

## DEVELOPMENT DATA

This data sheet contains preliminary information and specifications are subject to change without notice.

捷多邦，专业PCB打样工厂，24小时加急出货

TDA5709

## RADIAL ERROR SIGNAL PROCESSOR FOR COMPACT DISC PLAYERS

### GENERAL DESCRIPTION

The TDA5709 is a bipolar integrated circuit which provides control signals for the radial motor. These control signals are generated from radial error signals received from a photo-diode signal processor (TDA5708), and velocity control signals from the control processor.

### Features

- Tracking error processor with automatic asymmetry control
- A.G.C. circuitry with automatic start-up and wobble generator
- Tracking control for fast forward/reverse scan, search, repeat and pause functions
- TTL compatible digital input/output
- Digitalized tracking error signal
- Possibility for car application

### QUICK REFERENCE DATA

|                                     |                 |               |
|-------------------------------------|-----------------|---------------|
| Supply voltage range                | $V_{DD}-V_{BB}$ | 8 to 13 V     |
| Quiescent supply current            | $I_Q$           | typ. 6 mA     |
| Operating ambient temperature range | $T_{amb}$       | -30 to +85 °C |

### PACKAGE OUTLINE

20 lead DIL : plastic (SOT146)



# TDA5709

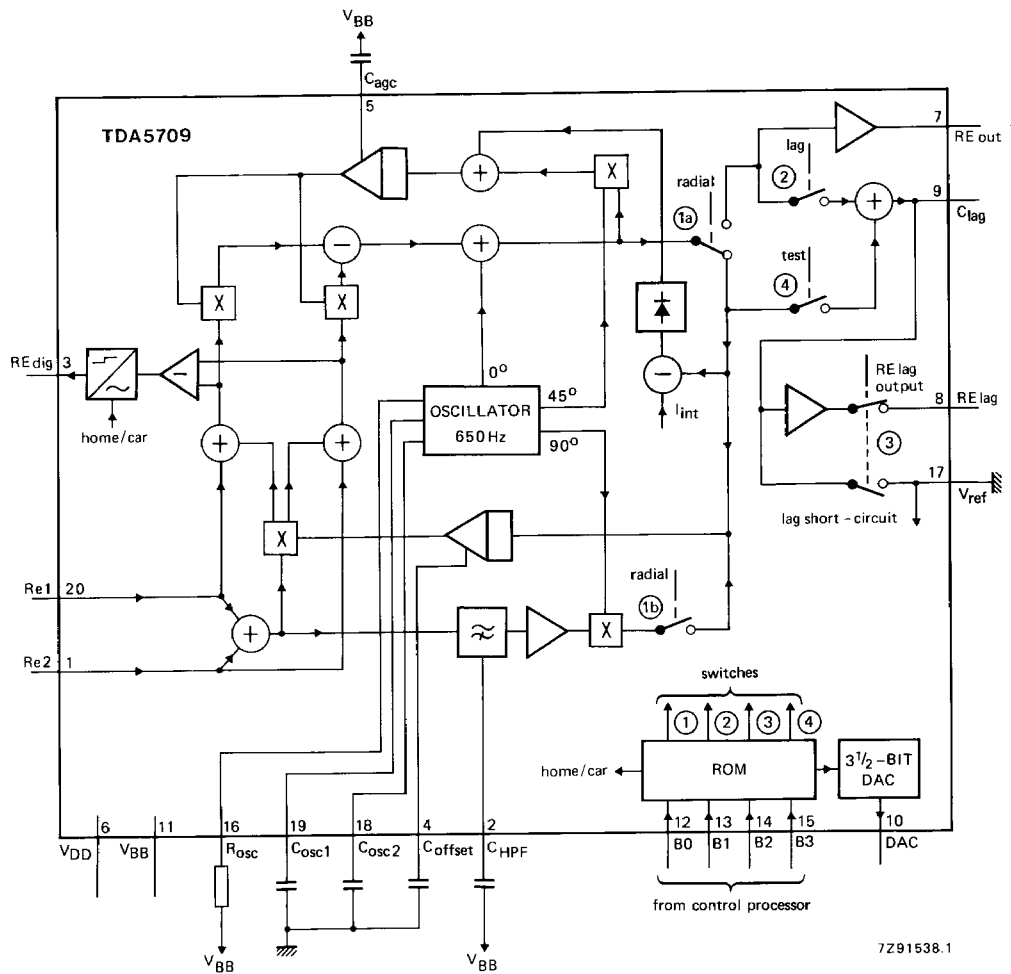


Fig. 1 Block diagram.

