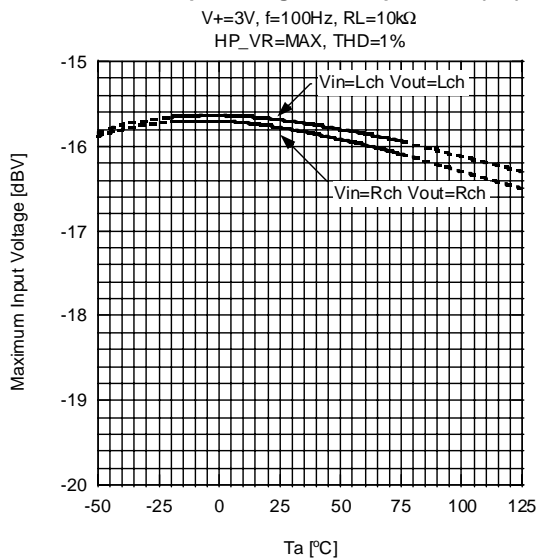


**Maximum Input Voltage vs. Temperature (2SP)**

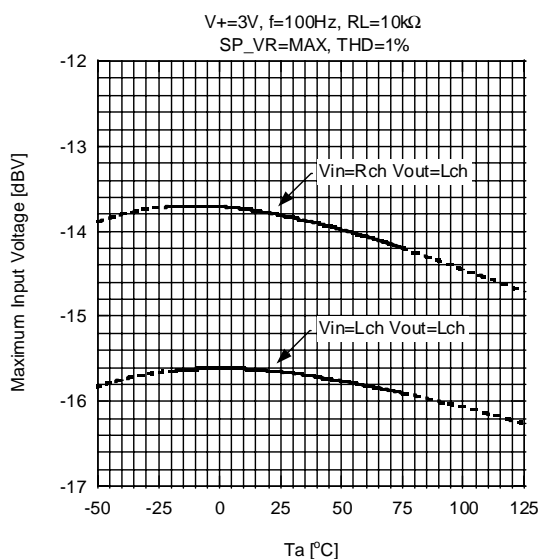


## TYPICAL CHARACTERISTICS

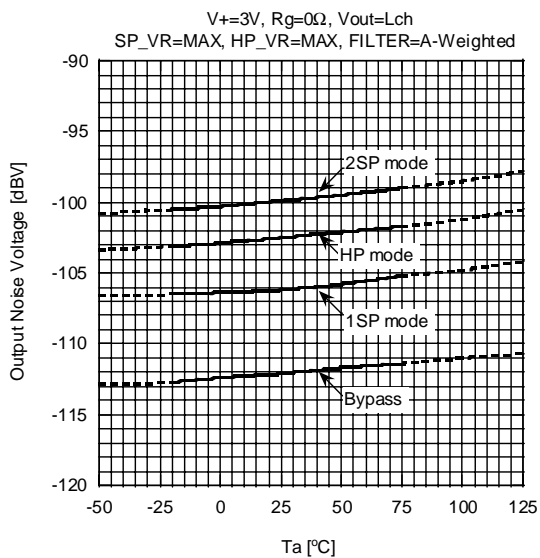
**Maximum Input Voltage vs. Temperature (HP)**



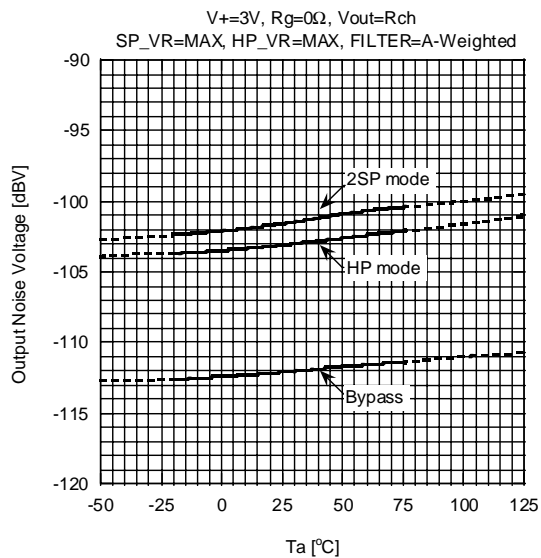
**Maximum Input Voltage vs. Temperature (1SP)**



