

### General purpose JFET dual operational amplifiers

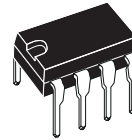
#### Features

- 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/ $\mu$ s (typical)

#### 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.

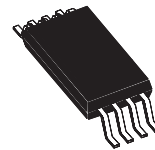
The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.



**N**  
**DIP8**  
(Plastic package)

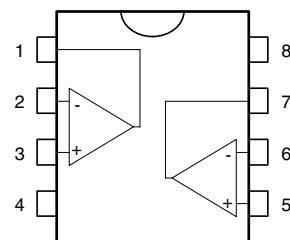


**D**  
**SO-8**  
(Plastic micropackage)



**P**  
**TSSOP8**  
(Thin shrink small outline package)

#### 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 -  $V_{CC}^+$

## 2 Absolute maximum ratings and operating conditions

**Table 1. Absolute maximum ratings**

| Symbol            | Parameter                                             | TL082I, AI, BI | TL082C, AC, BC | Unit |
|-------------------|-------------------------------------------------------|----------------|----------------|------|
| V <sub>CC</sub>   | Supply voltage <sup>(1)</sup>                         | ±18            |                | V    |
| V <sub>in</sub>   | Input voltage <sup>(2)</sup>                          | ±15            |                | V    |
| V <sub>id</sub>   | Differential input voltage <sup>(3)</sup>             | ±30            |                | V    |
| P <sub>tot</sub>  | Power dissipation                                     | 680            |                | mW   |
| R <sub>thja</sub> | Thermal resistance junction to ambient <sup>(4)</sup> |                |                | °C/W |
|                   | SO-8                                                  | 125            |                |      |
|                   | DIP8                                                  | 85             |                |      |
|                   | TSSOP8                                                | 120            |                |      |
| R <sub>thjc</sub> | Thermal resistance junction to case                   |                |                | °C/W |
|                   | SO-8                                                  | 40             |                |      |
|                   | DIP8                                                  | 41             |                |      |
|                   | TSSOP8                                                | 37             |                |      |
|                   | Output short-circuit duration <sup>(5)</sup>          | Infinite       |                |      |
| T <sub>stg</sub>  | Storage temperature range                             | -65 to +150    |                | °C   |
| ESD               | HBM: human body model <sup>(6)</sup>                  | 1              |                | kV   |
|                   | MM: machine model <sup>(7)</sup>                      | 200            |                | V    |
|                   | CDM: charged device model <sup>(8)</sup>              | 1500           |                | V    |

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 k $\Omega$  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  $\Omega$ ), 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**

| Symbol     | Parameter                            | TL082I, AI, BI | TL082C, AC, BC | Unit               |
|------------|--------------------------------------|----------------|----------------|--------------------|
| $V_{CC}$   | Supply voltage                       | 6 to 36        |                | V                  |
| $T_{oper}$ | Operating free-air temperature range | -40 to +105    | 0 to +70       | $^{\circ}\text{C}$ |

### 3 Electrical characteristics

Table 3.  $V_{CC} = \pm 15V$ ,  $T_{amb} = +25^{\circ}C$  (unless otherwise specified)

| Symbol        | Parameter                                                                                                                                                           | TL082I,AC,AI,BC,BI   |             |                              | TL082C               |            |              | Unit              |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------|------------------------------|----------------------|------------|--------------|-------------------|
|               |                                                                                                                                                                     | Min.                 | Typ.        | Max.                         | Min.                 | Typ.       | Max.         |                   |
| $V_{io}$      | Input offset voltage ( $R_s = 50\Omega$ )<br>$T_{amb} = +25^{\circ}C$ TL082<br>TL082A<br>TL082B<br>$T_{min} \leq T_{amb} \leq T_{max}$ TL082<br>TL082A<br>TL082B    |                      | 3<br>3<br>1 | 10<br>6<br>3<br>13<br>7<br>5 |                      | 3          | 10<br><br>13 | mV                |
| $DV_{io}$     | Input offset voltage drift                                                                                                                                          |                      | 10          |                              |                      | 10         |              | $\mu V/^{\circ}C$ |
| $I_{io}$      | Input offset current <sup>(1)</sup><br>$T_{amb} = +25^{\circ}C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                              |                      | 5           | 100<br>4                     |                      | 5          | 100<br>10    | pA<br>nA          |
| $I_{ib}$      | Input bias current<br>$T_{amb} = +25^{\circ}C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                               |                      | 20          | 200<br>20                    |                      | 20         | 400<br>20    | pA<br>nA          |
| $A_{vd}$      | Large signal voltage gain ( $R_L = 2k\Omega$ , $V_o = \pm 10V$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                 | 50<br>25             | 200         |                              | 25<br>15             | 200        |              | V/mV              |
| SVR           | Supply voltage rejection ratio ( $R_S = 50\Omega$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                              | 80<br>80             | 86          |                              | 70<br>70             | 86         |              | dB                |
| $I_{CC}$      | Supply current, no load<br>$T_{amb} = +25^{\circ}C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                          |                      | 1.4         | 2.5<br>2.5                   |                      | 1.4        | 2.5<br>2.5   | mA                |
| $V_{icm}$     | Input common mode voltage range                                                                                                                                     | $\pm 11$             | +15<br>-12  |                              | $\pm 11$             | +15<br>-12 |              | V                 |
| CMR           | Common mode rejection ratio ( $R_S = 50\Omega$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                 | 80<br>80             | 86          |                              | 70<br>70             | 86         |              | dB                |
| $I_{os}$      | Output short-circuit current<br>$T_{amb} = +25^{\circ}C$<br>$T_{min} \leq T_{amb} \leq T_{max}$                                                                     | 10<br>10             | 40          | 60<br>60                     | 10<br>10             | 40         | 60<br>60     | mA                |
| $\pm V_{opp}$ | Output voltage swing<br>$T_{amb} = +25^{\circ}C$ $R_L = 2k\Omega$<br>$R_L = 10k\Omega$<br>$T_{min} \leq T_{amb} \leq T_{max}$ $R_L = 2k\Omega$<br>$R_L = 10k\Omega$ | 10<br>12<br>10<br>12 | 12<br>13.5  |                              | 10<br>12<br>10<br>12 | 12<br>13.5 |              | V                 |
| SR            | Slew rate<br>$V_{in} = 10V$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain                                                                                         | 8                    | 16          |                              | 8                    | 16         |              | V/ $\mu s$        |