## PIN DESCRIPTION

| Pin No. | Symbol              | Description                                                             |
|---------|---------------------|-------------------------------------------------------------------------|
| 1       | Re2                 | Input for amplified currents from photo diodes D1 and D2                |
| 2       | C <sub>HPF</sub>    | High-pass filter for Re1 and Re2, used for radial offset control        |
| 3       | REdig               | Digital output of sign (Re2 – Re1)                                      |
| 4       | C <sub>offset</sub> | Offset control input for radial offset                                  |
| 5       | C <sub>agc</sub>    | Gain control input for radial error signal                              |
| 6       | V <sub>DD</sub>     | Positive supply voltage                                                 |
| 7       | REout               | Current output of amplified (Re2 – Re1) input currents                  |
| 8       | RElag               | Voltage output of integrated (Re2 – Re1) input currents                 |
| 9       | C <sub>lag</sub>    | Integrator capacitor for (Re1 – Re2) input currents                     |
| 10      | DAC                 | Current output for track jumping (3½ bits)                              |
| 11      | V <sub>BB</sub>     | Negative supply connection (also substrate connection)                  |
| 12      | B0                  | Input control bits for off-, catch-, play-status and DAC output current |
| 13      | B1                  |                                                                         |
| 14      | B2                  |                                                                         |
| 15      | B3                  |                                                                         |
| 16      | R <sub>osc</sub>    | Biassing resistor for oscillator frequency and internal amplitude       |
| 17      | V <sub>ref</sub>    | Intermediate supply voltage                                             |
| 18      | C <sub>osc2</sub>   | Frequency setting capacitors for oscillator                             |
| 19      | C <sub>osc1</sub>   |                                                                         |
| 20      | Re1                 | Input for amplified currents from photo-diodes D3 and D4                |

DEVELOPMENT DATA

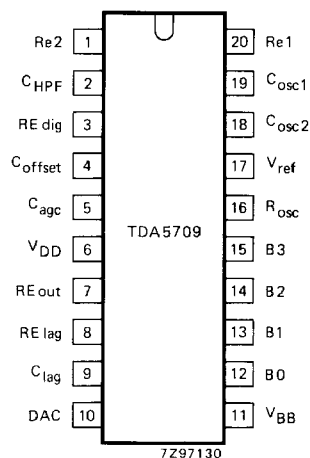


Fig. 2 Pinning diagram.

# TDA5709

## RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage range ( $V_{DD} - V_{BB}$ )

pin 6 – pin 11

$V_{DD}-V_{BB}$  –0,3 to +13 V

Total power dissipation

$P_{tot}$  see Fig. 3

Storage temperature range

$T_{stg}$  –55 to +150 °C

Operating ambient temperature range

$T_{amb}$  –30 to +85 °C

Operating junction temperature

$T_j$  max. 150 °C

## THERMAL RESISTANCE

From junction to ambient

$R_{th\ j-a}$  = 72 K/W

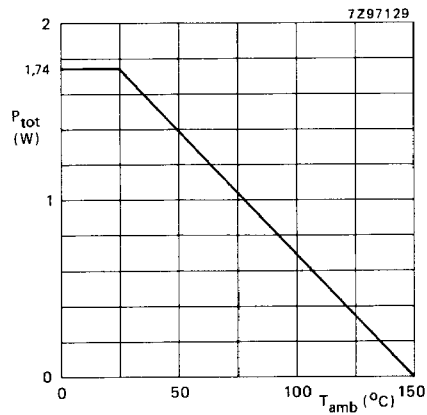


Fig. 3 Power derating curve.

## CHARACTERISTICS

$V_{DD} = +5\text{ V}$ ;  $V_{BB} = -5\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $V_{ref} = 0\text{ V}$ ;  $R_{osc} = 24\text{ k}\Omega$ ; all voltages with respect to  $V_{ref}$ ; unless otherwise specified.

