

# DATA SHEET

## **TDA6108JF**

### Triple video output amplifier

Product specification  
Supersedes data of 1998 Jun 22  
File under Integrated Circuits, IC02

1999 Oct 29

Triple video output amplifier

TDA6108JF

FEATURES

- Typical bandwidth of 9.0 MHz for an output signal of 60 V (p-p)
- High slew rate of 1850 V/μs
- No external components required
- Very simple application
- Single supply voltage of 200 V
- Internal reference voltage of 2.5 V
- Fixed gain of 51

- Black-Current Stabilization (BCS) circuit
- Thermal protection.

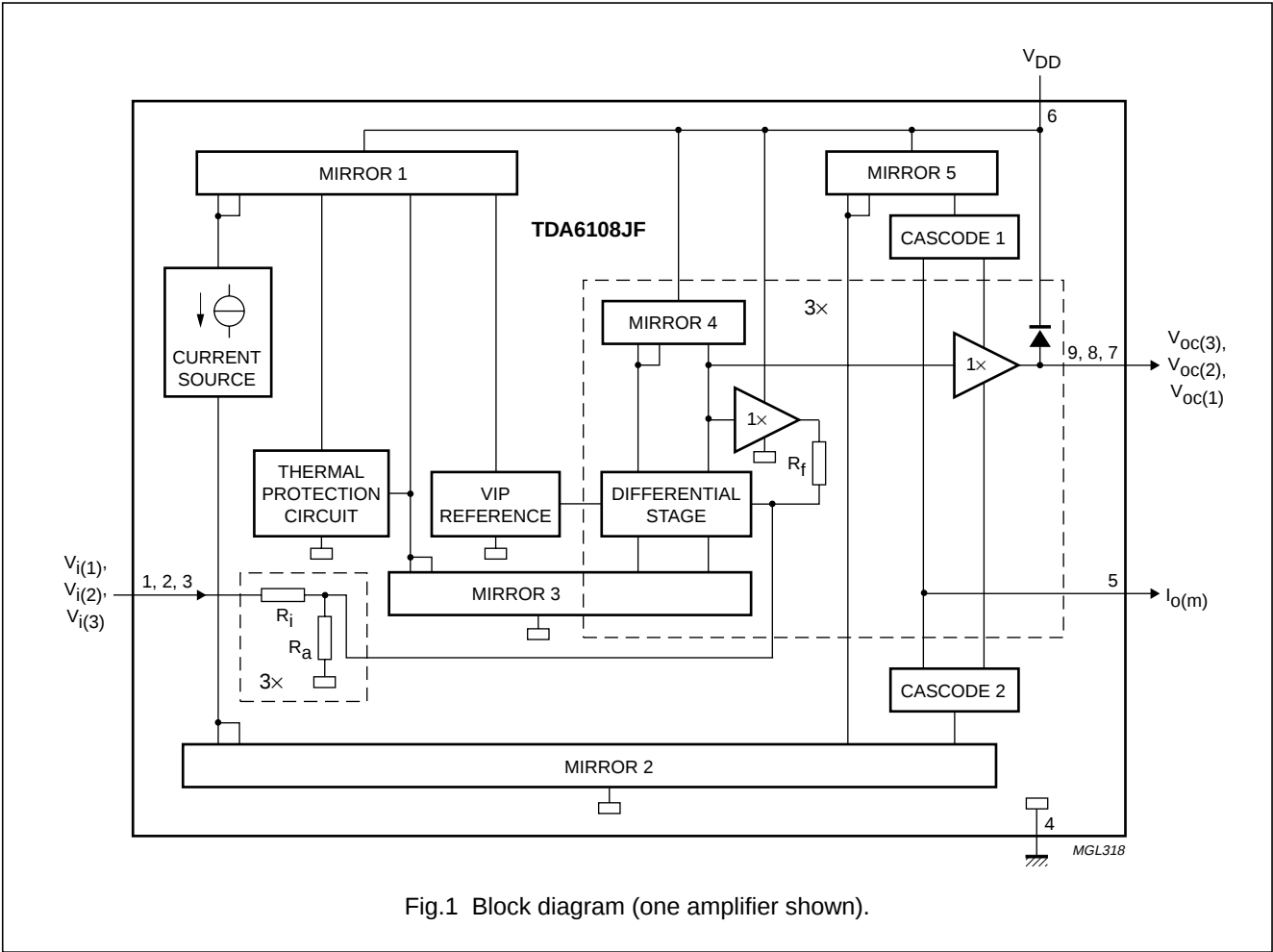
GENERAL DESCRIPTION

The TDA6108JF includes three video output amplifiers in one plastic DIL-bent-SIL 9-pin medium power (DBS9MPF) package (SOT111-1), using high-voltage DMOS technology, and is intended to drive the three cathodes of a colour CRT directly. To obtain maximum performance, the amplifier should be used with black-current control.

ORDERING INFORMATION

| TYPE<br>NUMBER | PACKAGE |                                                             |          |
|----------------|---------|-------------------------------------------------------------|----------|
|                | NAME    | DESCRIPTION                                                 | VERSION  |
| TDA6108JF      | DBS9MPF | plastic DIL-bent-SIL medium power package with fin; 9 leads | SOT111-1 |

BLOCK DIAGRAM

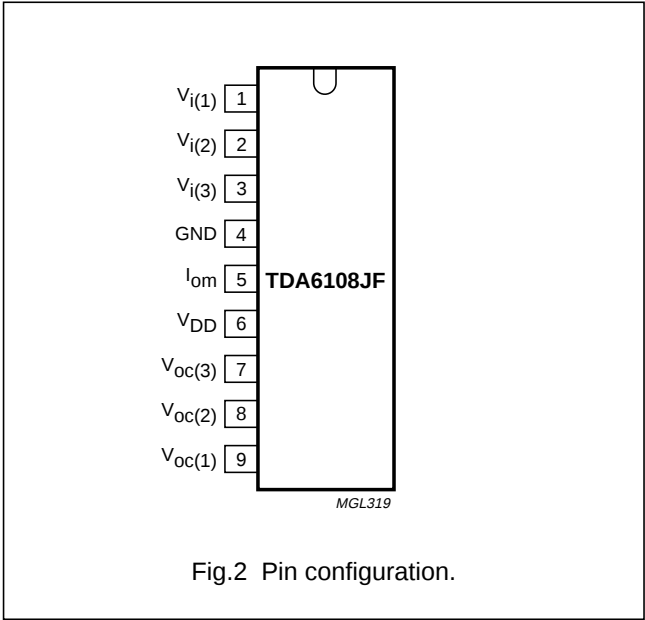


Triple video output amplifier