Table 3.  $V_{CC} = \pm 15V$ ,  $T_{amb} = +25^{\circ}C$  (unless otherwise specified) (continued)

| Symbol          | Parameter                                                                                                   | TL082I,AC,AI,BC,BI |           |      | TL082C |           |      | Unit                   |
|-----------------|-------------------------------------------------------------------------------------------------------------|--------------------|-----------|------|--------|-----------|------|------------------------|
|                 |                                                                                                             | Min.               | Typ.      | Max. | Min.   | Typ.      | Max. |                        |
| $t_r$           | Rise time<br>$V_{in} = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain                                |                    | 0.1       |      |        | 0.1       |      | $\mu s$                |
| $K_{ov}$        | Overshoot<br>$V_{in} = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain                                |                    | 10        |      |        | 10        |      | %                      |
| GBP             | Gain bandwidth product<br>$V_{in} = 10mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $F = 100kHz$                 | 2.5                | 4         |      | 2.5    | 4         |      | MHz                    |
| $R_i$           | Input resistance                                                                                            |                    | $10^{12}$ |      |        | $10^{12}$ |      | $\Omega$               |
| THD             | Total harmonic distortion<br>$F = 1kHz$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $A_v = 20dB$ , $V_o = 2V_{pp}$ |                    | 0.01      |      |        | 0.01      |      | %                      |
| $e_n$           | Equivalent input noise voltage<br>$R_S = 100\Omega$ , $F = 1kHz$                                            |                    | 15        |      |        | 15        |      | $\frac{nV}{\sqrt{Hz}}$ |
| $\phi_m$        | Phase margin                                                                                                |                    | 45        |      |        | 45        |      | degrees                |
| $V_{o1}/V_{o2}$ | Channel separation<br>$A_v = 100$                                                                           |                    | 120       |      |        | 120       |      | dB                     |

1. The input bias currents are junction leakage currents which approximately double for every  $10^{\circ}C$  increase in the junction temperature.

