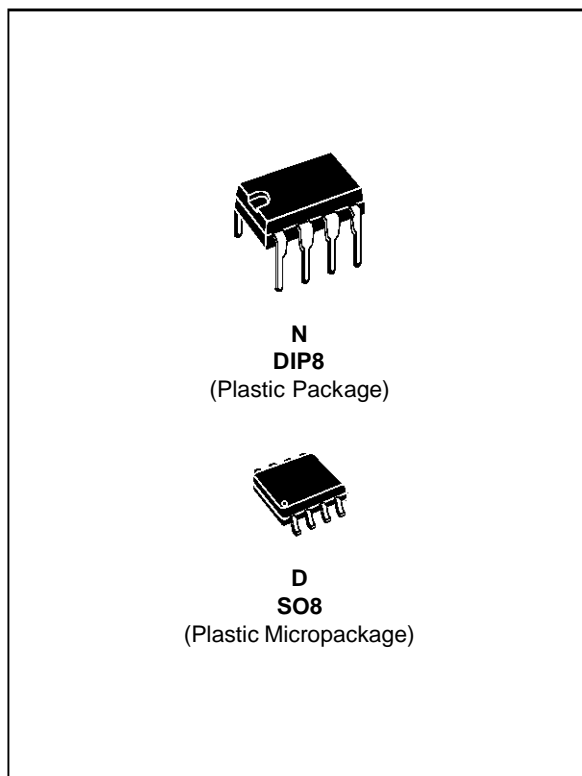


## LOW NOISE DUAL OPERATIONAL AMPLIFIERS

- LOW VOLTAGE NOISE :  $4.5\text{nV}/\sqrt{\text{Hz}}$
- HIGH GAIN BANDWIDTH PRODUCT : 15MHz
- HIGH SLEW RATE :  $7\text{V}/\mu\text{s}$
- LOW DISTORTION : 0.002%
- LARGE OUTPUT VOLTAGE SWING :  
+14.3V/-14.6V
- LOW INPUT OFFSET VOLTAGE
- EXCELLENT FREQUENCY STABILITY
- ESD PROTECTION 2kV



### DESCRIPTION

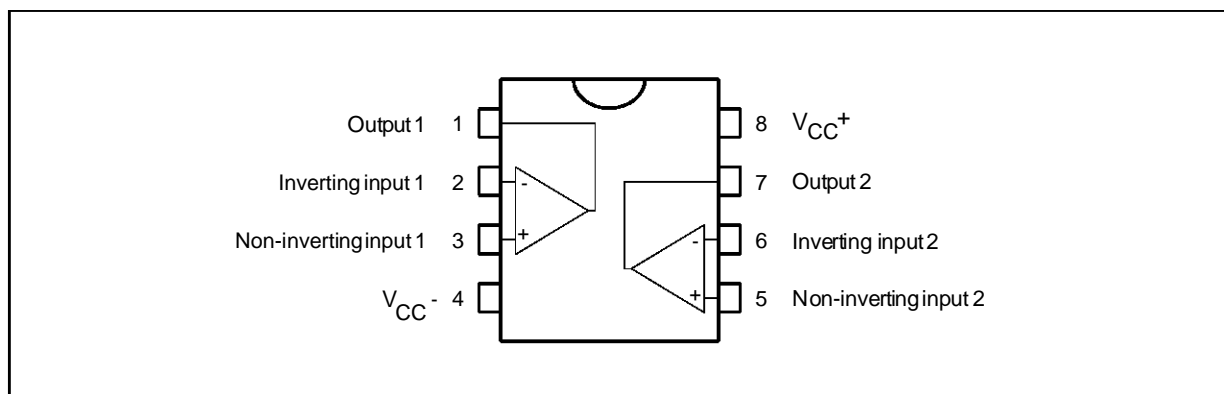
The TS5532 is a monolithic dual operational amplifier dedicated to audio applications. The TS5532 offers low voltage noise ( $4.5\text{nV}/\sqrt{\text{Hz}}$ ) and high frequency performances (15MHz gain bandwidth product,  $7\text{V}/\mu\text{s}$  slew rate).

In addition the TS5532 has a very low distortion (0.002%) and excellent phase/gain margins. The output stage allows a large output voltage swing and symmetrical source and sink currents.