TDA6108JF

PINNING

| 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 (fin)                     |
| $I_{om}$    | 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                 |



LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134); voltages measured with respect to pin 4 (ground); currents as specified in Fig.1; unless otherwise specified.

| SYMBOL    | PARAMETER                  | MIN. | MAX.     | UNIT |
|-----------|----------------------------|------|----------|------|
| $V_{DD}$  | supply voltage             | 0    | 250      | V    |
| $V_i$     | input voltage              | 0    | 12       | V    |
| $V_{om}$  | measurement output voltage | 0    | 6        | V    |
| $V_{oc}$  | cathode output voltage     | 0    | $V_{DD}$ | V    |
| $T_{stg}$ | storage temperature        | -55  | +150     | °C   |
| $T_j$     | junction temperature       | -20  | +150     | °C   |
| $V_{es}$  | electrostatic handling     |      |          |      |
|           | human body model (HBM)     | —    | 2000     | V    |
|           | machine model (MM)         | —    | 300      | V    |

HANDLING

Inputs and outputs are protected against electrostatic discharge in normal handling. However, to be totally safe, it is desirable to take normal precautions appropriate to handling MOS devices (see “Handling MOS Devices”).

QUALITY SPECIFICATION

Quality specification “SNW-FQ-611 part D” is applicable.

