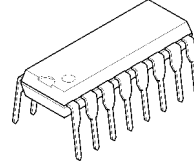


DUAL OPERATIONAL TRANSCONDUCTANCE AMPLIFIER

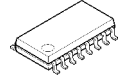
■ GENERAL DESCRIPTION

The NJM13600/13700 consist of two current controlled trans conductance amplifiers each with differential inputs and a push pull output. The two amplifiers share common supplies but otherwise operate independently. Linearizing diodes are provided at the inputs to reduce distortion and allow higher input levels. The result is a 10 dB signal-to-noise improvement referenced to 0.5 percent THD. Controlled impedance buffers are provided which are especially designed to complement the dynamic range of the amplifiers.

■ PACKAGE OUTLINE



NJM13600D
NJM13700D

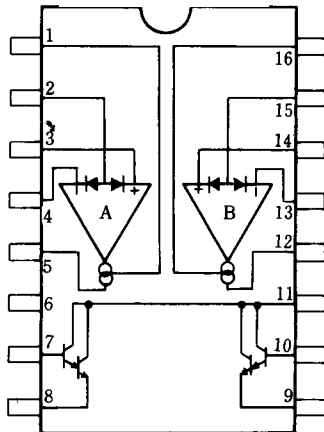


NJM13600M
NJM13700M

■ FEATURES

- Package Outline DIP16, DMP16
- Bipolar Technology

■ PIN CONFIGURATION

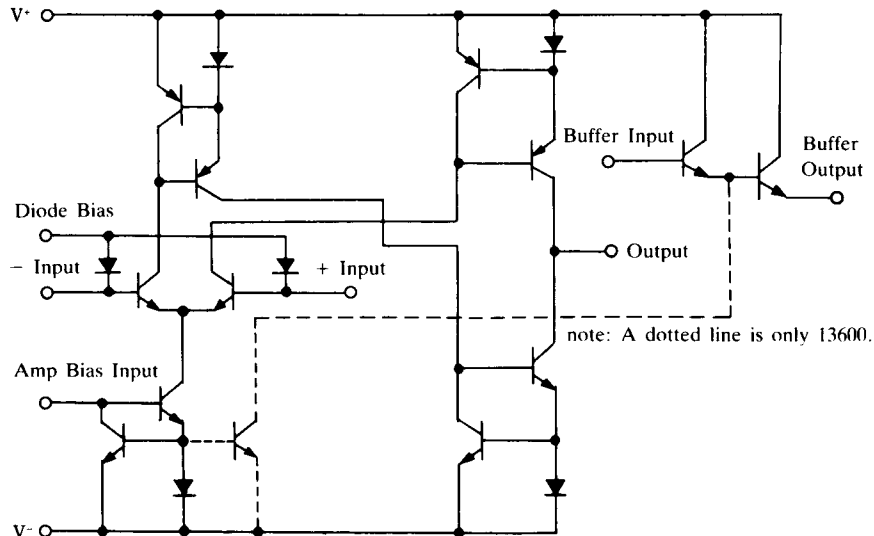


NJM13600D, NJM13600M
NJM13700D, NJM13700M

PIN FUNCTION

- | | |
|---------------------|----------------------|
| 1. AMP BIAS INPUT A | 9. BUFFER OUTPUT B |
| 2. DIODE BIAS A | 10. BUFFER INPUT B |
| 3. +INPUT | 11. V ⁺ |
| 4. -INPUT | 12. OUTPUT B |
| 5. OUTPUT A | 13. -INPUT B |
| 6. V ⁻ | 14. +INPUT B |
| 7. BUFFER INPUT A | 15. DIODE BIAS B |
| 8. BUFFER OUTPUT A | 16. AMP BIAS INPUT B |

■ EQUIVALENT CIRCUIT



NJM13600/13700

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|-----------------------------|--------------------------------|---------------------------------------|------|
| Supply Voltage | V ⁺ /V ⁻ | 36 or ±18 | V |
| Differential Input Voltage | V _{ID} | ± 5 | V |
| Diode Bias Current | I _D | 2 | mA |
| Amp Bias Current | I _{ABC} | 2 | mA |
| Buffer Output Current | I _O | 20 | mA |
| Power Dissipation | P _D | (DIP16) 570 (DMP16) 700 (note) | mW |
| DC Input Voltage | V _{IN} | V ⁺ ~V ⁻ | V |
| Operating Temperature Range | T _{opr} | -40~+85 | °C |
| Storage Temperature Range | T _{stg} | -40~+125 | °C |

