

# TDA6108AJF

Triple video output amplifier

Rev. 03 — 20 April 2005

Product data sheet

## 1. General description

The TDA6108AJF contains three video output amplifiers which are intended to drive the three cathodes of a color CRT. The device is contained in a plastic DIL-bent-SIL 9-pin medium power (DBS9MPF) package, and uses high-voltage DMOS technology.

To obtain maximum performance, the amplifier should be used with black-current control.

## 2. Features

- Typical bandwidth of 9.0 MHz for an output signal of 60 V (p-p)
- High slew rate of 1310 V/ $\mu$ s
- No external components required
- Very simple application
- Single supply voltage of 200 V
- Internal reference voltage of 2.5 V
- Fixed gain of 81
- Black-Current Stabilization (BCS) circuit with voltage window from 1.5 V to 6 V and current window from +100  $\mu$ A to -10 mA
- Thermal protection

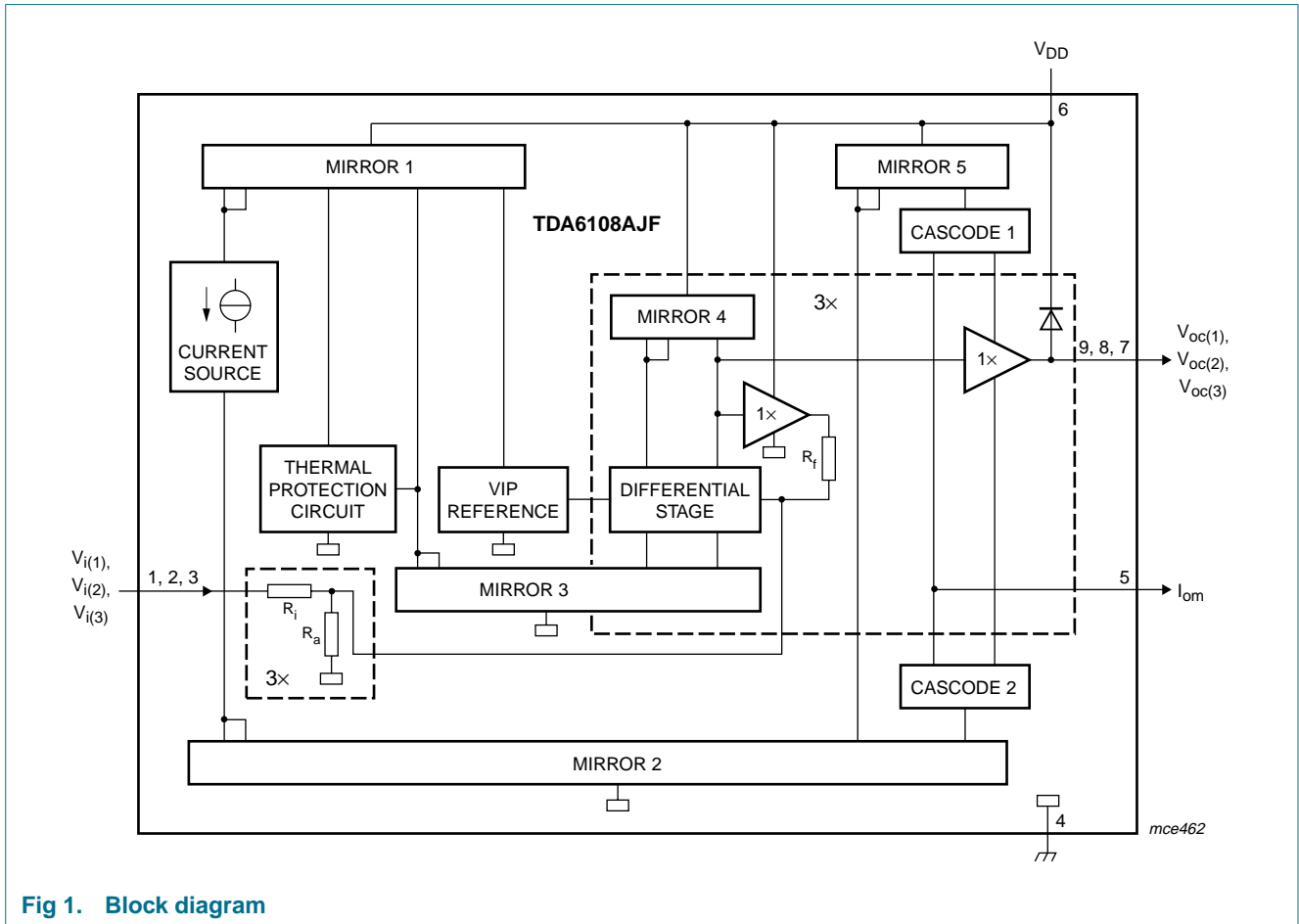
## 3. Ordering information

Table 1: Ordering information

| Type number | Package |   |          |
|-------------|---------|---|----------|
|             | Name    | Description   | Version  |
| TDA6108AJF  | DBS9MPF | plastic DIL-bent-SIL medium power package with fin; 9 leads | SOT111-1 |

