TL082, TL082A, TL082B

General purpose JFET dual operation amplifiers

Description
The TL082, TL082A and TL082B are high speed JFET input dual operational amplifiers incorporating well-matched, high voltage JFET and bipolar transistors in a monolithic integrated circuit.
The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.

Features
- Wide common-mode (up to $V_{CC^+}$) and differential voltage range
- Low input bias and offset current
- Output short-circuit protection
- High input impedance JFET input stage
- Internal frequency compensation
- Latch up free operation
- High slew rate: 16 V/µs (typical)
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1 Schematic diagram

Figure 1: Schematic diagram
2 Pin connections

Figure 2: Pin connections (top view)

1 = Output 1
2 = Inverting input 1
3 = Non-inverting input 1
4 = $V_{CC}$
5 = Non-inverting input 2
6 = Inverting input 2
7 = Output 2
8 = $V_{CC}$
3 Absolute maximum ratings and operating conditions

Table 1: Absolute maximum ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>TL082I, AI, BI</th>
<th>TL082C, AC, BC</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CC}$</td>
<td>Supply voltage (1)</td>
<td></td>
<td>±18</td>
<td>V</td>
</tr>
<tr>
<td>$V_{in}$</td>
<td>Input voltage (2)</td>
<td></td>
<td>±15</td>
<td>V</td>
</tr>
<tr>
<td>$V_{id}$</td>
<td>Differential input voltage (3)</td>
<td></td>
<td>±30</td>
<td>V</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>Power dissipation</td>
<td>680</td>
<td></td>
<td>mW</td>
</tr>
<tr>
<td>$R_{thja}$</td>
<td>Thermal resistance</td>
<td>SO8</td>
<td>125</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td>junction-to-ambient (4)</td>
<td>TSSOP8</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>$R_{thjc}$</td>
<td>Thermal resistance</td>
<td>SO8</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>junction-to-case</td>
<td>TSSOP8</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output short-circuit duration (5)</td>
<td></td>
<td>Infinite</td>
<td></td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>Storage temperature range</td>
<td></td>
<td>-65 to 150</td>
<td>°C</td>
</tr>
<tr>
<td>ESD</td>
<td>HBM: human body model (6)</td>
<td>1</td>
<td></td>
<td>kV</td>
</tr>
<tr>
<td>ESD</td>
<td>MM: machine model (7)</td>
<td>200</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>ESD</td>
<td>CDM: charged device model (8)</td>
<td>1500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
(1) All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between $V_{CC^+}$ and $V_{CC^-}$.
(2) The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
(3) Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
(4) Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuit on all amplifiers.
(5) The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.
(6) Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
(7) Machine model: a 200 pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.
(8) Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to the ground.

Table 2: Operating conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>TL082I, AI, BI</th>
<th>TL082C, AC, BC</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CC}$</td>
<td>Supply voltage</td>
<td>6 to 36</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$T_{oper}$</td>
<td>Operating free-air temperature range</td>
<td>-40 to 105</td>
<td>0 to 70</td>
<td>°C</td>
</tr>
</tbody>
</table>
## 4 Electrical characteristics