| parameter                                               | symbol      | min.            | typ. | max.            | unit             |
|---------------------------------------------------------|-------------|-----------------|------|-----------------|------------------|
| <b>Supplies</b>                                         |             |                 |      |                 |                  |
| Supply voltage                                          |             |                 |      |                 |                  |
| pin 6 – pin 11 ( $V_{DD} - V_{BB}$ )                    |             | 8               | —    | 13              | V                |
| pin 17 – pin 11 ( $V_{ref} - V_{BB}$ )                  |             | 4,5             | 5,0  | 5,5             | V                |
| Quiescent supply current                                | $I_Q$       | —               | 6    | —               | mA               |
| <b>REdig output (pin 3)</b>                             |             |                 |      |                 |                  |
| Output voltage level                                    |             |                 |      |                 |                  |
| HIGH (note 1; C)                                        | $V_{REdig}$ | $V_{ref} + 2,4$ | —    | —               | V                |
| LOW (note 1; A)                                         | $V_{REdig}$ | $V_{ref} - 0,3$ | —    | $V_{ref} + 0,4$ | V                |
| LOW (note 1; B)                                         | $V_{REdig}$ | $V_{BB}$        | —    | $V_{BB} + 0,4$  | V                |
| Output current                                          |             |                 |      |                 |                  |
| sink current (note 1; A or B)                           | $I_{REdig}$ | 400             | —    | —               | $\mu\text{A}$    |
| source current (note 1; C)                              | $I_{REdig}$ | —               | –150 | –50             | $\mu\text{A}$    |
| <b>Digital inputs (pins 12 to 15)</b>                   |             |                 |      |                 |                  |
| B0, B1, B2 and B3                                       |             |                 |      |                 |                  |
| Input voltage HIGH (note 2)                             | $V_B$       | $V_{ref} + 2$   | —    | $V_{DD}$        | V                |
| Input voltage LOW (note 2)                              | $V_B$       | $V_{BB} + 2$    | —    | $V_{ref} + 0,8$ | V                |
| Input voltage HIGH (note 3)                             | $V_B$       | $V_{BB} + 2$    | —    | $V_{DD}$        | V                |
| Input voltage LOW (note 3)                              | $V_B$       | $V_{BB} - 0,3$  | —    | $V_{BB} + 0,8$  | V                |
| Input current                                           |             |                 |      |                 |                  |
| at $V_B = \text{HIGH}$                                  | $I_B$       | —               | 0    | —               | $\mu\text{A}$    |
| at $V_B = \text{LOW}$                                   | $I_B$       | —               | —    | –10             | $\mu\text{A}$    |
| <b>DAC output (pin 10)</b>                              |             |                 |      |                 |                  |
| Output voltage range                                    |             |                 |      |                 |                  |
| at $I_{DAC} = +150\text{ }\mu\text{A}$ (sink current)   | $V_{DAC}$   | $V_{BB} + 1,5$  | —    | $V_{DD}$        | V                |
| at $I_{DAC} = -150\text{ }\mu\text{A}$ (source current) | $V_{DAC}$   | $V_{BB}$        | —    | $V_{DD} - 1$    | V                |
| Output impedance                                        |             |                 |      |                 |                  |
| at $I_{DAC} = 200\text{ }\mu\text{A}$                   | $ Z_{DAC} $ | —               | 50   | —               | $\text{M}\Omega$ |

## CHARACTERISTICS (continued)

| parameter                                                                                    | symbol                 | min.                                                                          | typ.                                                                | max.                                                                         | unit       |
|----------------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------|------------|
| <b>DAC output (continued)</b>                                                                |                        |                                                                               |                                                                     |                                                                              |            |
| Ratio of output current<br>pin 10 to pin 16 (see Table 1)                                    | $I_{10}/I_{16}$        | 3,6<br>-4,6<br>0,9<br>-1,2<br>0,68<br>-0,86<br>0,45<br>-0,58<br>0,23<br>-0,29 | 4<br>-4<br>1<br>-1<br>0,75<br>-0,75<br>0,5<br>-0,5<br>0,25<br>-0,25 | 4,4<br>-3,4<br>1,1<br>-0,8<br>0,82<br>-0,64<br>0,55<br>-0,42<br>0,27<br>-0,2 |            |
| <b>Analogue input (pin 16)</b>                                                               |                        |                                                                               |                                                                     |                                                                              |            |
| Input voltage level                                                                          | $V_{Rosc}$             | —                                                                             | $V_{BB} + 1,2$                                                      | —                                                                            | V          |
| Input current level                                                                          | $I_{Rosc}$             | —                                                                             | -50                                                                 | —                                                                            | $\mu A$    |
| <b>Radial error inputs</b><br>(Re1 pin 20, Re2 pin 1)                                        |                        |                                                                               |                                                                     |                                                                              |            |
| Input voltage level<br>at $I_{Re1}, I_{Re2} = -105 \mu A$                                    | $V_{Re1}, V_{Re2}$     | —                                                                             | $V_{BB} + 1,4$                                                      | —                                                                            | V          |
| Input current                                                                                | $I_{Re1}, I_{Re2}$     | —                                                                             | 105                                                                 | —                                                                            | $\mu A$    |
| Input impedance                                                                              | $ Z_{Re1} ,  Z_{Re2} $ | —                                                                             | 1                                                                   | —                                                                            | k $\Omega$ |
| <b>Gain control input (pin 5)</b>                                                            |                        |                                                                               |                                                                     |                                                                              |            |
| Input voltage for<br>minimum radial gain                                                     | $V_{Cagc}$             | —                                                                             | $V_{BB} + 3,5$                                                      | —                                                                            | V          |
| maximum radial gain                                                                          | $V_{Cagc}$             | —                                                                             | $V_{BB} + 5,5$                                                      | —                                                                            | V          |
| Input impedance                                                                              | $ Z_{Cagc} $           | —                                                                             | 20                                                                  | —                                                                            | M $\Omega$ |
| <b>Offset control (pin 4)</b>                                                                |                        |                                                                               |                                                                     |                                                                              |            |
| Output current<br>at $I_{Re1} = I_{Re2} = -105 \mu A$ ;<br>$V_{Cosc1} = V_{Cosc2} = V_{ref}$ | $-I_{Coffset}$         | —                                                                             | 0,25                                                                | —                                                                            | $\mu A$    |
| Input voltage for<br>maximum amplification Re1                                               | $V_{Coffset}$          | —                                                                             | $V_{ref} - 1$                                                       | —                                                                            | V          |
| minimum amplification Re2                                                                    | $V_{Coffset}$          | —                                                                             | $V_{ref} - 1$                                                       | —                                                                            | V          |
| minimum amplification Re1                                                                    | $V_{Coffset}$          | —                                                                             | $V_{ref} + 1$                                                       | —                                                                            | V          |
| maximum amplification Re2                                                                    | $V_{Coffset}$          | —                                                                             | $V_{ref} + 1$                                                       | —                                                                            | V          |
| Input impedance                                                                              | $ Z_{Coffset} $        | —                                                                             | 30                                                                  | —                                                                            | M $\Omega$ |