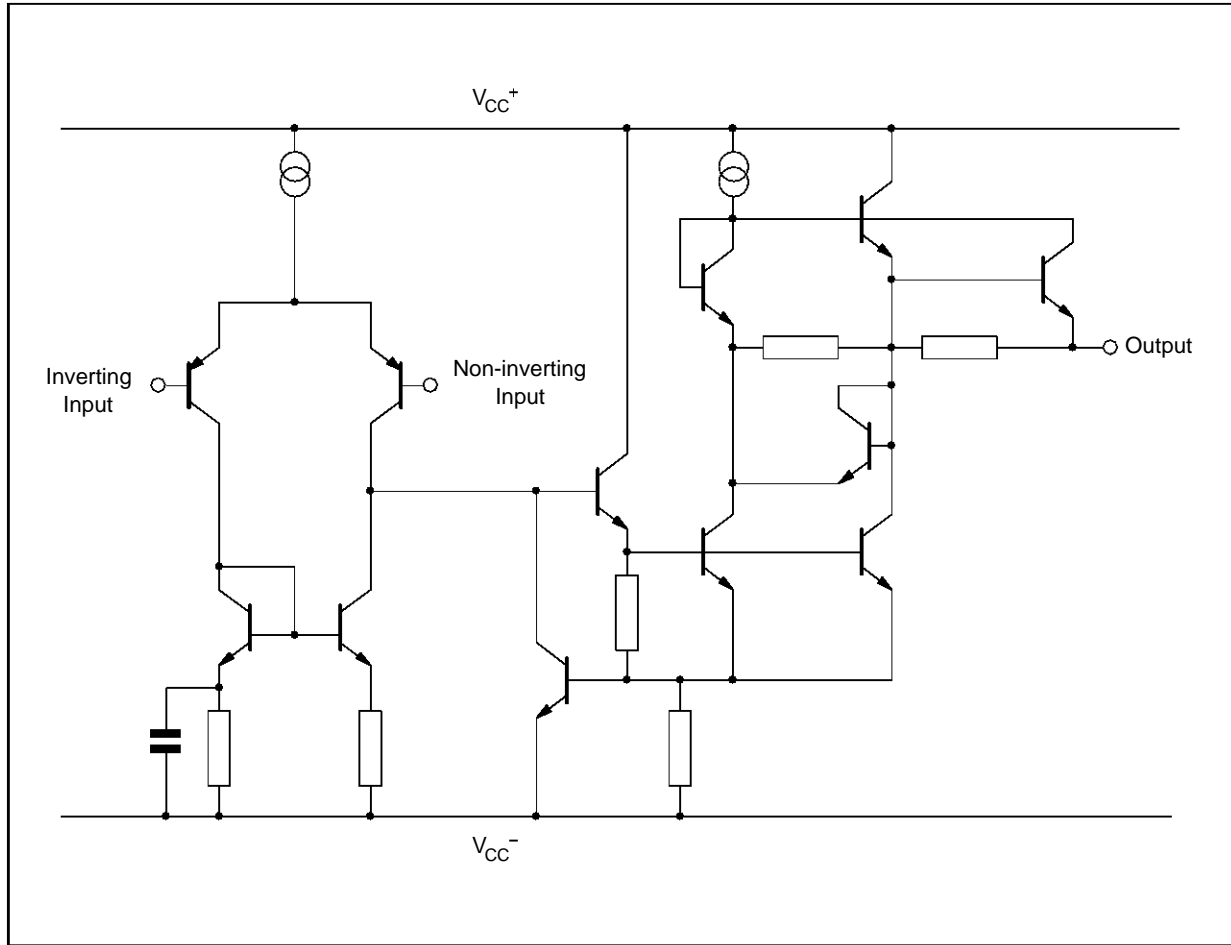
### ORDER CODES

| Part Number | Temperature Range | Package |   |
|-------------|-------------------|---------|---|
|             |                   | N       | D |
| TS5532      | -40, +125°C       | •       | • |

### PIN CONNECTIONS (top view)



**SCHEMATIC DIAGRAM (1/2 TS5532)**



**ABSOLUTE MAXIMUM RATINGS**

| Symbol     | Parameter                                | Value             | Unit        |
|------------|--|-------------------|-------------|
| $V_{CC}$   | Supply Voltage                           | $\pm 18$ or $+36$ | V           |
| $V_{id}$   | Differential Input Voltage - (note 1)    | $\pm 30$          | V           |
| $V_i$      | Input Voltage - (note 1)                 | $\pm 15$          | V           |
|            | Output Short-Circuit Duration - (note 2) | Infinite          |             |
| $T_{oper}$ | Operating Free-air Temperature Range     | $-40$ to $+105$   | $^{\circ}C$ |
| $T_j$      | Maximum Junction Temperature             | $+150$            | $^{\circ}C$ |
| $T_{stg}$  | Storage Temperature                      | $-65$ to $+150$   | $^{\circ}C$ |
| $P_{tot}$  | Maximum Power Dissipation - (note 2)     | 500               | mW          |