(note) At on a ceramic PCB (10x20x0.635 mm)

■ ELECTRICAL CHARACTERISTICS

(V⁺/V⁻=±15V, Ta=25°C, I_{ABC}=500μA)

| PARAMETER | SYMBOL | TEST CONDITION | 13600 | | | 13700 | | | UNIT |
|---|-------------------|---|-------|--------|-------|-------|--------|-------|------|
| | | | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. | |
| Input Offset Voltage (V _{OS}) | V _{IO} | | - | 0.4 | 5 | - | 0.4 | 4 | mV |
| Input Offset Voltage | | I _{ABC} =5μA | - | 0.3 | 5 | - | 0.3 | 4 | mV |
| V _{OS} Including Diodes | | Diode Bias Current, I _D =500μA | - | 0.5 | 5 | - | 0.5 | 5 | mV |
| Input Offset Change | | 5μA ≤ I _{ABC} ≤ 500μA | - | 0.1 | - | - | 0.1 | 3 | mV |
| Input Bias Current | I _B | | - | 0.4 | 5 | - | 0.4 | 5 | μA |
| Input Bias Current | | (-20~+75°C) | - | 1 | 8 | - | 1 | 8 | μA |
| Forward Transconductance | gm | | 6700 | 9600 | 13000 | 6700 | 9600 | 13000 | μS |
| | | (-20~+75°C) | 5400 | - | - | 5400 | - | - | μS |
| gm Tracking | | R _L =0, I _{ABC} =5μA | - | 0.3 | - | - | 0.3 | - | dB |
| Peak Output Current | I _{OP} | R _L =0, I _{ABC} =5μA | - | 5 | - | - | 0 | - | μA |
| Peak Output Current | | R _L =0, I _{ABC} =500μA | 350 | 500 | 650 | 350 | 500 | 650 | μA |
| Peak Output Current | | R _L =0 (-20~+75°C) | 300 | - | - | 300 | - | - | μA |
| Peak Output Voltage Positive | V _{OP} | R _L =∞, 5μA ≤ I _{ABC} ≤ 500μA | +12 | +14.2 | - | +12 | +14.2 | - | V |
| Peak Output Voltage Negative | | R _L =∞, 5μA ≤ I _{ABC} ≤ 500μA | -12 | -14.4 | - | -12 | -14.4 | - | V |
| Operating Current | I _{CC} | I _{ABC} =500μA, two circuit | - | 2.6 | - | - | 2.6 | - | mA |
| V _{OS} Sensitivity Positive | SVR | ΔV _{OS} /ΔV ⁺ | 76.5 | 94 | - | 76.5 | 94 | - | dB |
| V _{OS} Sensitivity Negative | | ΔV _{OS} /ΔV ⁻ | 76.5 | 94 | - | 76.5 | 94 | - | dB |
| Input Offset Current | I _{IO} | | - | 0.1 | 0.6 | - | 0.1 | 0.6 | μA |
| CMRR | CMR | | 80 | 110 | - | 80 | 110 | - | dB |
| Common Mode Range | V _{ICM} | | ± 12 | ± 13.5 | - | ± 12 | ± 13.5 | - | V |
| Cross Talk | CT | 20Hz < f < 20kHz (note2) | - | -100 | - | - | -100 | - | dB |
| Differential Input Current | I _{ID} | I _{ABC} =0, Input=±4V | - | 0.02 | 100 | - | 0.02 | 100 | nA |
| Leakage Current | I _{LEAK} | I _{ABC} =0(Refer to Test Circuit) | - | 0.2 | 100 | - | 0.2 | 100 | nA |
| Input Resistance | R _{IN} | | 10 | 26 | - | 10 | 26 | - | kΩ |
| Open Loop Bandwidth | | | - | 2 | - | - | 2 | - | MHz |
| Slew Rate | SR | | - | 50 | - | - | 50 | - | V/μs |
| Buffer Input Current | | (note2) | - | 0.4 | 5 | - | 0.4 | 5 | μA |
| Peak Buffer Output Voltage | | (note2) | 10 | - | - | 10 | - | - | V |

(note1) Open unless otherwise specified. The inputs to the buffers are grounded and outputs are open.

(note2) R_{OUT}=5kΩ connected from the buffer output to V⁺ and the input of buffer is connected to the transconductance amplifier output.