**PHILIPS**

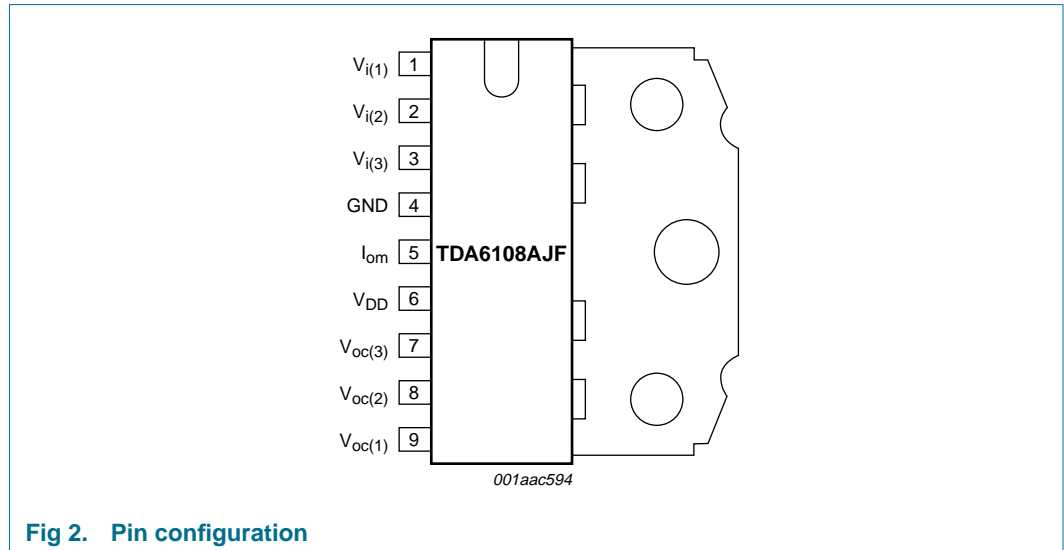
**4. Block diagram**



**Fig 1. Block diagram**

## 5. Pinning information

### 5.1 Pinning

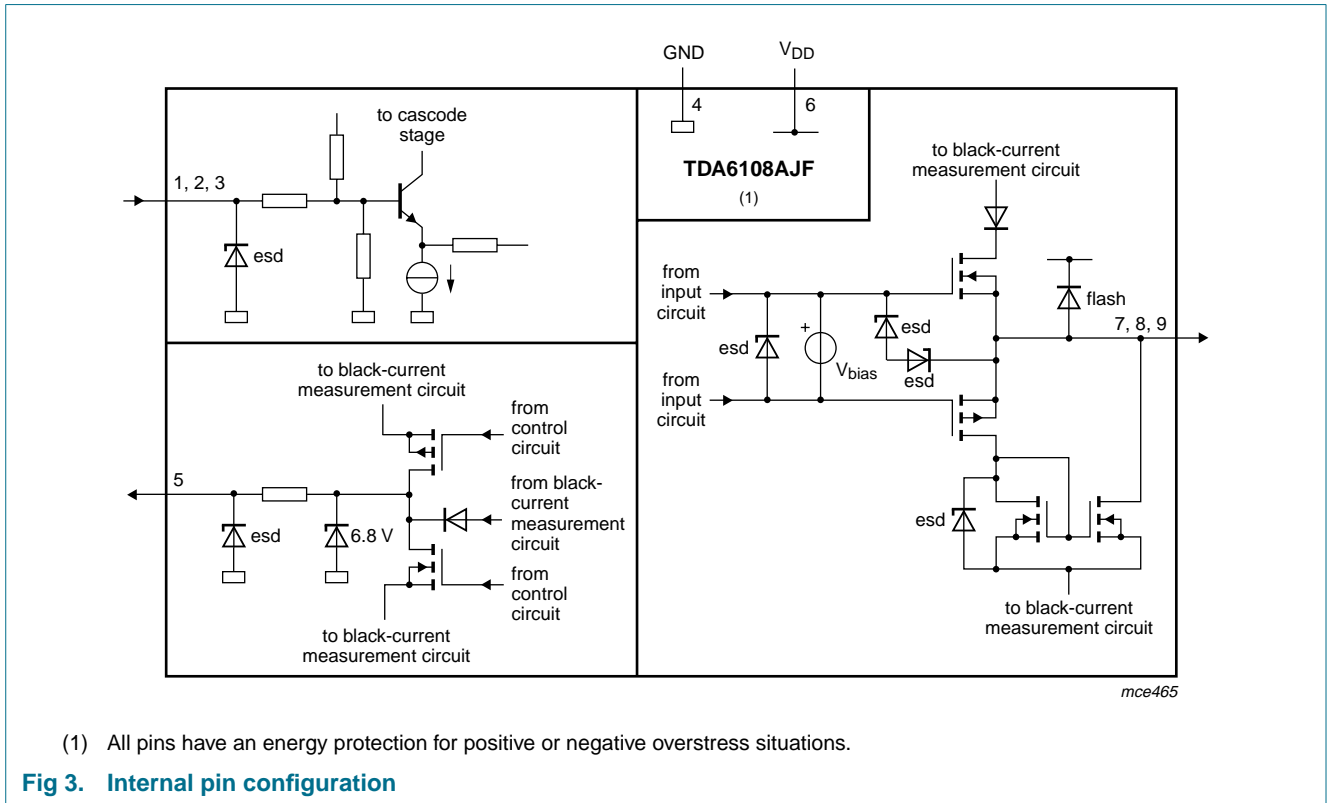


### 5.2 Pin description

Table 2: Pin description

| Symbol      | Pin | Description                      |
|-------------|-----|----------------------------------|
| $V_{i(1)}$  | 1   | inverting input 1                |
| $V_{i(2)}$  | 2   | inverting input 2                |
| $V_{i(3)}$  | 3   | inverting input 3                |
| GND         | 4   | ground                           |
| $I_{om}$    | 5   | black-current measurement output |
| $V_{DD}$    | 6   | supply voltage                   |
| $V_{oc(3)}$ | 7   | cathode output 3                 |
| $V_{oc(2)}$ | 8   | cathode output 2                 |
| $V_{oc(1)}$ | 9   | cathode output 1                 |

## 6. Internal circuitry



## 7. Limiting values

**Table 3: Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Voltages measured with respect to ground; currents as specified in Figure 9; unless otherwise specified.