| parameter                                                          | symbol        | min.           | typ.           | max.           | unit       |
|--------------------------------------------------------------------|---------------|----------------|----------------|----------------|------------|
| <b>High-pass filter</b> (pin 2)                                    |               |                |                |                |            |
| Voltage level<br>at $I_{Re1} = I_{Re2} = 0$                        | $V_{HPF}$     | —              | $V_{BB} + 2,8$ | —              | V          |
| Impedance                                                          | $ Z_{HPF} $   | —              | 5              | —              | k $\Omega$ |
| <b>Oscillator</b><br>( $C_{osc1}$ pin 19, $C_{osc2}$ pin 18)       |               |                |                |                |            |
| Linear input voltage range<br>$V_{Cosc1}$ , $V_{Cosc2}$            | $V_{Cosc}$    | $V_{ref} - 2$  | —              | $V_{ref} + 2$  | V          |
| <b>RElag voltage output</b> (pin 8)                                |               |                |                |                |            |
| Output voltage range<br>at $I_{RElag} = +200 \mu A$ (sink current) | $V_{RElag}$   | $V_{BB} + 1,5$ | —              | $V_{DD}$       | V          |
| at $I_{RElag} = -200 \mu A$ (source current)                       | $V_{RElag}$   | $V_{BB}$       | —              | $V_{DD} - 1$   | V          |
| Maximum source current output                                      | $I_{RElag}$   | —              | -2,5           | —              | mA         |
| Maximum sink current output                                        | $I_{RElag}$   | —              | 4              | —              | mA         |
| Output impedance ( $f < 10$ kHz)<br>with RElag switched on         | $ Z_{RElag} $ | —              | —              | 50             | $\Omega$   |
| with RElag switched off                                            | $ Z_{RElag} $ | 1              | —              | —              | M $\Omega$ |
| <b>REout push-pull current output</b> (pin 7)                      |               |                |                |                |            |
| Output voltage range<br>at $I_{REout} = +40 \mu A$ (sink current)  | $V_{REout}$   | $V_{BB} + 1,5$ | —              | $V_{DD}$       | V          |
| at $I_{REout} = -40 \mu A$ (source current)                        | $V_{REout}$   | $V_{BB}$       | —              | $V_{DD} - 1$   | V          |
| Output impedance                                                   | $ Z_{REout} $ | —              | 2              | —              | M $\Omega$ |
| <b>Clag push-pull current output/voltage input</b> (pin 9)         |               |                |                |                |            |
| Output voltage range<br>at $I_{Clag} = +4 \mu A$ (sink current)    | $V_{Clag}$    | $V_{BB} + 1,5$ | —              | $V_{DD}$       | V          |
| at $I_{Clag} = -4 \mu A$ (source current)                          | $V_{Clag}$    | $V_{BB}$       | —              | $V_{DD} - 1,5$ | V          |
| Output impedance                                                   | $ Z_{Clag} $  | —              | 15             | —              | M $\Omega$ |