Table 3: VCC = ±15V, Tamb = +25°C (unless otherwise specified)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>TL082I, AC, AI, BC, BI</th>
<th></th>
<th>TL082C</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{io}$</td>
<td>Input offset voltage, $R_s = 50 , \Omega$, $T_{amb} = 25 , ^\circ C$, TL082</td>
<td>3</td>
<td>10</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>$V_{io}$</td>
<td>Input offset voltage, $R_s = 50 , \Omega$, $T_{amb} = 25 , ^\circ C$, TL082A</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{io}$</td>
<td>Input offset voltage, $R_s = 50 , \Omega$, $T_{amb} = 25 , ^\circ C$, TL082B</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{io}$</td>
<td>Input offset voltage, $R_s = 50 , \Omega$, $T_{min} \leq T_{amb} \leq T_{max}$, TL082</td>
<td>13</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{io}$</td>
<td>Input offset voltage, $R_s = 50 , \Omega$, $T_{min} \leq T_{amb} \leq T_{max}$, TL082A</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{io}$</td>
<td>Input offset voltage, $R_s = 50 , \Omega$, $T_{min} \leq T_{amb} \leq T_{max}$, TL082B</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D_{vio}$</td>
<td>Input offset voltage drift</td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{io}$</td>
<td>Input offset current, $T_{amb} = 25 , ^\circ C$ (1)</td>
<td>5</td>
<td>100</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>$I_{io}$</td>
<td>Input offset current, $T_{min} \leq T_{amb} \leq T_{max}$ (1)</td>
<td>4</td>
<td></td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>$I_{ib}$</td>
<td>Input bias current, $T_{amb} = 25 , ^\circ C$</td>
<td>20</td>
<td>200</td>
<td>20</td>
<td>400</td>
</tr>
<tr>
<td>$I_{ib}$</td>
<td>Input bias current, $T_{min} \leq T_{amb} \leq T_{max}$</td>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$A_{sv}$</td>
<td>Large signal voltage gain, $R_L = 2 , \text{k} \Omega$, $V_o = \pm 10 , \text{V}$, $T_{amb} = 25 , ^\circ C$</td>
<td>50</td>
<td>200</td>
<td>25</td>
<td>200</td>
</tr>
<tr>
<td>$A_{sv}$</td>
<td>Large signal voltage gain, $R_L = 2 , \text{k} \Omega$, $V_o = \pm 10 , \text{V}$, $T_{min} \leq T_{amb} \leq T_{max}$</td>
<td>25</td>
<td></td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>$SVR$</td>
<td>Supply voltage rejection ratio, $R_s = 50 , \Omega$, $T_{amb} = 25 , ^\circ C$</td>
<td>80</td>
<td>86</td>
<td>70</td>
<td>86</td>
</tr>
<tr>
<td>$SVR$</td>
<td>Supply voltage rejection ratio, $R_s = 50 , \Omega$, $T_{min} \leq T_{amb} \leq T_{max}$</td>
<td>80</td>
<td></td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>$I_{CC}$</td>
<td>Supply current, no load, $T_{amb} = 25 , ^\circ C$</td>
<td>1.4</td>
<td>2.5</td>
<td>1.4</td>
<td>2.5</td>
</tr>
<tr>
<td>$I_{CC}$</td>
<td>Supply current, no load, $T_{min} \leq T_{amb} \leq T_{max}$</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{cm}$</td>
<td>Input common mode voltage range</td>
<td>$\pm 11$</td>
<td>15</td>
<td>15</td>
<td>$\pm 12$</td>
</tr>
<tr>
<td>$CMR$</td>
<td>Common mode rejection ratio, $R_s = 50 , \Omega$, $T_{amb} = 25 , ^\circ C$</td>
<td>80</td>
<td>86</td>
<td>70</td>
<td>86</td>
</tr>
<tr>
<td>$CMR$</td>
<td>Common mode rejection ratio, $R_s = 50 , \Omega$, $T_{min} \leq T_{amb} \leq T_{max}$</td>
<td>80</td>
<td></td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>$I_{os}$</td>
<td>Output short-circuit current, $T_{amb} = 25 , ^\circ C$</td>
<td>10</td>
<td>40</td>
<td>60</td>
<td>10</td>
</tr>
<tr>
<td>$I_{os}$</td>
<td>Output short-circuit current, $T_{min} \leq T_{amb} \leq T_{max}$</td>
<td>10</td>
<td>60</td>
<td>10</td>
<td>60</td>
</tr>
</tbody>
</table>
## Electrical characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>TL082I, AC, AI, BC, BI</th>
<th>TL082C</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>±V_{opp}</td>
<td>Output voltage swing, ( T_{\text{amb}} = 25 ^\circ \text{C}, R_L = 2 , \text{kΩ} )</td>
<td>Min. 10</td>
<td>Typ. 12</td>
<td>Max. 10</td>
</tr>
<tr>
<td></td>
<td>Output voltage swing, ( T_{\text{amb}} = 25 ^\circ \text{C}, R_L = 10 , \text{kΩ} )</td>
<td>Min. 12</td>
<td>Typ. 13.5</td>
<td>Max. 12</td>
</tr>
<tr>
<td></td>
<td>Output voltage swing, ( T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}, R_L = 2 , \text{kΩ} )</td>
<td>Min. 10</td>
<td>Typ. 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output voltage swing, ( T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}, R_L = 10 , \text{kΩ} )</td>
<td>Min. 12</td>
<td>Typ. 12</td>
<td></td>
</tr>
<tr>
<td>SR</td>
<td>Slew rate, ( T_{\text{amb}} = 25 ^\circ \text{C}, V_{\text{in}} = 10 , \text{V}, R_L = 2 , \text{kΩ}, C_L = 100 , \text{pF}, ) unity gain</td>
<td>Min. 8</td>
<td>Typ. 16</td>
<td>Max. 8</td>
</tr>
<tr>
<td>( t_r )</td>
<td>Rise time, ( T_{\text{amb}} = 25 ^\circ \text{C}, V_{\text{in}} = 20 , \text{mV}, R_L = 2 , \text{kΩ}, C_L = 100 , \text{pF}, ) unity gain</td>
<td>Min. 0.1</td>
<td>Typ. 0.1</td>
<td></td>
</tr>
<tr>
<td>( K_{\text{ov}} )</td>
<td>Overshoot, ( T_{\text{amb}} = 25 ^\circ \text{C}, V_{\text{in}} = 20 , \text{mV}, R_L = 2 , \text{kΩ}, C_L = 100 , \text{pF}, ) unity gain</td>
<td>Min. 10</td>
<td>Typ. 10</td>
<td>%</td>
</tr>
<tr>
<td>GBP</td>
<td>Gain bandwidth product, ( T_{\text{amb}} = 25 ^\circ \text{C}, V_{\text{in}} = 10 , \text{mV}, R_L = 2 , \text{kΩ}, C_L = 100 , \text{pF}, F = 100 , \text{kHz} )</td>
<td>Min. 2.5</td>
<td>Typ. 4</td>
<td>Max. 2.5</td>
</tr>
<tr>
<td>( R_i )</td>
<td>Input resistance</td>
<td>Min. 10^{12}</td>
<td>Typ. 10^{12}</td>
<td>Ω</td>
</tr>
<tr>
<td>THD</td>
<td>Total harmonic distortion, ( T_{\text{amb}} = 25 ^\circ \text{C}, F = 1 , \text{kHz}, R_L = 2 , \text{kΩ}, C_L = 100 , \text{pF}, A_v = 20 , \text{dB}, V_o = 2 , V_{pp} )</td>
<td>Min. 0.01</td>
<td>Typ. 0.01</td>
<td>%</td>
</tr>
<tr>
<td>( e_n )</td>
<td>Equivalent input noise voltage, ( R_B = 100 , \Omega, F = 1 , \text{kHz} )</td>
<td>Min. 15</td>
<td>Typ. 15</td>
<td>nV/√Hz</td>
</tr>
<tr>
<td>( \phi )</td>
<td>Phase margin</td>
<td>Min. 45</td>
<td>Typ. 45</td>
<td>degrees</td>
</tr>
<tr>
<td>( V_{o1}/V_{o2} )</td>
<td>Channel separation, ( A_v = 100 )</td>
<td>Min. 120</td>
<td>Typ. 120</td>
<td>dB</td>
</tr>
</tbody>
</table>