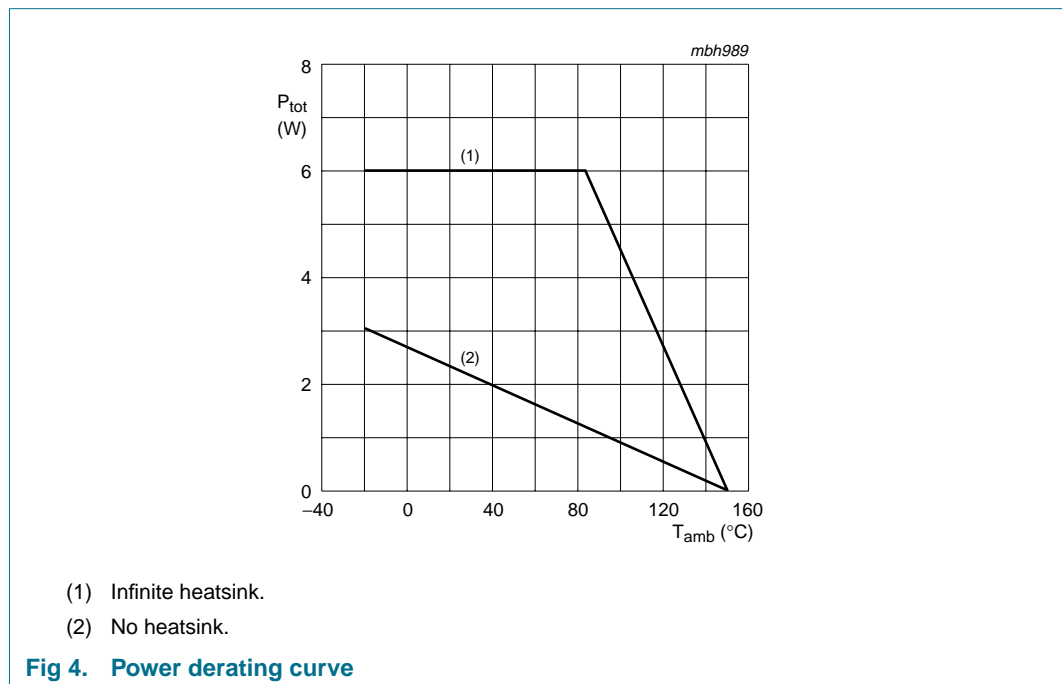
| Symbol                  | Parameter   | Conditions  | Min | Max      | Unit |
|-------------------------|---|---|-----|----------|------|
| $V_{DD}$                | supply voltage  |   | 0   | 250      | V    |
| $V_i$                   | input voltage at pins $V_{i(1)}$ , $V_{i(2)}$ and $V_{i(3)}$              |   | 0   | 12       | V    |
| $V_{om}$                | measurement output voltage  |   | 0   | 6        | V    |
| $ I_{om(\text{mean})} $ | absolute value of mean current of measurement output (for three channels) | $V_{oc} = 0 \text{ V to } V_{DD}$ ;<br>$V_{om} = 1.5 \text{ V to } 6 \text{ V}$ | -   | 5.6      | mA   |
| $V_{oc}$                | cathode output voltage  |   | 0   | $V_{DD}$ | V    |
| $T_{stg}$               | storage temperature   |   | -55 | +150     | °C   |
| $T_j$                   | junction temperature  |   | -20 | +150     | °C   |
| $V_{esd}$               | electrostatic discharge voltage   | Human Body Model (HBM)  | -   | ±3000    | V    |
|                         |   | Machine Model (MM)  | -   | ±300     | V    |

## 8. Thermal characteristics

**Table 4: Thermal characteristics**

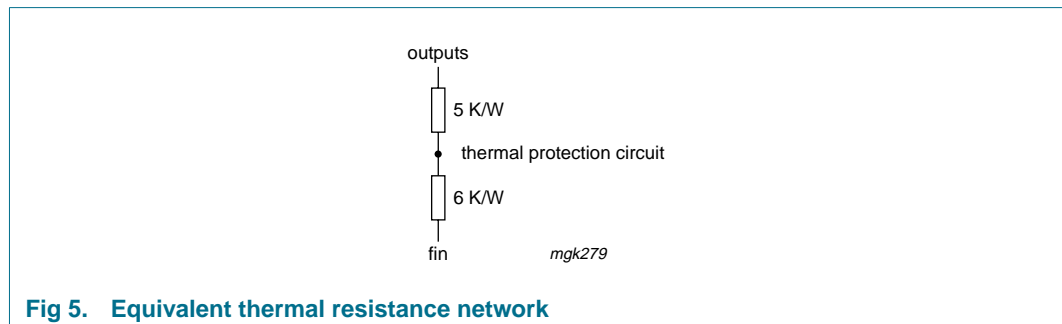
| Symbol          | Parameter                                   | Conditions  | Typ    | Unit |
|-----------------|---|-------------|--------|------|
| $R_{th(j-a)}$   | thermal resistance from junction to ambient | in free air | 56     | K/W  |
| $R_{th(j-fin)}$ | thermal resistance from junction to fin     |             | [1] 11 | K/W  |

[1] An external heatsink is necessary; see *Application Note AN10227-01*.



### 8.1 Thermal protection

The internal thermal protection circuit gives a decrease of the slew rate at high temperatures: 10 % decrease at 130 °C and 30 % decrease at 145 °C (typical values on the spot of the thermal protection circuit).



## 9. Characteristics

**Table 5: Characteristics**

Operating range:  $T_j = -20\text{ }^\circ\text{C}$  to  $+150\text{ }^\circ\text{C}$ ;  $V_{DD} = 180\text{ V}$  to  $210\text{ V}$ ; test conditions:  $T_{amb} = 25\text{ }^\circ\text{C}$ ;  $V_{DD} = 200\text{ V}$ ;  $V_{oc(1)} = V_{oc(2)} = V_{oc(3)} = 0.5V_{DD}$ ;  $C_L = 10\text{ pF}$  ( $C_L$  consists of parasitic and cathode capacitance);  $R_{th(h-a)} = 18\text{ K/W}$ ; measured in test circuit of [Figure 9](#); unless otherwise specified.