Triple video output amplifier

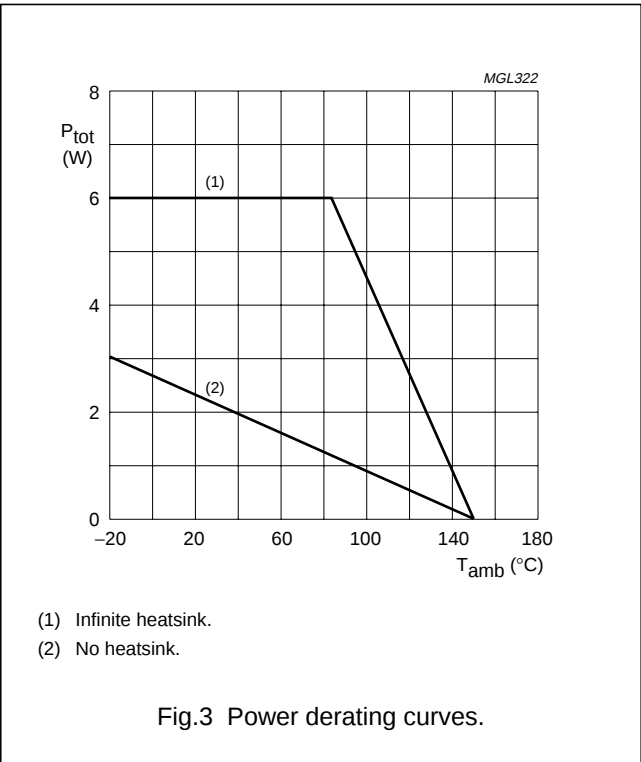
TDA6108JF

THERMAL CHARACTERISTICS

| SYMBOL          | PARAMETER                                   | CONDITIONS | VALUE | UNIT |
|-----------------|---------------------------------------------|------------|-------|------|
| $R_{th(j-a)}$   | thermal resistance from junction to ambient |            | 56    | K/W  |
| $R_{th(j-fin)}$ | thermal resistance from junction to fin     | note 1     | 11    | K/W  |
| $R_{th(h-a)}$   | thermal resistance from heatsink to ambient |            | 10    | K/W  |

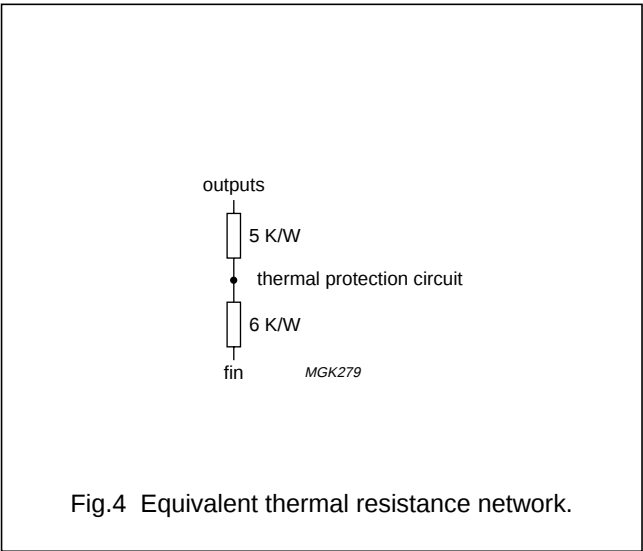
Note

1. An external heatsink is necessary.



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).