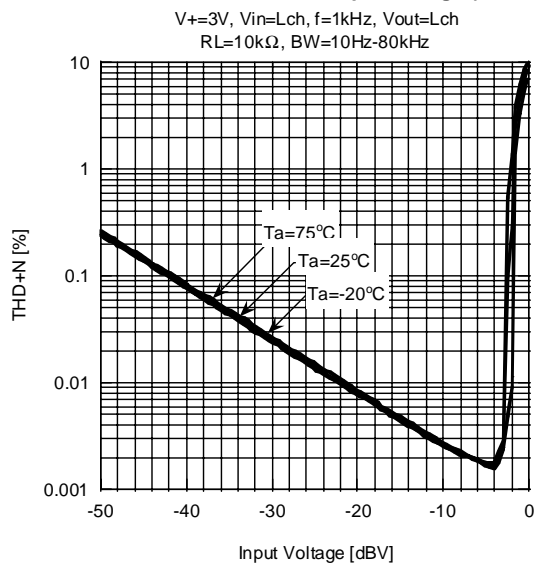
**Output Noise Voltage vs. Temperature**



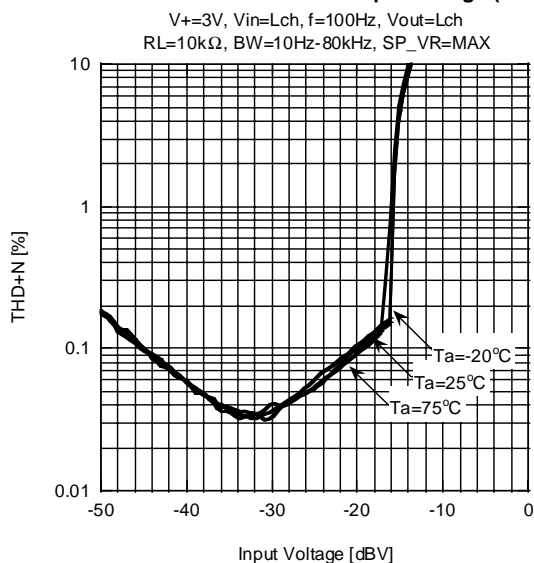
**Output Noise Voltage vs. Temperature**