| Symbol            | Parameter                                | Conditions          | Min  | Typ | Max  | Unit       |
|-------------------|--|---------------------|------|-----|------|------------|
| $I_q$             | quiescent supply current                 |                     | 7.9  | 9.4 | 10.8 | mA         |
| $V_{ref(int)}$    | internal reference voltage (input stage) |                     | -    | 2.5 | -    | V          |
| $R_i$             | input resistance                         |                     | -    | 2.1 | -    | k $\Omega$ |
| G                 | gain of amplifier                        |                     | 73   | 81  | 89   |            |
| $\Delta G$        | gain difference                          |                     | -4.2 | 0   | +4.2 |            |
| PSRR              | power supply rejection ratio             | $f < 50\text{ kHz}$ | [1]  | 65  | -    | dB         |
| $\alpha_{ct(DC)}$ | DC crosstalk between channels            |                     | -    | -50 | -    | dB         |

### Measurement output pin $I_{om}$ ; $V_{oc} = V_{oc(min)}$ to $V_{oc(max)}$

|                               |   |  |      |      |      |               |
|-------------------------------|---|--|------|------|------|---------------|
| $V_{om(clamp)}$               | clamping voltage of measurement output                    |  | 6    | -    | 10   | V             |
| $I_{om(offset)}$              | offset current of measurement output (for three channels) | $I_{oc} = 0\text{ }\mu\text{A}$ ;<br>$V_{om} = 1.5\text{ V}$ to $6\text{ V}$                                 | -50  | -    | +50  | $\mu\text{A}$ |
| $\Delta I_{om}/\Delta I_{oc}$ | linearity of current transfer (for three channels)        | $I_{oc} = -100\text{ }\mu\text{A}$ to $+100\text{ }\mu\text{A}$ ;<br>$V_{om} = 1.5\text{ V}$ to $6\text{ V}$ | -0.9 | -1.0 | -1.1 |               |
|                               |   | $I_{oc} = -100\text{ }\mu\text{A}$ to $+10\text{ mA}$ ;<br>$V_{om} = 1.5\text{ V}$ to $4\text{ V}$           | -0.9 | -1.0 | -1.1 |               |

### Output pins $V_{oc(1)}$ , $V_{oc(2)}$ , $V_{oc(3)}$

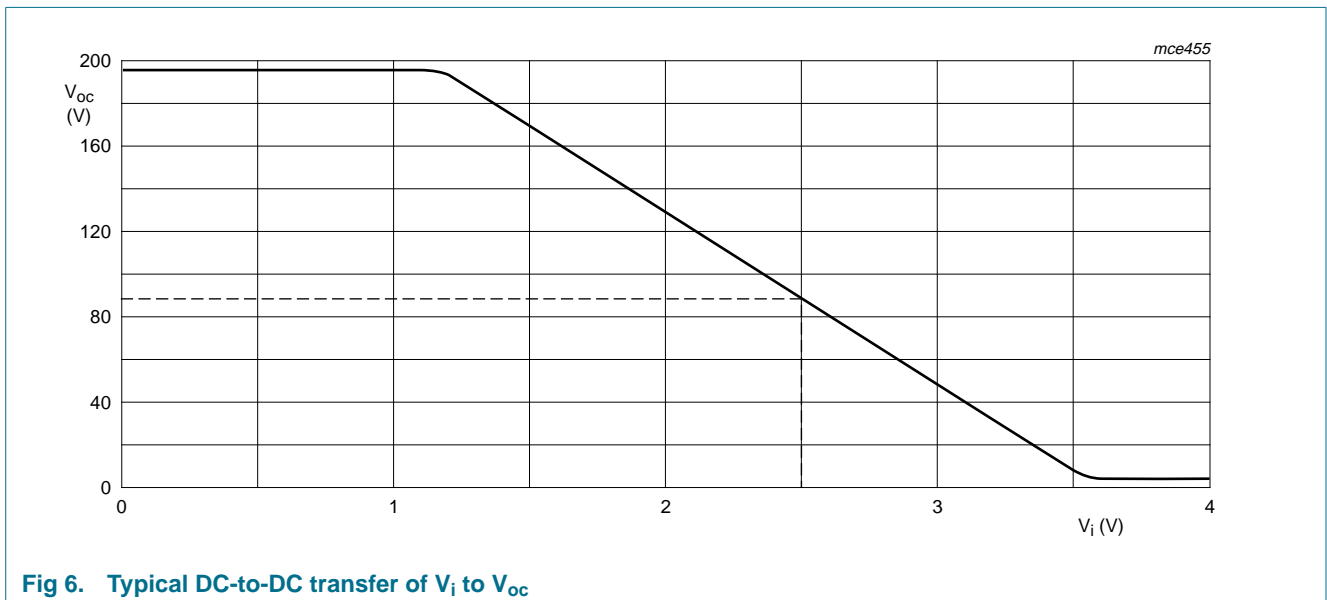
|                             |   |  |     |               |    |      |    |
|-----------------------------|---|--|-----|---------------|----|------|----|
| $V_{oc(DC)}$                | DC output voltage   | $I_i = 0\text{ }\mu\text{A}$                         | 76  | 87            | 97 | V    |    |
| $\Delta V_{oc(DC)(offset)}$ | differential DC output offset voltage between two output pins                                     | $I_i = 0\text{ }\mu\text{A}$                         | -5  | 0             | +5 | V    |    |
| $\Delta V_{oc(T)}$          | output voltage temperature drift  |  | -   | 10            | -  | mV/K |    |
| $\Delta V_{oc(T)(offset)}$  | differential output offset voltage temperature drift between two output pins                      |  | -   | 0             | -  | mV/K |    |
| $I_{oc(max)}$               | maximum peak output current   | $V_{oc} = 50\text{ V}$ to $V_{DD} - 50\text{ V}$     | -   | 28            | -  | mA   |    |
| $V_{oc(min)}$               | minimum output voltage  | $V_i = 4.5\text{ V}$ ; at $I_{oc} = 0\text{ mA}$     | [2] | -             | 10 | V    |    |
| $V_{oc(max)}$               | maximum output voltage  | $V_i = 0.5\text{ V}$ ; at $I_{oc} = 0\text{ mA}$     | [2] | $V_{DD} - 15$ | -  | V    |    |
| $B_S$                       | small signal bandwidth  | $V_{oc} = 60\text{ V}$ (p-p)                         | -   | 9.0           | -  | MHz  |    |
| $B_L$                       | large signal bandwidth  | $V_{oc} = 100\text{ V}$ (p-p)                        | -   | 8.0           | -  | MHz  |    |
| $t_{oc(p)}$                 | cathode output propagation time 50 % input to 50 % output   | $V_{oc} = 100\text{ V}$ (p-p) square wave            | [3] | -             | 32 | -    | ns |
| $\Delta t_{oc(p)}$          | difference in cathode output propagation time 50 % input to 50 % output (between two output pins) | $V_{oc} = 100\text{ V}$ (p-p) square wave            | [3] | -10           | 0  | +10  | ns |
| $t_{oc(r)}$                 | cathode output rise time 10 % output to 90 % output   | $V_{oc} = 50\text{ V}$ to $150\text{ V}$ square wave | [3] | 35            | 50 | 70   | ns |
| $t_{oc(f)}$                 | cathode output fall time 90 % output to 10 % output   | $V_{oc} = 150\text{ V}$ to $50\text{ V}$ square wave | [3] | 35            | 50 | 65   | ns |