**Notes :** 1. Either or both input voltages must not exceed the magnitude of  $V_{CC}^{+}$  or  $V_{CC}^{-}$   
 2. Power dissipation must be considered to ensure maximum junction temperature ( $T_j$ ) is not exceeded

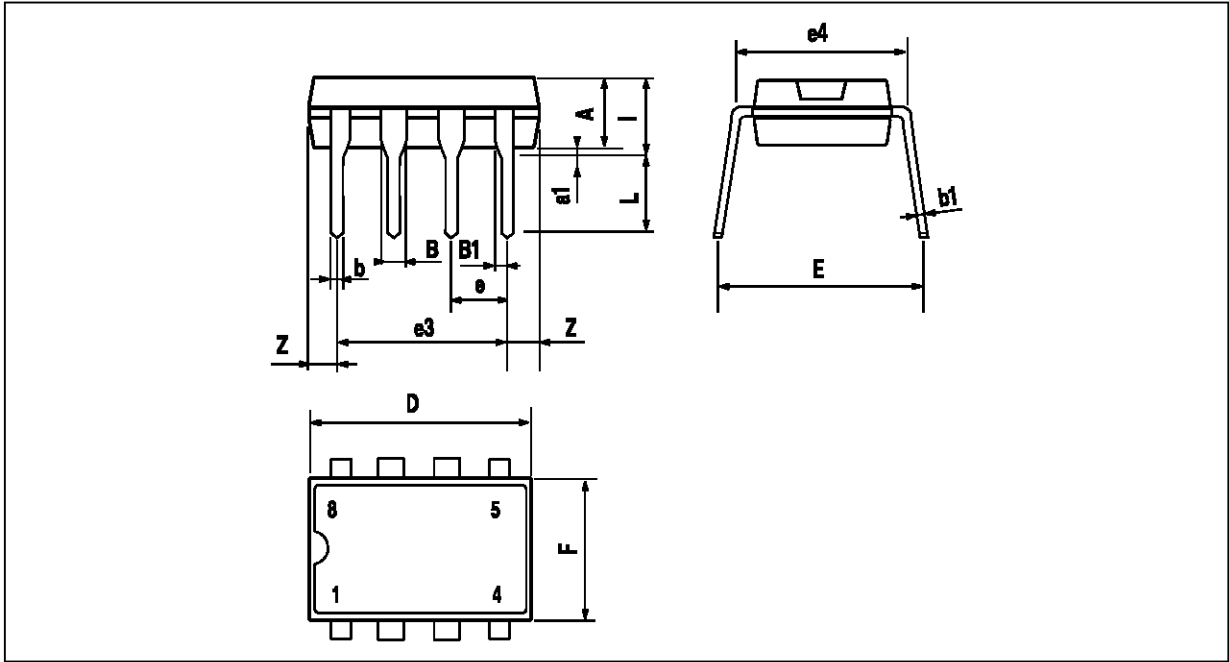
**OPERATING CONDITIONS**

| Symbol   | Parameter      | Value                 | Unit |
|----------|----------------|-----------------------|------|
| $V_{CC}$ | Supply Voltage | $\pm 2.5$ to $\pm 15$ | V    |