## Triple video output amplifier

## TDA6108JF

**CHARACTERISTICS**

Operating range:  $T_j = -20$  to  $+150$  °C;  $V_{DD} = 180$  to  $210$  V. Test conditions:  $T_{amb} = 25$  °C;  $V_{DD} = 200$  V;

$V_{o(c1)} = V_{o(c2)} = V_{o(c3)} = \frac{1}{2}V_{DD}$ ;  $C_L = 10$  pF ( $C_L$  consists of parasitic and cathode capacitance);  $R_{th(h-a)} = 18$  K/W (measured in test circuit of Fig.8); unless otherwise specified.

| SYMBOL                            | PARAMETER                                                                                       | CONDITIONS                                                                                                    | MIN.          | TYP. | MAX. | UNIT       |
|-----------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------|------|------|------------|
| $I_q$                             | quiescent supply current                                                                        |                                                                                                               | 8.8           | 10.3 | 11.7 | mA         |
| $V_{ref(int)}$                    | internal reference voltage (input stage)                                                        |                                                                                                               | –             | 2.5  | –    | V          |
| $R_i$                             | input resistance                                                                                |                                                                                                               | –             | 3.2  | –    | k $\Omega$ |
| G                                 | gain of amplifier                                                                               |                                                                                                               | 47.5          | 51.0 | 55.0 |            |
| $\Delta G$                        | gain difference                                                                                 |                                                                                                               | –2.5          | 0    | +2.5 |            |
| $V_{O(c)}$                        | nominal output voltage at pins 7, 8 and 9 (DC value)                                            | $I_i = 0$ $\mu$ A                                                                                             | 116           | 129  | 142  | V          |
| $\Delta V_{O(c)(offset)}$         | differential nominal output offset voltage between pins 7 and 8, 8 and 9 and 9 and 7 (DC value) | $I_i = 0$ $\mu$ A                                                                                             | –             | 0    | 5    | V          |
| $\Delta V_{O(c)(T)}$              | output voltage temperature drift at pins 7, 8 and 9                                             |                                                                                                               | –             | –10  | –    | mV/K       |
| $\Delta V_{O(c)(T)(offset)}$      | differential output offset voltage temperature drift between pins 7 and 8, 8 and 9 and 7 and 9  |                                                                                                               | –             | 0    | –    | mV/K       |
| $I_{o(m)(offset)}$                | offset current of measurement output (for 3 channels)                                           | $I_{o(c)} = 0$ $\mu$ A;<br>$1.5$ V < $V_i$ < $5.5$ V;<br>$3$ V < $V_{o(m)}$ < $6$ V                           | –50           | –    | +50  | $\mu$ A    |
| $\Delta I_{o(m)}/\Delta I_{o(c)}$ | linearity of current transfer                                                                   | $-100$ $\mu$ A < $I_{o(c)}$ < $100$ $\mu$ A;<br>$1.5$ V < $V_i$ < $5.5$ V;<br>$3$ V < $V_{o(m)}$ < $6$ V      | 0.9           | 1.0  | 1.1  |            |
| $I_{o(c)(max)}$                   | maximum peak output current (pins 7, 8 and 9)                                                   | $50$ V < $V_{o(c)}$ < $V_{DD} - 50$ V                                                                         | –             | 28   | –    | mA         |
| $V_{o(c)(min)}$                   | minimum output voltage (pins 7, 8 and 9)                                                        | $V_i = 7.0$ V; note 1                                                                                         | –             | –    | 10   | V          |
| $V_{o(c)(max)}$                   | maximum output voltage (pins 7, 8 and 9)                                                        | $V_i = 1.0$ V; note 1                                                                                         | $V_{DD} - 15$ | –    | –    | V          |
| $B_S$                             | small signal bandwidth (pins 7, 8 and 9)                                                        | $V_{o(c)} = 60$ V (p-p)                                                                                       | –             | 9.0  | –    | MHz        |
| $B_L$                             | large signal bandwidth (pins 7, 8 and 9)                                                        | $V_{o(c)} = 100$ V (p-p)                                                                                      | –             | 8.0  | –    | MHz        |
| $t_{PCO}$                         | cathode output propagation time 50% input to 50% output (pins 7, 8 and 9)                       | $V_{o(c)} = 100$ V (p-p) square wave; $f < 1$ MHz;<br>$t_r = t_f = 40$ ns (pins 1, 2 and 3); see Figs 6 and 7 | –             | 32   | –    | ns         |