**Table 5: Characteristics ...continued**

Operating range:  $T_j = -20\text{ }^\circ\text{C}$  to  $+150\text{ }^\circ\text{C}$ ;  $V_{DD} = 180\text{ V}$  to  $210\text{ V}$ ; test conditions:  $T_{amb} = 25\text{ }^\circ\text{C}$ ;  $V_{DD} = 200\text{ V}$ ;  $V_{oc(1)} = V_{oc(2)} = V_{oc(3)} = 0.5V_{DD}$ ;  $C_L = 10\text{ pF}$  ( $C_L$  consists of parasitic and cathode capacitance);  $R_{th(h-a)} = 18\text{ K/W}$ ; measured in test circuit of [Figure 9](#); unless otherwise specified.

| Symbol   | Parameter  | Conditions                                | Min   | Typ  | Max | Unit             |
|----------|--|---|-------|------|-----|------------------|
| $t_{st}$ | settling time input (50 %) to output (99 % to 101 %) | $V_{oc} = 100\text{ V}$ (p-p) square wave | [3] - | -    | 350 | ns               |
| SR       | slew rate between 50 V to $V_{DD} - 50\text{ V}$     | $V_{oc} = 2.5\text{ V}$ (p-p) square wave | [3] - | 1310 | -   | V/ $\mu\text{s}$ |
| $O_v$    | cathode output voltage overshoot                     | $V_{oc} = 100\text{ V}$ (p-p) square wave | [3] - | 10   | -   | %                |

- [1] The ratio of the change in supply voltage to the change in input voltage when there is no change in output voltage.
- [2] See [Figure 6](#) for the typical DC-to-DC transfer of  $V_i$  to  $V_{oc}$ .
- [3]  $f < 1\text{ MHz}$ ;  $t_r = t_f = 40\text{ ns}$  [pins  $V_{i(1)}$ ,  $V_{i(2)}$  and  $V_{i(3)}$ ] see [Figure 7](#) and [Figure 8](#).



**Fig 6. Typical DC-to-DC transfer of  $V_i$  to  $V_{oc}$**

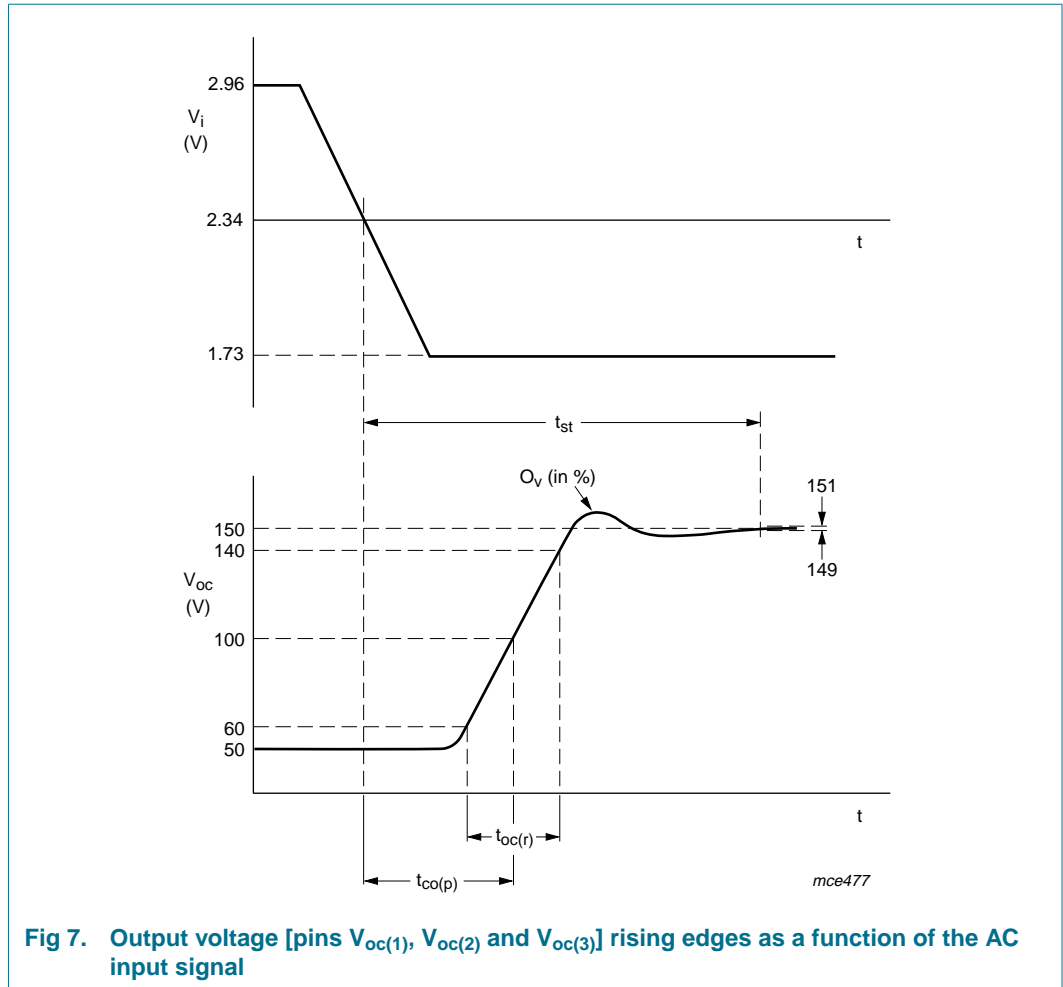


Fig 7. Output voltage [pins  $V_{oc(1)}$ ,  $V_{oc(2)}$  and  $V_{oc(3)}$ ] rising edges as a function of the AC input signal