**ELECTRICAL CHARACTERISTICS**
 $V_{CC}^+ = +15V, V_{CC}^- = -15V, T_{amb} = 25^{\circ}C$  (unless otherwise specified)

| Symbol          | Parameter  | Min.     | Typ.  | Max.       | Unit                   |
|-----------------|--|----------|---|------------|------------------------|
| $V_{io}$        | Input Offset Voltage ( $V_o = 0V, V_{ic} = 0V$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$  |          | 0.15  | 2<br>3     | mV                     |
| $DV_{io}$       | Input Offset Voltage Drift<br>$V_{ic} = 0V, V_o = 0V, T_{min.} \leq T_{amb} \leq T_{max.}$   |          | 2   |            | $\mu V/^{\circ}C$      |
| $I_{io}$        | Input Offset Current ( $V_{ic} = 0V, V_o = 0V$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$  |          | 10  | 150<br>175 | nA                     |
| $I_{ib}$        | Input Bias Current ( $V_{ic} = 0V, V_o = 0V$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$  |          | 250   | 750<br>800 | nA                     |
| $V_{icm}$       | Common Mode Input Voltage Range ( $\Delta V_{IO} = 5mV, V_o = 0V$ )  | $\pm 13$ | $\pm 14$  |            | V                      |
| $A_{vd}$        | Large Signal Voltage Gain ( $R_L = 2k\Omega, V_o = \pm 10V$ )<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$   | 90<br>85 | 100   |            | dB                     |
| $\pm V_{opp}$   | Output Voltage Swing ( $V_{id} = \pm 1V$ )<br><br>$R_L = 600\Omega$<br>$R_L = 600\Omega$<br><br>$R_L = 2.0k\Omega$<br>$R_L = 2.0k\Omega$<br><br>$R_L = 10k\Omega$<br>$R_L = 10k\Omega$ |          | 12.2<br>-12.7<br><br>14<br>-14.2<br><br>14.3<br>-14.6 |            | V                      |
| CMR             | Common Mode Rejection Ratio ( $V_{ic} = \pm 13V$ )   | 80       | 100   |            | dB                     |
| SVR             | Supply Voltage Rejection Ratio<br>$V_{CC}^+ / V_{CC}^- = +15V / -15V$ to $+5V / -5V$   | 80       | 105   |            | dB                     |
| $I_o$           | Output Short Circuit Current ( $V_{id} = \pm 1V$ , Output to Ground)<br>Source<br>Sink   | 15<br>20 | 29<br>37  |            | mA                     |
| $I_{CC}$        | Supply current ( $V_o = 0V$ , All Amplifiers)<br>$T_{amb} = +25^{\circ}C$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$   |          | 4   | 5<br>5.5   | mA                     |
| SR              | Slew Rate<br>$V_i = -10V$ to $+10V, R_L = 2k\Omega, C_L = 100pF, A_V = +1$   | 5        | 7   |            | V/ $\mu s$             |
| GBP             | Gain Bandwidth Product ( $f = 100kHz, R_L = 2k\Omega, C_L = 100pF$ )   | 10       | 15  |            | MHz                    |
| B               | Unity Gain Bandwidth (Open loop)   |          | 9   |            | MHz                    |
| $A_m$           | Gain Margin ( $R_L = 2k\Omega$ )<br>$C_L = 0pF$<br>$C_L = 100pF$   |          | -11<br>-6   |            | dB                     |
| $\phi_m$        | Phase Margin ( $R_L = 2k\Omega$ )<br>$C_L = 0pF$<br>$C_L = 100pF$  |          | 55<br>30  |            | Degrees                |
| $e_n$           | Equivalent Input Noise Voltage ( $R_S = 100\Omega, f = 1kHz$ )   |          | 4.5   |            | $\frac{nV}{\sqrt{Hz}}$ |
| $i_n$           | Equivalent Input Noise current ( $f = 1kHz$ )  |          | 0.5   |            | $\frac{pA}{\sqrt{Hz}}$ |
| THD             | Total Harmonic Distortion<br>$R_L = 2k\Omega, f = 20Hz$ to $20kHz, V_o = 3V_{rms}, A_V = +1$   |          | 0.002   |            | %                      |
| $V_{O1}/V_{O2}$ | Channel Separation ( $f = 20Hz$ to $20kHz$ )   |          | 120   |            | dB                     |
| FPB             | Full Power Bandwidth ( $V_o = 27V_{pp}, R_L = 2k\Omega, THD \leq 1\%$ )  |          | 120   |            | kHz                    |
| $Z_o$           | Output Impedance ( $V_o = 0V, f = 9MHz$ )  |          | 37  |            | $\Omega$               |
| $R_i$           | Input Resistance ( $V_{ic} = 0V$ )   |          | 175   |            | k $\Omega$             |
| $C_i$           | Input Capacitance ( $V_{ic} = 0V$ )  |          | 12  |            | pF                     |