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

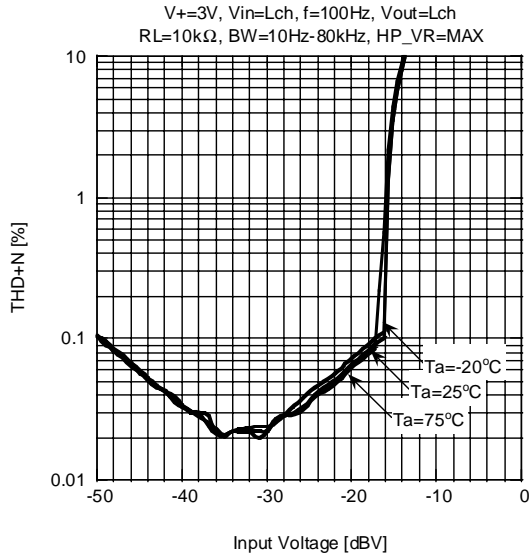


**Total Harmonic Distortion vs. Input Voltage (2SP)**

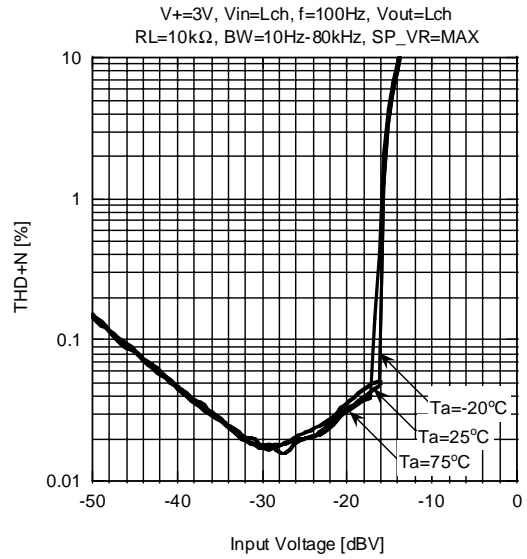


## TYPICAL CHARACTERISTICS

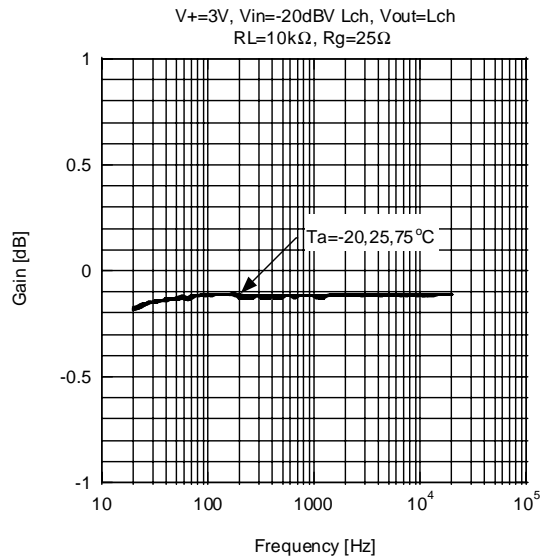
**Total Harmonic Distortion vs. Input Voltage (HP)**



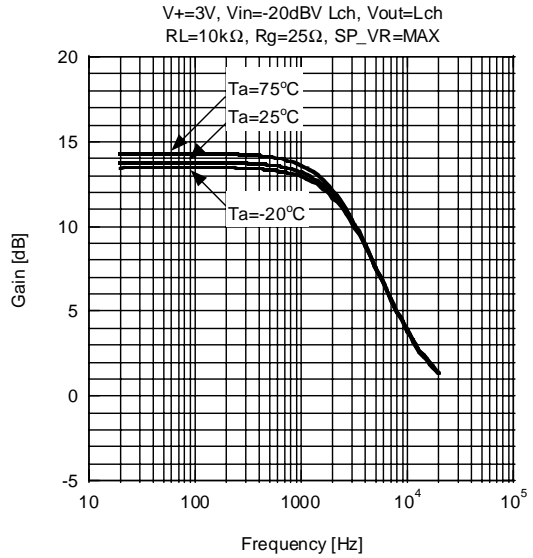
**Total Harmonic Distortion vs. Input Voltage (1SP)**



