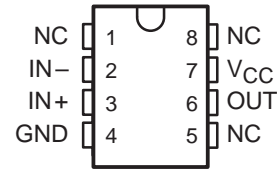


TL321C, TL321I OPERATIONAL AMPLIFIERS

SLOS085 – D2343, APRIL 1977 – REVISED OCTOBER 1990

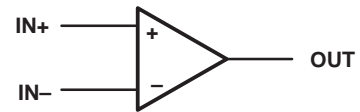
- **Wide Range of Single Supply Voltages . . . 3 V to 30 V or Dual Supplies**
- **Low Supply Current Independent of Supply Voltage . . . 0.8 mA Typ**
- **Common-Mode Input Voltage Range Includes Ground Allowing Direct Sensing Near Ground**
- **Low Input Bias and Offset Parameters**
 - Input Offset Voltage . . . 2 mV Typ
 - Input Offset Current . . . 3 nA Typ (TL321I)
 - Input Bias Current . . . 45 nA Typ
- **Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage . . . ± 32 V**
- **Open-Loop Differential Voltage Amplification . . . 100 V/mV Typ**
- **Internal Frequency Compensation**

TTL321C, TL321I . . . D OR P PACKAGE
(TOP VIEW)



NC – No internal connection

symbol



AVAILABLE OPTIONS

| T _A | V _{IO} MAX at 25°C | PACKAGE | |
|----------------|--------------------------------|----------------------|--------------------|
| | | SMALL OUTLINE (D) | PLASTIC DIP (P) |
| 0°C to 70°C | 7 mV | TL321CD | TL321CP |
| -25°C to 85°C | 5 mV | TL321ID | TL321IP |

The D packages are available taped and reeled. Add the suffix R to the device type, (e.g., TL321CDR).

description

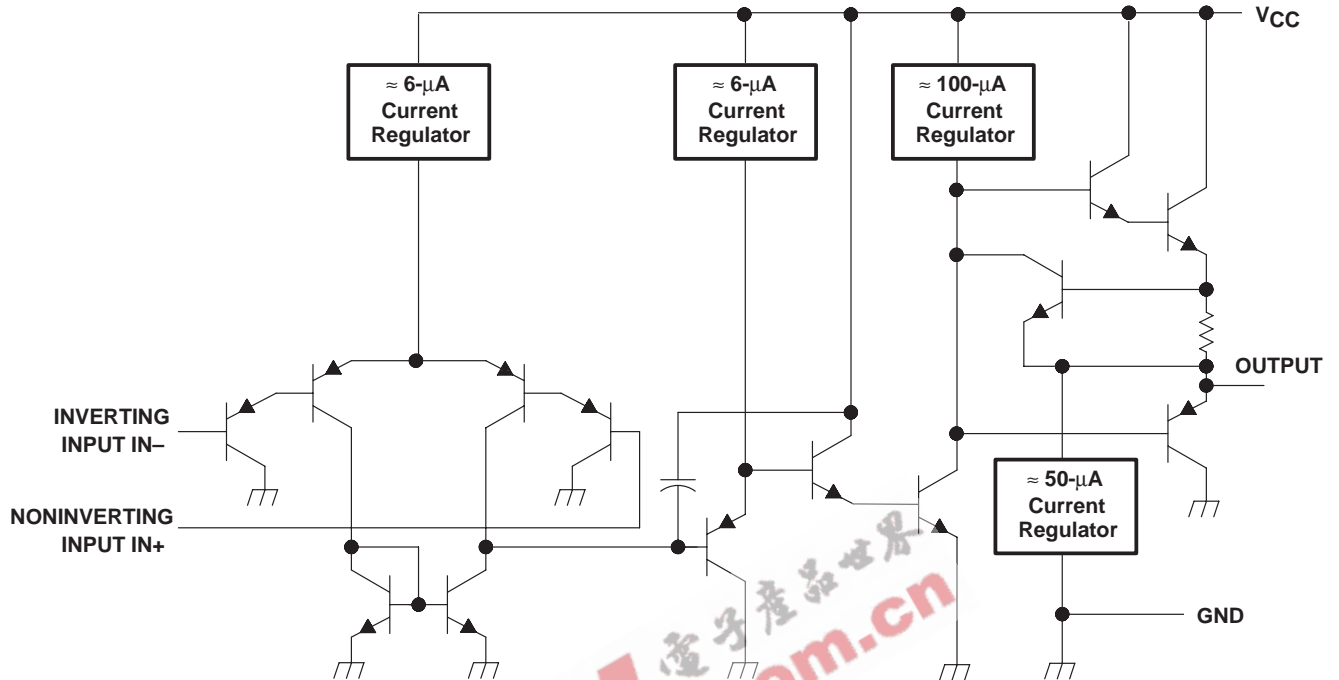
The TL321 is a high-gain, frequency-compensated operational amplifier that is designed specifically to operate from a single supply over a wide range of voltages. Operation from split supplies is also possible as long as the difference between the two supplies is 3 V to 30 V and pin 7 is at least 1.5 V more positive than the input common-mode voltage. The low supply current is independent of the magnitude of the supply voltage.

Applications include transducer amplifiers, dc amplification blocks, and all the conventional operational amplifier circuits that now can be more easily implemented in single-supply-voltage systems. For example, the TL321 can be operated directly off of the standard 5-V supply that is used in digital systems and will easily provide the required interface electronics without requiring additional ± 15 -V supplies.

The TL321C is characterized for operation from 0°C to 70°C. The TL321I is characterized for operation from -25°C to 85°C.