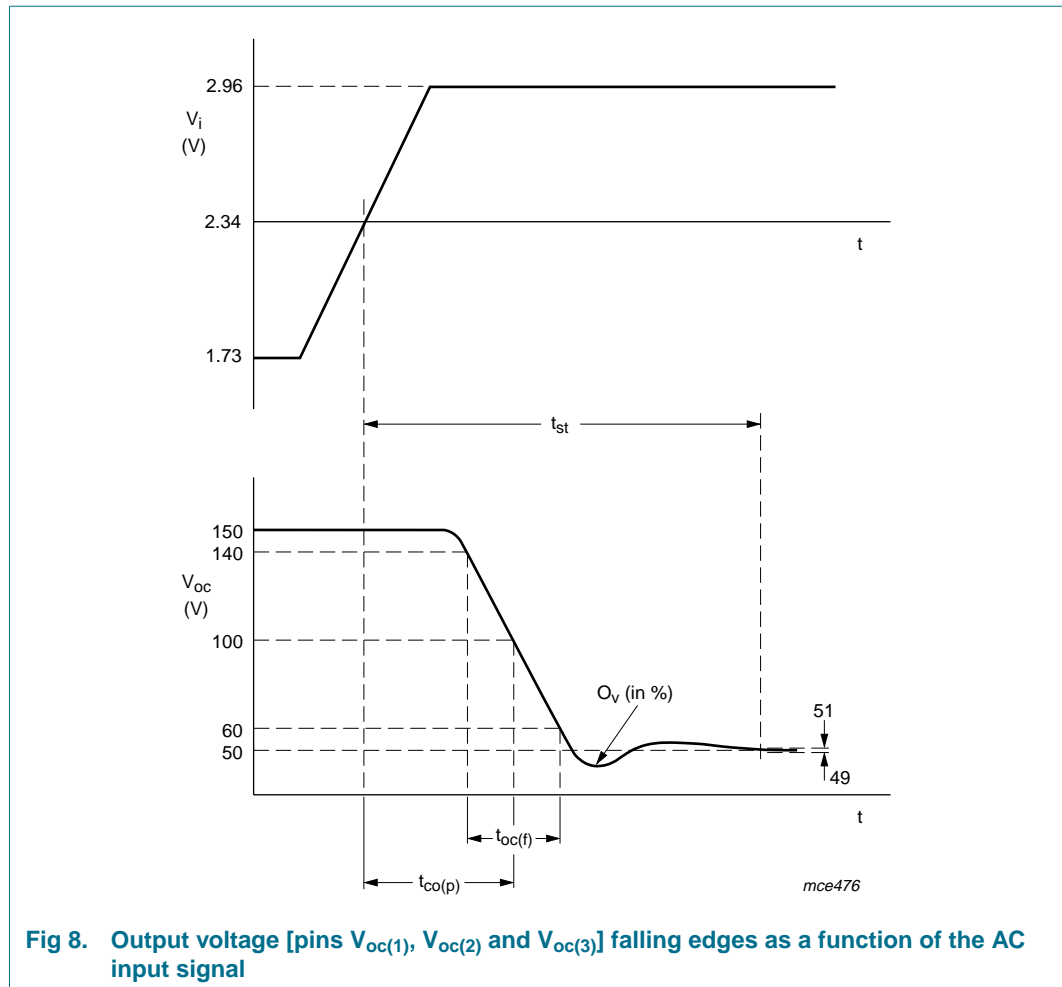


Fig 8. Output voltage [pins  $V_{oc(1)}$ ,  $V_{oc(2)}$  and  $V_{oc(3)}$ ] falling edges as a function of the AC input signal

## 10. Application information

### 10.1 Flashover protection

For sufficient flashover protection it is necessary to apply an external diode and 100  $\Omega$  resistor for each channel; see *Application Note AN10227-01*.

To limit the diode current an external 1 k $\Omega$  carbon high-voltage resistor in series with the cathode output and a 2 kV spark gap are needed (for this resistor value, the CRT has to be connected to the main PCB).

$V_{DD}$  must be decoupled to GND:

1. With a capacitor > 20 nF with good HF behavior (e.g. foil); this capacitor must be placed as close as possible to pins  $V_{DD}$  and GND and must be within 5 mm
2. With a capacitor > 3.3  $\mu$ F on the picture tube base print, depending on the CRT size.

## 10.2 Switch-off behavior

The switch-off behavior of the TDA6108AJF is controllable. This is because the output pins of the TDA6108AJF are still under control of the input pins for low power supply voltages (approximately 30 V and higher).

## 10.3 Bandwidth

The addition of the flash resistor produces a decreased bandwidth and increases the rise and fall times.

## 10.4 Dissipation

A distinction must first be made between static dissipation (independent of frequency) and dynamic dissipation (proportional to frequency).

The static dissipation of the TDA6108AJF is due to voltage supply currents and load currents in the feedback network and CRT.

The static dissipation  $P_{\text{stat}}$  equals:  $P_{\text{stat}} = V_{\text{DD}} \times I_{\text{DD}} + 3 \times V_{\text{oc}} \times I_{\text{oc}}$

Where:

$V_{\text{DD}}$  = supply voltage

$I_{\text{DD}}$  = supply current

$V_{\text{oc}}$  = DC value of cathode output voltage

$I_{\text{oc}}$  = DC value of cathode output current.