**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC DIP

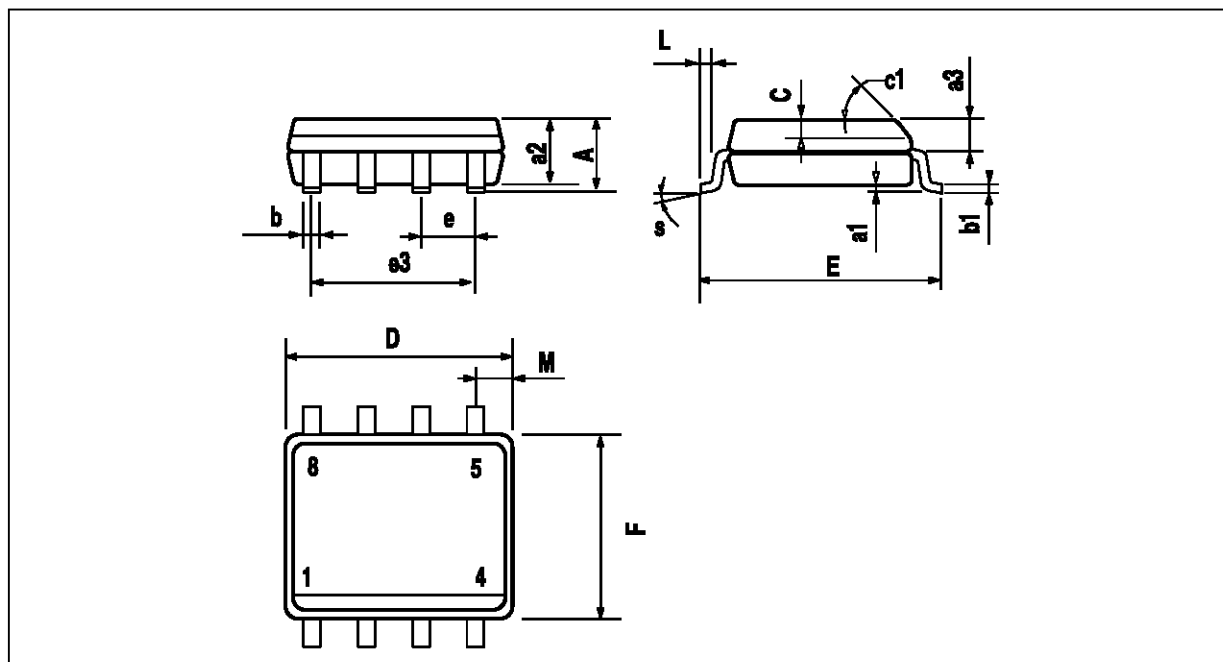


PM-DIP8.EPS

| Dimensions | Millimeters |      |       | Inches |       |       |
|------------|-------------|------|-------|--------|-------|-------|
|            | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A          |             | 3.32 |       |        | 0.131 |       |
| a1         | 0.51        |      |       | 0.020  |       |       |
| B          | 1.15        |      | 1.65  | 0.045  |       | 0.065 |
| b          | 0.356       |      | 0.55  | 0.014  |       | 0.022 |
| b1         | 0.204       |      | 0.304 | 0.008  |       | 0.012 |
| D          |             |      | 10.92 |        |       | 0.430 |
| E          | 7.95        |      | 9.75  | 0.313  |       | 0.384 |
| e          |             | 2.54 |       |        | 0.100 |       |
| e3         |             | 7.62 |       |        | 0.300 |       |
| e4         |             | 7.62 |       |        | 0.300 |       |
| F          |             |      | 6.6   |        |       | 0.260 |
| i          |             |      | 5.08  |        |       | 0.200 |
| L          | 3.18        |      | 3.81  | 0.125  |       | 0.150 |
| Z          |             |      | 1.52  |        |       | 0.060 |

DIP8.TBL

**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC MICROPACKAGE (SO)



PWA-S08.EPS

| Dimensions | Millimeters |      |      | Inches |       |       |
|------------|-------------|------|------|--------|-------|-------|
|            | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A          |             |      | 1.75 |        |       | 0.069 |
| a1         | 0.1         |      | 0.25 | 0.004  |       | 0.010 |
| a2         |             |      | 1.65 |        |       | 0.065 |
| a3         | 0.65        |      | 0.85 | 0.026  |       | 0.033 |
| b          | 0.35        |      | 0.48 | 0.014  |       | 0.019 |
| b1         | 0.19        |      | 0.25 | 0.007  |       | 0.010 |
| C          | 0.25        |      | 0.5  | 0.010  |       | 0.020 |
| c1         | 45° (typ.)  |      |      |        |       |       |
| D          | 4.8         |      | 5.0  | 0.189  |       | 0.197 |
| E          | 5.8         |      | 6.2  | 0.228  |       | 0.244 |
| e          |             | 1.27 |      |        | 0.050 |       |
| e3         |             | 3.81 |      |        | 0.150 |       |
| F          | 3.8         |      | 4.0  | 0.150  |       | 0.157 |
| L          | 0.4         |      | 1.27 | 0.016  |       | 0.050 |
| M          |             |      | 0.6  |        |       | 0.024 |
| S          | 8° (max.)   |      |      |        |       |       |

S08-TBL

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