## CHARACTERISTICS (continued)

| parameter                                                           | symbol            | min. | typ.                 | max. | unit |
|---------------------------------------------------------------------|-------------------|------|----------------------|------|------|
| <b>TRANSFER SPECIFICATIONS</b>                                      |                   |      |                      |      |      |
| Oscillator (pins 19, 18)                                            |                   |      |                      |      |      |
| (V <sub>osc1</sub> , V <sub>osc2</sub> : -2 V to + 2 V)             |                   |      |                      |      |      |
| <b>Transconductance factor</b>                                      |                   |      |                      |      |      |
| $\frac{I_{Cosc2}}{V_{Cosc1}} \cdot R_{osc}$                         |                   | —    | 0,48                 | —    |      |
| $\frac{I_{Cosc1}}{V_{Cosc2}} \cdot R_{osc}$                         |                   | —    | -0,48                | —    |      |
| <b>Amplitude stabilization</b>                                      |                   |      |                      |      |      |
| I <sub>osc1</sub> = f(V <sub>osc1</sub> ) at V <sub>Cosc2</sub> = 0 |                   |      |                      |      |      |
| V <sub>osc1</sub> = 0 V                                             | I <sub>osc1</sub> | —    | 0,1                  | —    | μA   |
| V <sub>osc1</sub> = + 0,87 V                                        | I <sub>osc1</sub> | —    | M <sub>2</sub> + 1,4 | —    | μA   |
| V <sub>osc1</sub> = - 0,87 V                                        | I <sub>osc1</sub> | —    | M <sub>2</sub> - 1,4 | —    | μA   |
| V <sub>osc1</sub> = + 1,2 V                                         | I <sub>osc1</sub> | —    | M <sub>2</sub>       | —    | μA   |
| V <sub>osc1</sub> = - 1,2 V                                         | I <sub>osc1</sub> | —    | M <sub>2</sub>       | —    | μA   |
| V <sub>osc1</sub> = + 1,8 V                                         | I <sub>osc1</sub> | —    | M <sub>2</sub> - 3,5 | —    | μA   |
| V <sub>osc1</sub> = - 1,8 V                                         | I <sub>osc1</sub> | —    | M <sub>2</sub> + 3,5 | —    | μA   |
| (note 4)                                                            |                   |      |                      |      |      |
| <b>Amplitude stabilization</b>                                      |                   |      |                      |      |      |
| I <sub>osc2</sub> = f(V <sub>osc2</sub> ) at V <sub>Cosc1</sub> = 0 |                   |      |                      |      |      |
| V <sub>osc2</sub> = 0 V                                             | I <sub>osc2</sub> | —    | 0,1                  | —    | μA   |
| V <sub>osc2</sub> = + 0,87 V                                        | I <sub>osc2</sub> | —    | M <sub>3</sub> + 1,4 | —    | μA   |
| V <sub>osc2</sub> = - 0,87 V                                        | I <sub>osc2</sub> | —    | M <sub>3</sub> - 1,4 | —    | μA   |
| V <sub>osc2</sub> = + 1,2 V                                         | I <sub>osc2</sub> | —    | M <sub>3</sub>       | —    | μA   |
| V <sub>osc2</sub> = - 1,2 V                                         | I <sub>osc2</sub> | —    | M <sub>3</sub>       | —    | μA   |
| V <sub>osc2</sub> = + 1,8 V                                         | I <sub>osc2</sub> | —    | M <sub>3</sub> - 3,5 | —    | μA   |
| V <sub>osc2</sub> = - 1,8 V                                         | I <sub>osc2</sub> | —    | M <sub>3</sub> + 3,5 | —    | μA   |
| (note 5)                                                            |                   |      |                      |      |      |
| <b>Transconductance factor</b>                                      |                   |      |                      |      |      |
| $\frac{I_{Clag}}{V_{osc1}} \cdot R_{osc}$                           |                   |      |                      |      |      |
| with test on; radial off;                                           |                   |      |                      |      |      |
| I <sub>Re1</sub> = I <sub>Re2</sub> = 0                             |                   | —    | -0,08                | —    |      |

| parameter                                                                                                                                                        | symbol | min. | typ.   | max. | unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|--------|------|------|
| <b>Transconductance factor</b>                                                                                                                                   |        |      |        |      |      |
| $\frac{I_{Clag}}{V_{osc1}} \cdot R_{osc}$<br>with lag on; radial on;<br>$I_{Re1} = I_{Re2} = 0$                                                                  |        | —    | −0,08  | —    |      |
| <b>Transconductance factor</b>                                                                                                                                   |        |      |        |      |      |
| $\frac{I_{REout}}{V_{osc2}} \cdot R_{osc}$<br>with radial on; $I_{Re1} = I_{Re2} = 0$                                                                            |        | —    | 0      | —    |      |
| $\frac{I_{REout}}{V_{osc1}} \cdot R_{osc}$<br>with radial on; $I_{Re1} = I_{Re2} = 0$                                                                            |        | —    | 0,8    | —    |      |
| <b>Transconductance factor</b>                                                                                                                                   |        |      |        |      |      |
| $\frac{I_{Coffset}}{V_{Cosc2}} \cdot R_{osc}$<br>with radial on; $I_{Re1} = I_{Re2} = 0$<br>at $I_{HPF} = 30 \mu A$                                              |        | —    | 0,48   | —    |      |
| at $I_{HPF} = 0 \mu A$                                                                                                                                           |        | —    | 0      | —    |      |
| at $I_{HPF} = -30 \mu A$                                                                                                                                         |        | —    | −0,48  | —    |      |
| with radial off; $I_{Re1} = I_{Re2} = 0$<br>at $I_{HPF} = 30 \mu A$                                                                                              |        | —    | 0      | —    |      |
| <b>Transconductance factor</b>                                                                                                                                   |        |      |        |      |      |
| $\frac{I_{Coffset}}{V_{Cosc1}} \cdot R_{osc}$<br>with radial on; $I_{Re1} = I_{Re2} = 0$<br>at $I_{HPF} = 30 \mu A$                                              |        | —    | 0      | —    |      |
| with radial off; $I_{Re1} = I_{Re2} = 0$<br>at $I_{HPF} = 30 \mu A$                                                                                              |        | —    | 0,08   | —    |      |
| <b>Transconductance factor</b>                                                                                                                                   |        |      |        |      |      |
| $\frac{I_{agc}}{V_{Cosc1}} \cdot R_{osc}$<br>with radial on; $V_{agc} = 0,5 V$ ;<br>$V_{Coffset} = V_{Cosc2} = 0 V$<br>at $I_{Re1} = -150 \mu A$ ; $I_{Re2} = 0$ |        | —    | −0,48  | —    |      |
| at $I_{Re1} = I_{Re2} = -100 \mu A$                                                                                                                              |        | —    | note 6 | —    |      |
| at $I_{Re1} = 0$ ; $I_{Re2} = -150 \mu A$                                                                                                                        |        | —    | + 0,48 | —    |      |