I_{ABC}=500μA

■ TEST CIRCUIT

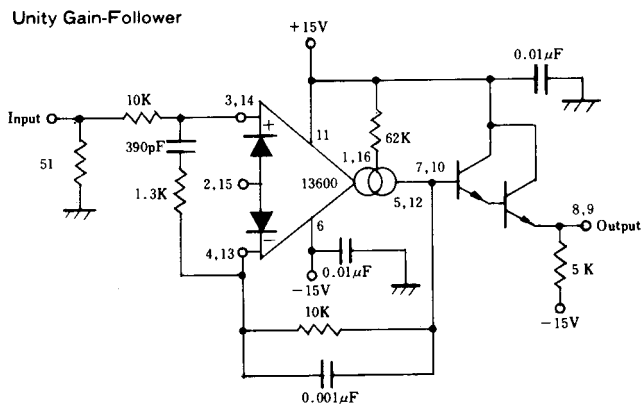


Differential Input Current



Leakage Current

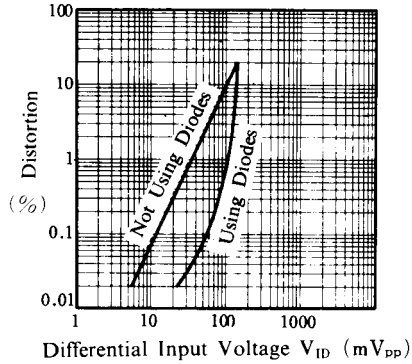
■ TYPICAL APPLICATIONS



■ TYPICAL CHARACTERISTICS

Distortion vs. Differential Input Voltage

($V^+/V^- = \pm 15V$, $R_L = 10k\Omega$, $I_{ABC} = 1mA$, $T_a = 25^\circ C$)



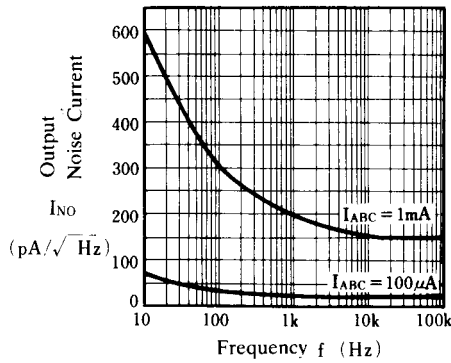
Voltage vs. Amplifier Bias Current

($V^+/V^- = \pm 15V$, $R_L = 10k\Omega$, $T_a = 25^\circ C$)



Output Noise Current vs. Frequency

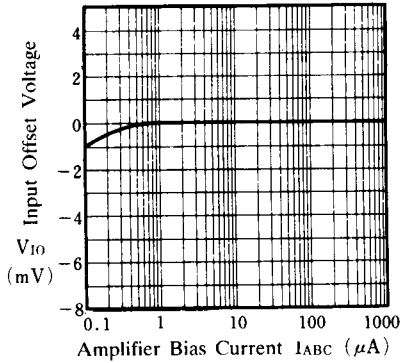
($T_a = 25^\circ C$)



■ TYPICAL CHARACTERISTICS

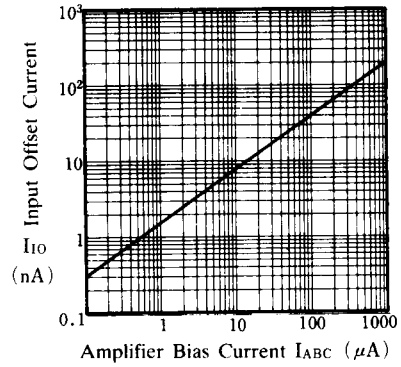
Input Offset Voltage

($V^+/V^- = \pm 15V$, $T_a = 25^\circ C$)



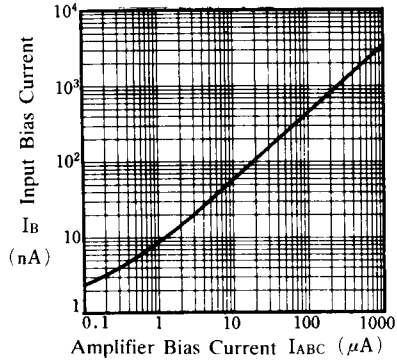
Input Offset Current

($V^+/V^- = \pm 15V$, $T_a = 25^\circ C$)