The dynamic dissipation  $P_{\text{dyn}}$  equals:  $P_{\text{dyn}} = 3 \times V_{\text{DD}} \times (C_{\text{L}} + C_{\text{int}}) \times f_{\text{i}} \times V_{\text{oc(p-p)}} \times \delta$

Where:

$C_{\text{L}}$  = load capacitance

$C_{\text{int}}$  = internal load capacitance ( $\approx 4$  pF)

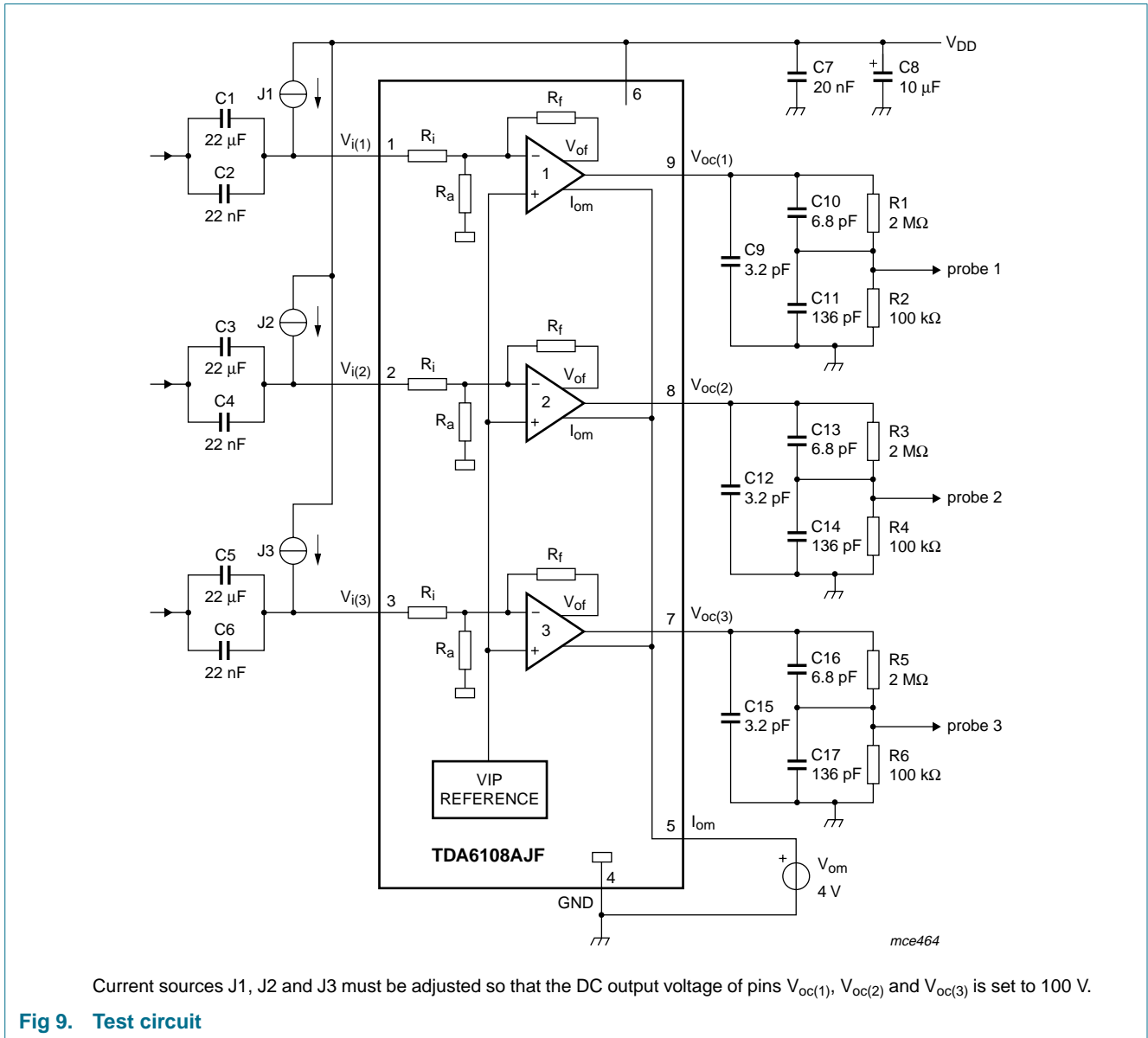
$f_{\text{i}}$  = input frequency

$V_{\text{oc(p-p)}}$  = cathode output voltage (peak-to-peak value)

$\delta$  = non-blanking duty factor.

The TDA6108AJF must be mounted on the picture tube base print to minimize the load capacitance.

### 11. Test information



#### 11.1 Quality information

The *General Quality Specification for Integrated Circuits, SNW-FQ-611* is applicable.