## CHARACTERISTICS (continued)

| parameter                                                                                                                                                                                                                                                                             | symbol          | min. | typ.                | max. | unit             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|---------------------|------|------------------|
| <b>Transconductance factor</b>                                                                                                                                                                                                                                                        |                 |      |                     |      |                  |
| $\frac{I_{agc}}{V_{Cosc2}} \cdot R_{osc}$<br>with radial on; $V_{agc} = 0,5 \text{ V}$ ;<br>$V_{offset} = V_{Cosc1} = 0 \text{ V}$<br>at $I_{Re1} = -150 \mu\text{A}$ ; $I_{Re2} = 0$<br>at $I_{Re1} = I_{Re2} = -100 \mu\text{A}$<br>at $I_{Re1} = 0$ ; $I_{Re2} = -150 \mu\text{A}$ |                 | —    | —0,48<br>0<br>+0,48 | —    |                  |
| <b>Transfer</b> $C_{lag} \rightarrow RE_{lag}$                                                                                                                                                                                                                                        |                 |      |                     |      |                  |
| $\frac{V_{RElag}}{V_{Clag}}$ ; at frequencies $< 10 \text{ kHz}$<br>with lag short-circuit off;<br>RElag output on                                                                                                                                                                    |                 | —    | 1                   | —    |                  |
| <b>Slew rate</b>                                                                                                                                                                                                                                                                      |                 |      |                     |      |                  |
| RElag amplifier<br>with lag short-circuit off;<br>RElag output on                                                                                                                                                                                                                     | SR              | —    | 0,4                 | —    | V/ $\mu\text{s}$ |
| <b>Switch lag short-circuit</b>                                                                                                                                                                                                                                                       |                 |      |                     |      |                  |
| Impedance $\frac{\Delta V_{Clag}}{\Delta I_{Clag}}$<br>with lag short-circuit on;<br>$ I_{Clag}  < 10 \mu\text{A}$                                                                                                                                                                    | $ Z_{lag\ sc} $ | —    | —                   | 1    | k $\Omega$       |
| Offset $ V_{Clag} - V_{ref} $<br>with lag short-circuit on;<br>$I_{Clag} = 0 \mu\text{A}$                                                                                                                                                                                             | $ V_{RElag} $   | —    | —                   | 10   | mV               |
| <b>Transfer resistance</b> (Re1, Re2 to $C_{HPF}$ )                                                                                                                                                                                                                                   |                 |      |                     |      |                  |
| $\frac{\Delta V_{CHPF}}{\Delta(I_{Re1} + I_{Re2})}$                                                                                                                                                                                                                                   |                 | —    | 2,5                 | —    | k $\Omega$       |
| <b>Gain</b> (Re1, Re2 to REout)                                                                                                                                                                                                                                                       |                 |      |                     |      |                  |
| $\frac{\Delta I_{REout}}{\Delta(I_{Re1} - I_{Re2})}$<br>with lag short-circuit on; radial on;<br>$V_{Coffset} = V_{osc1} = V_{osc2} = 0 \text{ V}$<br>$V_{agc} = 0,5 \text{ V}$                                                                                                       |                 | —    | 5                   | —    | times            |