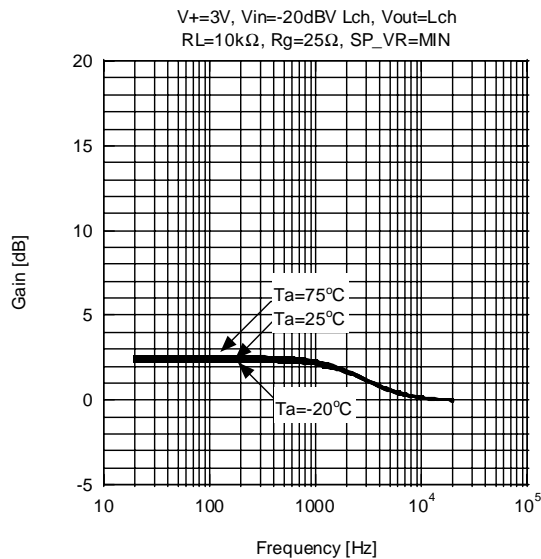
**Frequency Response (BYPASS)**



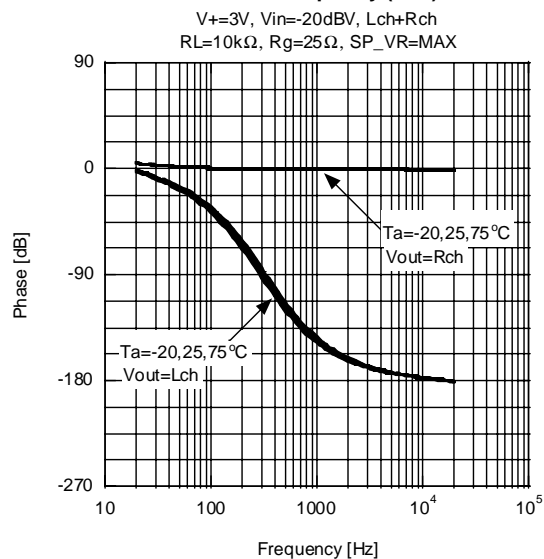
**Frequency Response (2SP)**



**Frequency Response (2SP)**



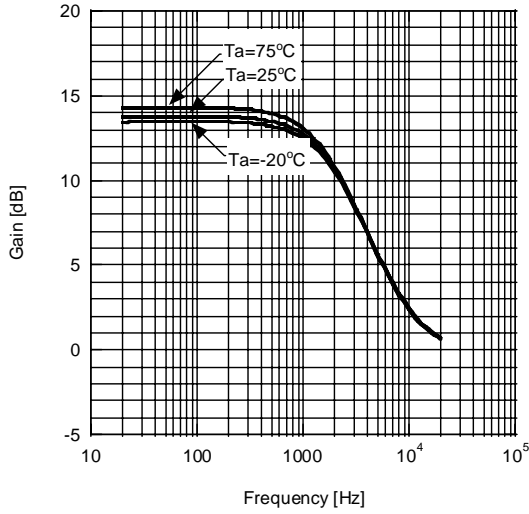
**Phase vs. Frequency (2SP)**



## TYPICAL CHARACTERISTICS

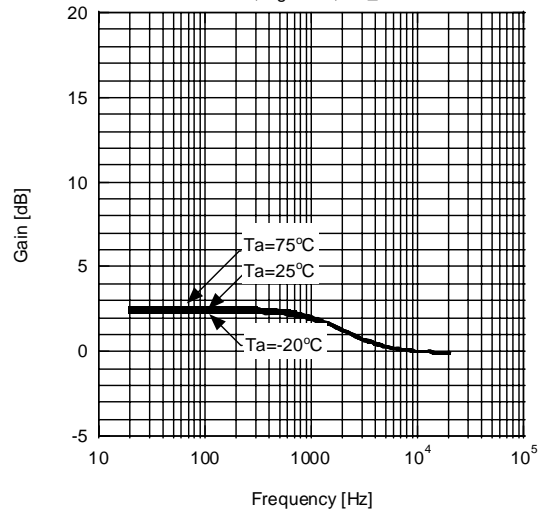
**Frequency Response (HP)**

V+=3V, Vin=-20dBV Lch, Vout=Lch  
RL=10kΩ, Rg=25Ω, HP\_VR=MAX



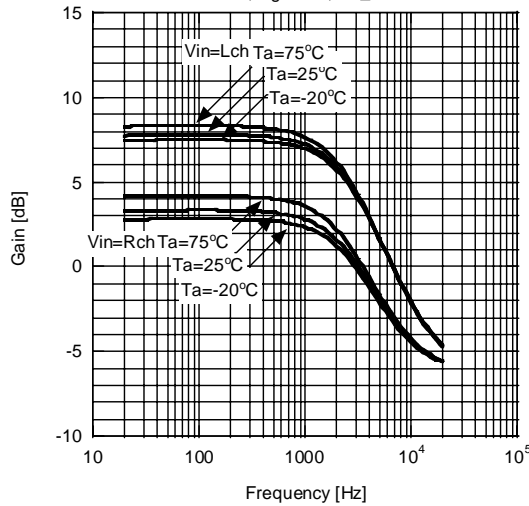
**Frequency Response (HP)**

V+=3V, Vin=-20dBV Lch, Vout=Lch  
RL=10kΩ, Rg=25Ω, HP\_VR=MIN



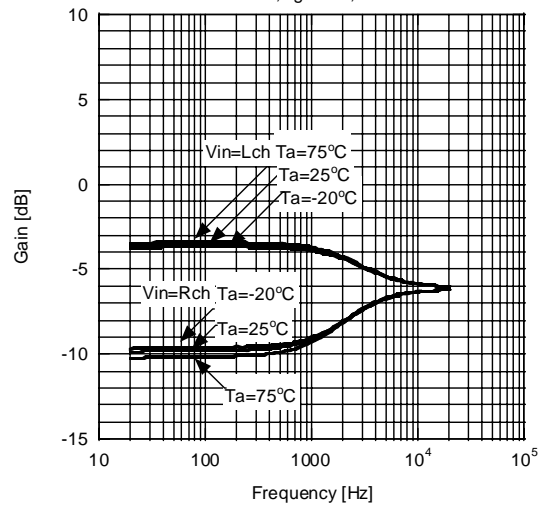
**Frequency Response (1SP)**

V+=3V, Vin=-20dBV, Vout=Lch  
RL=10kΩ, Rg=25Ω, SP\_VR=MAX



**Frequency Response (1SP)**

V+=3V, Vin=-20dBV, Vout=Lch  
RL=10kΩ, Rg=25Ω, VR=MIN



**[CAUTION]**

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.

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- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «**JONHON**», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «**FORSTAR**».



## JONHON

«**JONHON**» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«**FORSTAR**» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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