12. Package outline

DBS9MPF: plastic DIL-bent-SIL medium power package with fin; 9 leads

SOT111-1

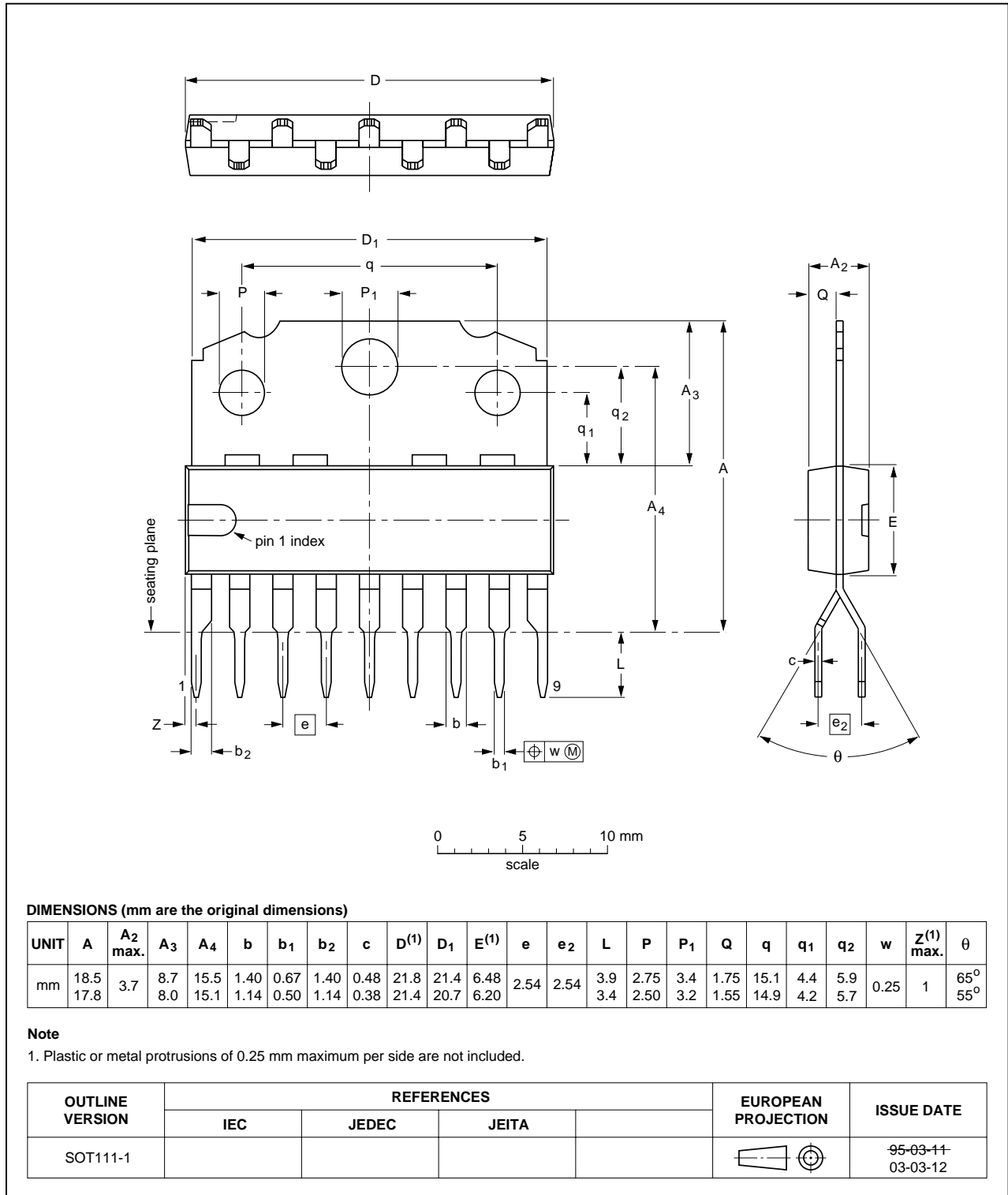


Fig 10. Package outline SOT111-1 (DBS9MPF)

## 13. Handling information

Inputs and outputs are protected against electrostatic discharge in normal handling. However, to be completely safe, it is desirable to take normal precautions appropriate to handling integrated circuits.

## 14. Soldering

### 14.1 Introduction to soldering through-hole mount packages

This text gives a brief insight to wave, dip and manual soldering. A more in-depth account of soldering ICs can be found in our *Data Handbook IC26; Integrated Circuit Packages* (document order number 9398 652 90011).

Wave soldering is the preferred method for mounting of through-hole mount IC packages on a printed-circuit board.

### 14.2 Soldering by dipping or by solder wave

Driven by legislation and environmental forces the worldwide use of lead-free solder pastes is increasing. Typical dwell time of the leads in the wave ranges from 3 seconds to 4 seconds at 250 °C or 265 °C, depending on solder material applied, SnPb or Pb-free respectively.

The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ( $T_{stg(max)}$ ). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

### 14.3 Manual soldering

Apply the soldering iron (24 V or less) to the lead(s) of the package, either below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 °C and 400 °C, contact may be up to 5 seconds.

### 14.4 Package related soldering information

**Table 6: Suitability of through-hole mount IC packages for dipping and wave soldering methods**

| Package                         | Soldering method |                              |
|---------------------------------|------------------|------------------------------|
|                                 | Dipping          | Wave                         |
| CPGA, HCPGA                     | –                | suitable                     |
| DBS, DIP, HDIP, RDBS, SDIP, SIL | suitable         | suitable <a href="#">[1]</a> |
| PMFP <a href="#">[2]</a>        | –                | not suitable                 |

[1] For SDIP packages, the longitudinal axis must be parallel to the transport direction of the printed-circuit board.

[2] For PMFP packages hot bar soldering or manual soldering is suitable.

## 15. Revision history

**Table 7: Revision history**

| Document ID    | Release date  | Data sheet status         | Change notice | Doc. number    | Supersedes   |
|----------------|---|---------------------------|---------------|----------------|--------------|
| TDA6108AJF_3   | 20050420  | Product data sheet        | -             | 9397 750 14729 | TDA6108AJF_2 |
| Modifications: | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors</li> </ul>  |                           |               |                |              |
| TDA6108AJF_2   | 040630  | Preliminary specification | -             | 9397 750 13498 | TDA6108AJF_1 |
| Modifications: | <ul style="list-style-type: none"> <li>In Features: change of slew rate</li> <li>In Limiting values; change to ESD</li> <li>In Characteristics; change of value for output measurement pin</li> <li>In Characteristics; change of value for slew rate and cathode output rise time</li> </ul> |                           |               |                |              |
| TDA6108AJF_1   | 030919  | Preliminary specification | -             | 9397 750 11633 | -            |

## 16. Data sheet status

| Level | Data sheet status <sup>[1]</sup> | Product status <sup>[2]</sup> <sup>[3]</sup> | Definition   |
|-------|----------------------------------|--|--|
| I     | Objective data                   | Development                                  | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.  |
| II    | Preliminary data                 | Qualification                                | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.             |
| III   | Product data                     | Production                                   | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

## 17. Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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