| parameter                                                                                                                                                                                                                                                                                                                                                                              | symbol            | min. | typ. | max. | unit          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------|------|------|---------------|
| <b>Offset current RE</b>                                                                                                                                                                                                                                                                                                                                                               |                   |      |      |      |               |
| Offset current<br>with lag short-circuit on; radial on;<br>$V_{\text{Coffset}} = V_{\text{osc1}} = V_{\text{osc2}} = 0 \text{ V}$<br>$V_{\text{agc}} = 0,5 \text{ V}$<br>at $I_{\text{Re1}} = I_{\text{Re2}} = 100 \mu\text{A}$                                                                                                                                                        | $I_{\text{RE}}$   | —    | 0    | —    | $\mu\text{A}$ |
| <b>Gain (Re1, Re2 to C<sub>agc</sub>)</b>                                                                                                                                                                                                                                                                                                                                              |                   |      |      |      |               |
| $\frac{\Delta I_{\text{Cagc}}}{\Delta(I_{\text{Re1}} - I_{\text{Re2}})}$ at $I_{\text{Re1}} = -104 \mu\text{A}$<br>with lag short-circuit on; radial on;<br>$V_{\text{Coffset}} = (\text{see note 7})$ ;<br>$V_{\text{agc}} = 0,5 \text{ V}$ ; $V_{\text{Cosc1}} = 0 \text{ V}$ ;<br>$V_{\text{Cosc2}} = 1,2 \text{ V}$ ;<br>$\Delta(I_{\text{Re1}} - I_{\text{Re2}}) = 8 \mu\text{A}$ |                   | —    | 0,8  | —    | times         |
| $\frac{\Delta I_{\text{Cagc}}}{\Delta(I_{\text{Re1}} - I_{\text{Re2}})}$ at $I_{\text{Re2}} = -104 \mu\text{A}$<br>with lag short-circuit on; radial on;<br>$V_{\text{Coffset}} = (\text{note 7})$ ;<br>$V_{\text{agc}} = 0,5 \text{ V}$ ; $V_{\text{Cosc1}} = 0 \text{ V}$ ;<br>$V_{\text{Cosc2}} = 1,2 \text{ V}$ ;<br>$\Delta(I_{\text{Re2}} - I_{\text{Re1}}) = 8 \mu\text{A}$     |                   | —    | −0,8 | —    | times         |
| <b>Offset current <math>I_{\text{Cagc}}</math></b>                                                                                                                                                                                                                                                                                                                                     |                   |      |      |      |               |
| Offset current<br>with lag short-circuit on; radial on;<br>$V_{\text{Cosc1}} = 0 \text{ V}$ ; $V_{\text{Cosc2}} = 0 \text{ V}$<br>$V_{\text{agc}} = 0,5 \text{ V}$<br>at $I_{\text{Re1}} = I_{\text{Re2}} = -100 \mu\text{A}$                                                                                                                                                          | $I_{\text{Cagc}}$ | —    | 0    | —    | $\mu\text{A}$ |
| <b>Transconductance factor</b>                                                                                                                                                                                                                                                                                                                                                         |                   |      |      |      |               |
| $\frac{\Delta I_{\text{RE}} \cdot V_{\text{RANGE}}}{I_{\text{tot}} \cdot V_{\text{Coffset}}}$<br>with $V_{\text{Cosc1}} = V_{\text{Cosc2}} = 0 \text{ V}$ ;<br>radial on; $V_{\text{agc}} = -3 \text{ V}$ ;<br>$V_{\text{RANGE}} = 1 \text{ V}$ (internal);<br>$I_{\text{tot}} = I_{\text{Re1}} + I_{\text{Re2}}$<br>at $I_{\text{Re1}} = I_{\text{Re2}} = -100 \mu\text{A}$           |                   | —    | 2,5  | —    |               |
| $\frac{\Delta I_{\text{RE}} \cdot V_{\text{RANGE}}}{I_{\text{tot}} \cdot V_{\text{Coffset}}}$<br>with $V_{\text{Cosc1}} = V_{\text{Cosc2}} = 0 \text{ V}$ ;<br>radial on; $V_{\text{agc}} = V_{\text{BB}}$ ;<br>$V_{\text{RANGE}} = 1 \text{ V}$ (internal);<br>$I_{\text{tot}} = I_{\text{Re1}} + I_{\text{Re2}}$<br>at $I_{\text{Re1}} = I_{\text{Re2}} = -100 \mu\text{A}$          |                   | —    | 0    | —    |               |

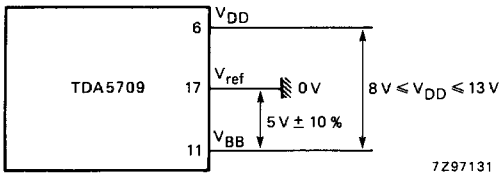
# TDA5709

## CHARACTERISTICS (continued)

| parameter                                                                                                                     | symbol    | min. | typ. | max. | unit          |
|-------------------------------------------------------------------------------------------------------------------------------|-----------|------|------|------|---------------|
| <b>Gain control current <math>I_{agc}</math></b>                                                                              |           |      |      |      |               |
| $I_{agc}$<br>with $V_{Cosc1} = V_{Cosc2} = 0\text{ V}$ ; $V_{agc} = 0,5\text{ V}$ ;<br>radial off; $V_{Coffset} = 0\text{ V}$ |           |      |      |      |               |
| at $I_{REtot} = 200\text{ }\mu\text{A}$ ; $I_{Re1} - I_{Re2} = 35\text{ }\mu\text{A}$                                         | $I_{agc}$ | —    | 0    | —    | $\mu\text{A}$ |
| at $I_{REtot} = 200\text{ }\mu\text{A}$ ; $I_{Re1} - I_{Re2} = 65\text{ }\mu\text{A}$                                         | $I_{agc}$ | —    | 50   | —    | $\mu\text{A}$ |