## 6.1 DIP8 package information

Figure 22. DIP8 package mechanical drawing

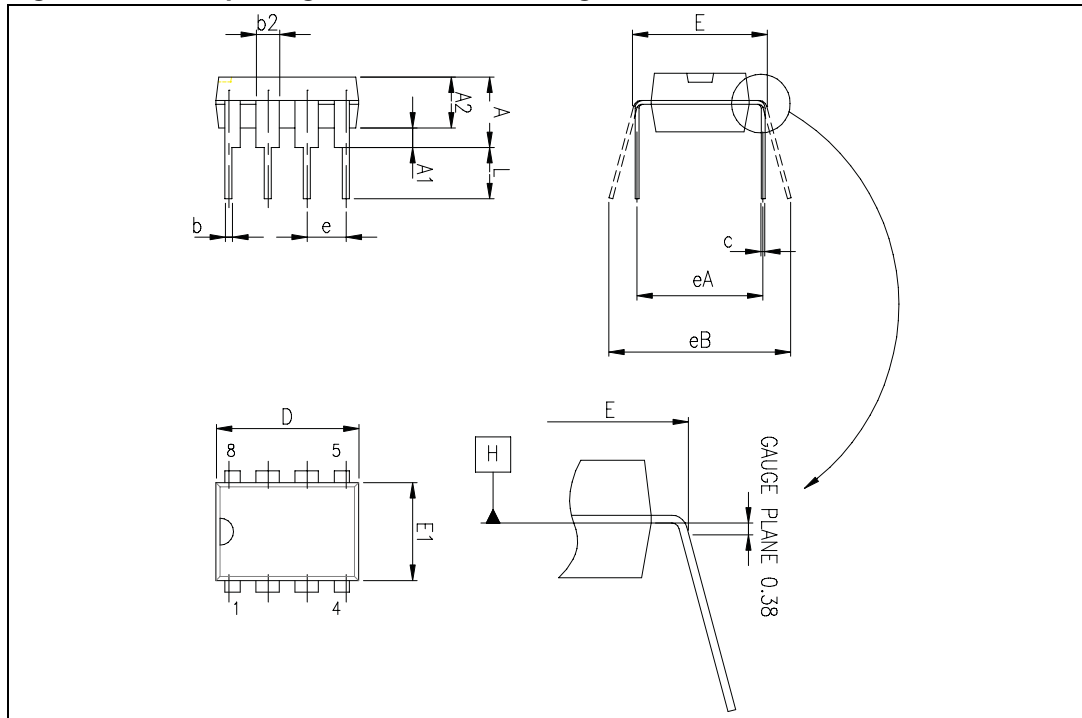


Table 4. DIP8 package mechanical data

| Ref. | Dimensions  |      |       |        |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Millimeters |      |       | Inches |       |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    |             |      | 5.33  |        |       | 0.210 |
| A1   | 0.38        |      |       | 0.015  |       |       |
| A2   | 2.92        | 3.30 | 4.95  | 0.115  | 0.130 | 0.195 |
| b    | 0.36        | 0.46 | 0.56  | 0.014  | 0.018 | 0.022 |
| b2   | 1.14        | 1.52 | 1.78  | 0.045  | 0.060 | 0.070 |
| c    | 0.20        | 0.25 | 0.36  | 0.008  | 0.010 | 0.014 |
| D    | 9.02        | 9.27 | 10.16 | 0.355  | 0.365 | 0.400 |
| E    | 7.62        | 7.87 | 8.26  | 0.300  | 0.310 | 0.325 |
| E1   | 6.10        | 6.35 | 7.11  | 0.240  | 0.250 | 0.280 |
| e    |             | 2.54 |       |        | 0.100 |       |
| eA   |             | 7.62 |       |        | 0.300 |       |
| eB   |             |      | 10.92 |        |       | 0.430 |
| L    | 2.92        | 3.30 | 3.81  | 0.115  | 0.130 | 0.150 |

## 7 Ordering information

**Table 7. Order codes**

| Order code                | Temperature range | Package                   | Packing                | Marking  |
|---------------------------|-------------------|---------------------------|------------------------|----------|
| TL082IN                   | -40°C, +105°C     | DIP8                      | Tube                   | TL082IN  |
| TL082ID                   |                   | SO-8                      | Tube or<br>tape & reel | 082I     |
| TL082IDT                  |                   |                           |                        |          |
| TL082IPT                  |                   | TSSOP8                    | Tape & reel            |          |
| TL082AIN                  |                   | DIP8                      | Tube                   | TL082AIN |
| TL082AID                  |                   | SO-8                      | Tube or<br>tape & reel | 082AI    |
| TL082AIDT                 |                   |                           |                        |          |
| TL082AIPT                 |                   | TSSOP8                    | Tape & reel            |          |
| TL082BIN                  |                   | DIP8                      | Tube                   | TL082BIN |
| TL082BID                  | -40°C, +105°C     | SO-8                      | Tube or<br>tape & reel | 082BI    |
| TL082BIDT                 |                   |                           |                        |          |
| TL082BIPT                 |                   | TSSOP8                    | Tape & reel            |          |
| TL082CN                   | 0°C, +70°C        | DIP8                      | Tube                   | TL082CN  |
| TL082CD                   |                   | SO-8                      | Tube or<br>tape & reel | 082C     |
| TL082CDT                  |                   |                           |                        |          |
| TL082CPT                  |                   | TSSOP8                    | Tape & reel            |          |
| TL082ACN                  |                   | DIP8                      | Tube                   | TL082ACN |
| TL082ACD                  |                   | SO-8                      | Tube or<br>tape & reel | 082AC    |
| TL082ACDT                 |                   |                           |                        |          |
| TL082ACPT                 |                   | TSSOP8                    | Tape & reel            |          |
| TL082BCN                  |                   | DIP8                      | Tube                   | TL082BCN |
| TL082BCD                  | 0°C, +70°C        | SO-8                      | Tube or<br>tape & reel | 082BC    |
| TL082BCDT                 |                   |                           |                        |          |
| TL082BCPT                 |                   | TSSOP8                    | Tape & reel            |          |
| TL082IYDT <sup>(1)</sup>  | -40°C, +105°C     | SO8<br>(automotive grade) | Tube or<br>tape & reel | 082IY    |
| TL082AIYDT <sup>(1)</sup> |                   |                           |                        | 82AIY    |
| TL082BIYDT <sup>(1)</sup> |                   |                           |                        | 82BIY    |

1. Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q 002 or equivalent.