TL321C, TL321I OPERATIONAL AMPLIFIERS

schematic



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

| | |
|--|------------------------------|
| Supply voltage, V_{CC} (see Note 1) | 32 V |
| Differential input voltage (see Note 2) | ± 32 V |
| Input voltage range (either input) | -0.3 V to 32 V |
| Duration of output short circuit to ground at (or below) 25°C free-air temperature ($V_{CC} \leq 15$ V) (see Note 3) | Unlimited |
| Continuous total dissipation | See Dissipation Rating Table |
| Operating free-air temperature range: TL321C | 0°C to 70°C |
| TL321I | -25°C to 85°C |
| Storage temperature range | -65°C to 150°C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | 260°C |

- NOTES: 1. All voltage values, except differential voltages, are with respect to the network ground terminal.
 2. Differential voltages are at the noninverting input terminal with respect to the inverting input terminal.
 3. Short circuits from the output to V_{CC} can cause excessive heating and eventual destruction.

DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25^\circ\text{C}$ POWER RATING | DERATING FACTOR | DERATE ABOVE T_A | $T_A = 70^\circ\text{C}$ POWER RATING | $T_A = 85^\circ\text{C}$ POWER RATING |
|---------|---|--------------------|-----------------------|--|--|
| D | 680 mW | 5.8 mW/°C | 33°C | 464 mW | 377 mW |
| P | 680 mW | 8.0 mW/°C | 65°C | 640 mW | 520 mW |

recommended operating conditions

| | MIN | NOM | MAX | UNIT |
|---------------------------------|------|-----|-----|------|
| Single supply voltage, V_{CC} | 5 | | 30 | V |
| Dual supply voltage, V_{CC+} | 2.5 | | 15 | V |
| Dual supply voltage, V_{CC-} | -2.5 | | -15 | V |

TL321C, TL321I OPERATIONAL AMPLIFIERS

electrical characteristics at specified free-air temperature, $V_{CC} = 5\text{ V}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS† | TL321C | | | TL321I | | | UNIT | |
|--|--|--|------|----------------|--------|------|----------------|------|------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | | |
| V_{IO} Input offset voltage | $V_{IC} = V_{ICR\text{ min}}$, $V_{CC} = 5\text{ V to }30\text{ V}$, $V_O = 1.4\text{ V}$, $R_S = 50\text{ k}\Omega$ | 25°C | | 2 | 7 | | 2 | 5 | mV |
| | | Full range | | | | 9 | | 7 | |
| I_{IO} Input offset current | $V_O = 1.4\text{ V}$ | 25°C | | 5 | 50 | | 3 | 30 | nA |
| | | Full range | | | 150 | | 100 | | |
| I_{IB} Input bias current | $V_O = 1.4\text{ V}$ | 25°C | | -45 | -250 | | -45 | -150 | nA |
| | | Full range | | | -500 | | -300 | | |
| V_{ICR} Common-mode input voltage range | $V_{CC} = 5\text{ V to }30\text{ V}$ | 25°C | 0 to | $V_{CC} - 1.5$ | | 0 to | $V_{CC} - 1.5$ | | V |
| | | Full range | 0 to | $V_{CC} - 1.5$ | | 0 to | $V_{CC} - 1.5$ | | |
| V_{OH} High-level output voltage | $V_{CC} = 30\text{ V}$, $R_L = 2\text{ k}\Omega$ | Full range | 26 | | | 26 | | | V |
| | $V_{CC} = 30\text{ V}$, $R_L \geq 10\text{ k}\Omega$ | Full range | 27 | 28 | | 27 | 28 | | |
| | $R_L \geq 2\text{ k}\Omega$ | 25°C | 3.5 | | | 3.5 | | | |
| V_{OL} Low-level output voltage | $R_L \geq 10\text{ k}\Omega$ | Full range | 5 | | | 5 | | | mV |
| A_{VD} Large-signal differential voltage amplification | $V_{CC} = 15\text{ V}$, $V_O = 1\text{ V to }11\text{ V}$, $R_L = 2\text{ k}\Omega$ | 25°C | 25 | 100 | | 50 | 100 | | V/mV |
| | | Full range | 15 | | | 25 | | | |
| CMRR Common-mode rejection ratio | $V_{IC} = V_{ICR\text{ min}}$, $R_S = 50\text{ k}\Omega$ | 25°C | 65 | 85 | | 70 | 85 | | dB |
| k_{SVR} Supply voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$) | $V_{CC} = 5\text{ V to }30\text{ V}$, $R_S = 50\text{ k}\Omega$ | 25°C | 65 | 100 | | 65 | 100 | | dB |
| I_O Output current | Source | 25°C | -20 | -40 | | -25 | -40 | | mA |
| | | Full range | -10 | -20 | | -10 | -20 | | |
| | Sink | 25°C | 10 | 20 | | 10 | 20 | | |
| | | Full range | 5 | 8 | | 5 | 8 | | |
| | | $V_{ID} = -1\text{ V}$, $V_O = 200\text{ V}$ | 25°C | 12 | 50 | | 12 | 50 | |
| I_{CC} Supply current | No load, $V_O = 15\text{ V}$, $V_{CC} = 30\text{ V}$ | Full range | 2 | | | 2 | | | mA |
| | No load, $V_O = 2.5\text{ V}$, $V_{CC} = 5\text{ V}$ | Full range | 1 | | | 0.4 | 1 | | |

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified. Full range is 0°C to 70°C for TL321C and -25°C to 85°C for TL321I.

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