### Notes to the characteristics

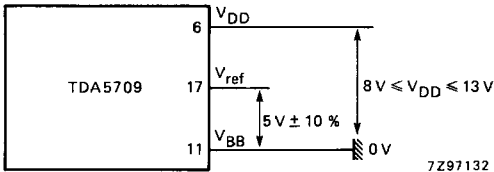
1. REdig output conditions:
  - A:  $I_{Re1} > I_{Re2} + 5\text{ }\mu\text{A}$ ;  $V_{Coffset} = V_{ref}$ ; B0 and B1 and B2 and B3  $> V_{BB} + 2,0\text{ V}$ .
  - B:  $I_{Re1} > I_{Re2} + 5\text{ }\mu\text{A}$ ;  $V_{Coffset} = V_{ref}$ ; B0 or B1 or B2 or B3  $< V_{BB} + 0,8\text{ V}$ .
  - C:  $I_{Re2} > I_{Re1} + 5\text{ }\mu\text{A}$ ;  $V_{Coffset} = V_{ref}$ ; don't cares for B0, B1, B2 and B3.
2. In the 'home' application all logical inputs B0, B1, B2 and B3 must be  $> V_{BB} + 2\text{ V}$ .



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Fig. 4 TDA5709 'home' application.

3. In the 'car' application one or more of the logical inputs B0, B1, B2, B3 must be  $< V_{BB} + 0,8\text{ V}$ .



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Fig. 5 TDA5709 'car' application.

4.  $M_2$  is the measured value of  $I_{osc1}$  at  $V_{osc1} = 0\text{ V}$ .
5.  $M_3$  is the measured value of  $I_{osc2}$  at  $V_{osc2} = 0\text{ V}$ .
6. Parabolic curve.
7.  $M_4$  is the measured value of  $I_{osc1}$  at  $V_{osc1} = 0\text{ V}$ .

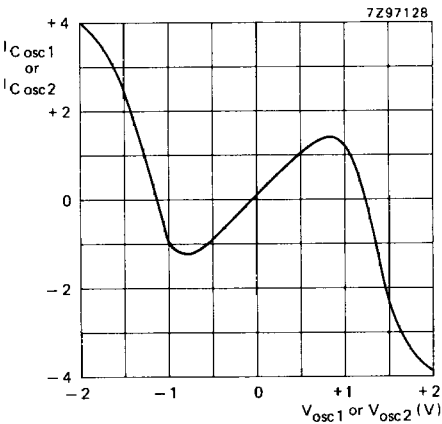


Fig. 6 Amplitude stabilization (typical curve).

Table 1 Truth table for DAC output current

| type names | DAC output (μA)* | logical inputs |    |    |    | internal switches |         |     |      |              |
|------------|------------------|----------------|----|----|----|-------------------|---------|-----|------|--------------|
|            |                  | B0             | B1 | B2 | B3 | lag               | lag s/c | rad | test | output RElag |
| OFF        | 0                | 0              | 0  | 0  | 0  | off               | on      | off | off  | off          |
| CATCH      | 0                | 0              | 0  | 0  | 1  | off               | on      | on  | off  | off          |
| PUSH       | -200             | 0              | 0  | 1  | 0  | off               | on      | off | off  | off          |
| (kick)     | -200             | 0              | 0  | 1  | 1  | off               | off     | off | off  | on           |
| PULL       | 50               | 0              | 1  | 0  | 0  | off               | on      | off | off  | off          |
| PULL       | 37,5             | 0              | 1  | 0  | 1  | off               | on      | off | off  | off          |
| PULL       | 25               | 0              | 1  | 1  | 0  | off               | on      | off | off  | off          |
| PULL       | 12,5             | 0              | 1  | 1  | 1  | off               | on      | off | off  | off          |
| PUSH       | -50              | 1              | 0  | 0  | 0  | off               | on      | off | off  | off          |
| PUSH       | -37,5            | 1              | 0  | 0  | 1  | off               | on      | off | off  | off          |
| PUSH       | -25              | 1              | 0  | 1  | 0  | off               | on      | off | off  | off          |
| PUSH       | -12,5            | 1              | 0  | 1  | 1  | off               | on      | off | off  | off          |
| PULL       | 200              | 1              | 1  | 0  | 0  | off               | on      | off | off  | off          |
| (kick)     | 200              | 1              | 1  | 0  | 1  | off               | off     | off | off  | on           |
| play       | 0                | 1              | 1  | 1  | 0  | on                | off     | on  | off  | on           |
| test**     | 0                | 1              | 1  | 1  | 1  | off               | off     | off | on   | on           |

Where:

0 = input voltage LOW; 1 = input voltage HIGH.

\* With  $R_{Osc} = 24\text{ k}\Omega$ .

\*\* Non-proper operating of output REdig if the logical zero is close to  $V_{BB}$ .