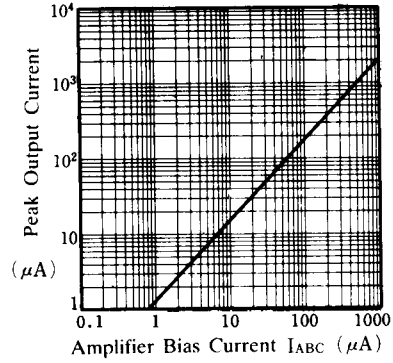
Input Bias Current

($V^+/V^- = \pm 15V$, $T_a = 25^\circ C$)



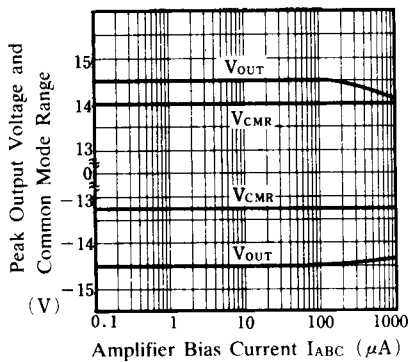
Peak Output Current

($V^+/V^- = \pm 15V$, $T_a = 25^\circ C$)



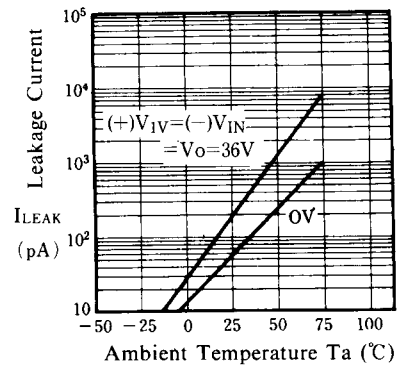
Peak Output Voltage and Common Mode Range

($V^+/V^- = \pm 15V$, $R_L = \infty$, $T_a = 25^\circ C$)



Leakage Current vs. Temperature

($+V_{IN} = -V_{IN} = V_O$)



■ TYPICAL CHARACTERISTICS

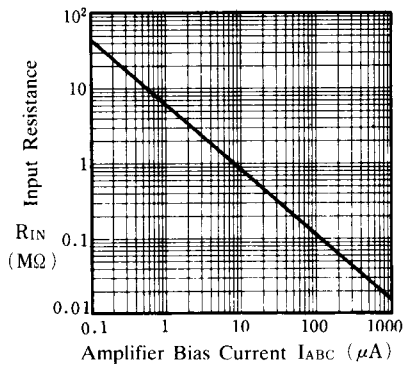
Input Leakage Current
($T_a = 25^\circ\text{C}$)



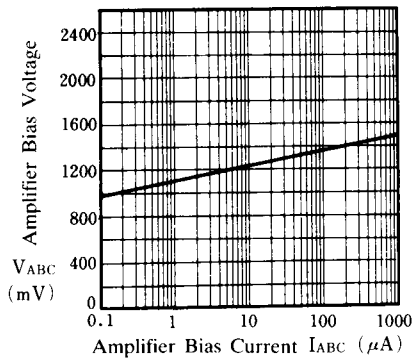
Transconductance



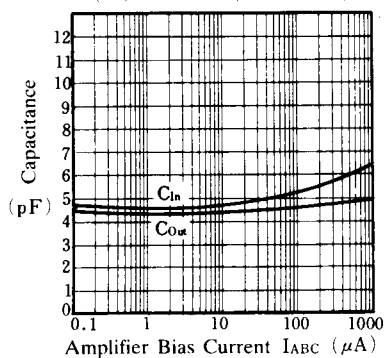
Input Resistance
(Pin2.15 Open, $T_a = 25^\circ\text{C}$)



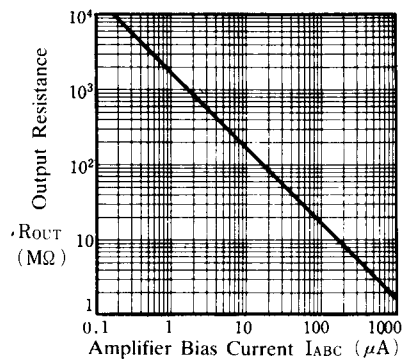
Amplifier Bias Voltage vs. Amplifier Bias Current
($T_a = 25^\circ\text{C}$)



Input and Output Capacitance
($V^+/V^- = \pm 15\text{V}$, $T_a = 25^\circ\text{C}$)



Output Resistance
($T_a = 25^\circ\text{C}$)



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