**Notes:**

1. The input bias currents are junction leakage currents which approximately double for every 10° C increase in the junction temperature.
5 Electrical characteristic curves

Figure 3: Maximum peak-to-peak output voltage versus frequency

Figure 4: Maximum peak-to-peak output voltage versus frequency

Figure 5: Maximum peak-to-peak output voltage versus load resistance

Figure 6: Maximum peak-to-peak output voltage versus frequency

Figure 7: Maximum peak-to-peak output voltage versus free air temperature

Figure 8: Maximum peak-to-peak output voltage versus supply voltage
Figure 9: Input bias current versus free air temperature

Figure 10: Large signal differential voltage amplification and phase shift versus frequency

Figure 11: Supply current per amplifier versus free air temperature

Figure 12: Large signal differential voltage amplification versus free air temperature

Figure 13: Total power dissipation versus free air temperature

Figure 14: Supply current per amplifier versus supply voltage
Electrical characteristic curves

Figure 15: Common-mode rejection ratio versus free air temperature

Figure 16: Output voltage versus elapsed time

Figure 17: Voltage follower large signal pulse response

Figure 18: Equivalent input noise voltage versus frequency

Figure 19: Total harmonic distortion versus frequency
6 Parameter measurement information

Figure 20: Voltage follower

Figure 21: Gain-of-10 inverting amplifier
7 Typical applications

Figure 22: 100 kHz quadruple oscillator

1. These resistor values may be adjusted for a symmetrical output.
8 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com.

ECOPACK® is an ST trademark.
8.1 SO8 package information

Figure 23: SO8 package outline

Table 4: SO8 mechanical data

<table>
<thead>
<tr>
<th>Reference</th>
<th>Dimensions</th>
<th>Millimeters</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>1.75</td>
<td>0.069</td>
</tr>
<tr>
<td>A1</td>
<td></td>
<td>0.25</td>
<td>0.010</td>
</tr>
<tr>
<td>A2</td>
<td></td>
<td>1.25</td>
<td>0.049</td>
</tr>
<tr>
<td>b</td>
<td></td>
<td>0.28</td>
<td>0.011</td>
</tr>
<tr>
<td>c</td>
<td></td>
<td>0.17</td>
<td>0.007</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>4.90</td>
<td>0.193</td>
</tr>
<tr>
<td>E</td>
<td></td>
<td>6.00</td>
<td>0.236</td>
</tr>
<tr>
<td>E1</td>
<td></td>
<td>3.90</td>
<td>0.154</td>
</tr>
<tr>
<td>e</td>
<td></td>
<td>1.27</td>
<td>0.050</td>
</tr>
<tr>
<td>h</td>
<td></td>
<td>0.50</td>
<td>0.020</td>
</tr>
<tr>
<td>L</td>
<td></td>
<td>1.27</td>
<td>0.020</td>
</tr>
<tr>
<td>L1</td>
<td></td>
<td>1.04</td>
<td>0.040</td>
</tr>
<tr>
<td>k</td>
<td></td>
<td>8°</td>
<td>8°</td>
</tr>
<tr>
<td>ccc</td>
<td></td>
<td>0.10</td>
<td>0.004</td>
</tr>
</tbody>
</table>
8.2 TSSOP8 package information

Figure 24: TSSOP8 package outline

Table 5: TSSOP8 mechanical data

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Millimeters</th>
<th>Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>0.05</td>
<td>0.15</td>
</tr>
<tr>
<td>A2</td>
<td>0.80</td>
<td>1.00</td>
</tr>
<tr>
<td>b</td>
<td>0.19</td>
<td>0.30</td>
</tr>
<tr>
<td>c</td>
<td>0.09</td>
<td>0.20</td>
</tr>
<tr>
<td>D</td>
<td>2.90</td>
<td>3.00</td>
</tr>
<tr>
<td>E</td>
<td>6.20</td>
<td>6.40</td>
</tr>
<tr>
<td>E1</td>
<td>4.30</td>
<td>4.40</td>
</tr>
<tr>
<td>e</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>k</td>
<td>0°</td>
<td>8°</td>
</tr>
<tr>
<td>L</td>
<td>0.45</td>
<td>0.60</td>
</tr>
<tr>
<td>L1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>aaa</td>
<td>0.1</td>
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</table>
## 9 Ordering information

### Table 6: Order codes

<table>
<thead>
<tr>
<th>Order code</th>
<th>Temperature range</th>
<th>Package</th>
<th>Packing</th>
<th>Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL082ID</td>
<td>-40 °C to 105 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>082I</td>
</tr>
<tr>
<td>TL082IDT</td>
<td>-40 °C to 105 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>082I</td>
</tr>
<tr>
<td>TL082IPT</td>
<td>-40 °C to 105 °C</td>
<td>Tube or tape and reel</td>
<td>082I</td>
<td></td>
</tr>
<tr>
<td>TL082CD</td>
<td>0 °C to 70 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>082C</td>
</tr>
<tr>
<td>TL082CDT</td>
<td>0 °C to 70 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>082C</td>
</tr>
<tr>
<td>TL082CPT</td>
<td>0 °C to 70 °C</td>
<td>TSSOP8</td>
<td>Tape and reel</td>
<td>082C</td>
</tr>
<tr>
<td>TL082ACDT</td>
<td>0 °C to 70 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>082AC</td>
</tr>
<tr>
<td>TL082BCDT</td>
<td>0 °C to 70 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>082BC</td>
</tr>
<tr>
<td>TL082IYDT (1)</td>
<td>-40 °C to 105 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>082IY</td>
</tr>
<tr>
<td>TL082AIYDT (1)</td>
<td>-40 °C to 105 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>82AIY</td>
</tr>
<tr>
<td>TL082BIYDT (1)</td>
<td>-40 °C to 105 °C</td>
<td>SO8</td>
<td>Tube or tape and reel</td>
<td>82BIY</td>
</tr>
</tbody>
</table>

### Notes:

(1) Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q002 or equivalent.
# Revision history

Table 7: Document revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-Apr-2001</td>
<td>1</td>
<td>Initial release.</td>
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<td>2002-2003</td>
<td>2-7</td>
<td>Internal revisions.</td>
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<tr>
<td>30-Apr-2004</td>
<td>8</td>
<td>Format update.</td>
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<tr>
<td>06-Mar-2007</td>
<td>9</td>
<td>Added ESD information in Table 1 on page 4. Expanded order codes table and added automotive grade order codes. See Table 7 on page 16. Added Table 2: Operating conditions on page 4. Updated package information to make it compliant with the latest JEDEC standards.</td>
</tr>
<tr>
<td>12-Jun-2008</td>
<td>10</td>
<td>Removed information concerning military temperature range (TL082M*, TL082AM*, TL082BM*).</td>
</tr>
<tr>
<td>10-Jun-2016</td>
<td>11</td>
<td>Removed DIP8 package and all obsolete order codes. Updated document layout.</td>
</tr>
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<td><em>Table 4: added L1 dimension</em></td>
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<td><em>Figure 24: removed silhouette and added package outline</em></td>
</tr>
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</table>
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