## Triple video output amplifier

## TDA6108JF

| SYMBOL            | PARAMETER                                                                                                 | CONDITIONS                                                                                                                                   | MIN. | TYP. | MAX. | UNIT       |
|-------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------------|
| $\Delta t_{PCO}$  | difference in cathode output propagation time 50% input to 50% output (pins 7 and 8, 7 and 9 and 8 and 9) | $V_{O(c)} = 100\text{ V (p-p)}$<br>square wave; $f < 1\text{ MHz}$ ;<br>$t_r = t_f = 40\text{ ns}$<br>(pins 1, 2 and 3)                      | -10  | 0    | +10  | ns         |
| $t_{o(r)}$        | cathode output rise time 10% output to 90% output (pins 7, 8 and 9)                                       | $V_{O(c)} = 50\text{ to }150\text{ V}$ square wave; $f < 1\text{ MHz}$ ; $t_r = 40\text{ ns}$ (pins 1, 2 and 3); see Fig.6                   | 35   | 50   | 65   | ns         |
| $t_{o(f)}$        | cathode output fall time 90% output to 10% output (pins 7, 8 and 9)                                       | $V_{O(c)} = 150\text{ to }50\text{ V}$ square wave; $f < 1\text{ MHz}$ ; $t_r = 40\text{ ns}$ (pins 1, 2 and 3); see Fig.7                   | 35   | 50   | 65   | ns         |
| $t_{st}$          | settling time 50% input to 99% < output < 101% (pins 7, 8 and 9)                                          | $V_{O(c)} = 100\text{ V (p-p)}$<br>square wave; $f < 1\text{ MHz}$ ;<br>$t_r = t_f = 40\text{ ns}$<br>(pins 1, 2 and 3);<br>see Figs 6 and 7 | —    | —    | 350  | ns         |
| SR                | slew rate between 50 V to ( $V_{DD} - 50\text{ V}$ ) (pins 7, 8 and 9)                                    | $V_i = 4\text{ V (p-p)}$ square wave; $f < 1\text{ MHz}$ ; $t_r = t_f = 40\text{ ns}$ (pins 1, 2 and 3)                                      | —    | 1850 | —    | V/ $\mu$ s |
| $O_v$             | cathode output voltage overshoot (pins 7, 8 and 9)                                                        | $V_{O(c)} = 100\text{ V (p-p)}$<br>square wave; $f < 1\text{ MHz}$ ;<br>$t_r = t_f = 40\text{ ns}$<br>(pins 1, 2 and 3);<br>see Figs 6 and 7 | —    | 10   | —    | %          |
| PSRR              | power supply rejection ratio                                                                              | $f < 50\text{ kHz}$ ; note 2                                                                                                                 | —    | 65   | —    | dB         |
| $\alpha_{ct(DC)}$ | DC crosstalk between channels                                                                             |                                                                                                                                              | —    | 50   | —    | dB         |

## Notes

1. See also Fig.5 for the typical DC-to-DC transfer of  $V_i$  to  $V_{O(c)}$ .
2. The ratio of the change in supply voltage to the change in input voltage when there is no change in output voltage.

Triple video output amplifier

TDA6108JF

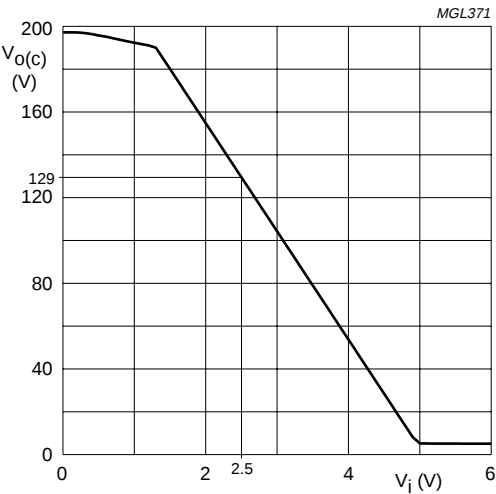


Fig.5 Typical DC-to-DC transfer of  $V_i$  to  $V_{o(c)}$ .

Triple video output amplifier

TDA6108JF

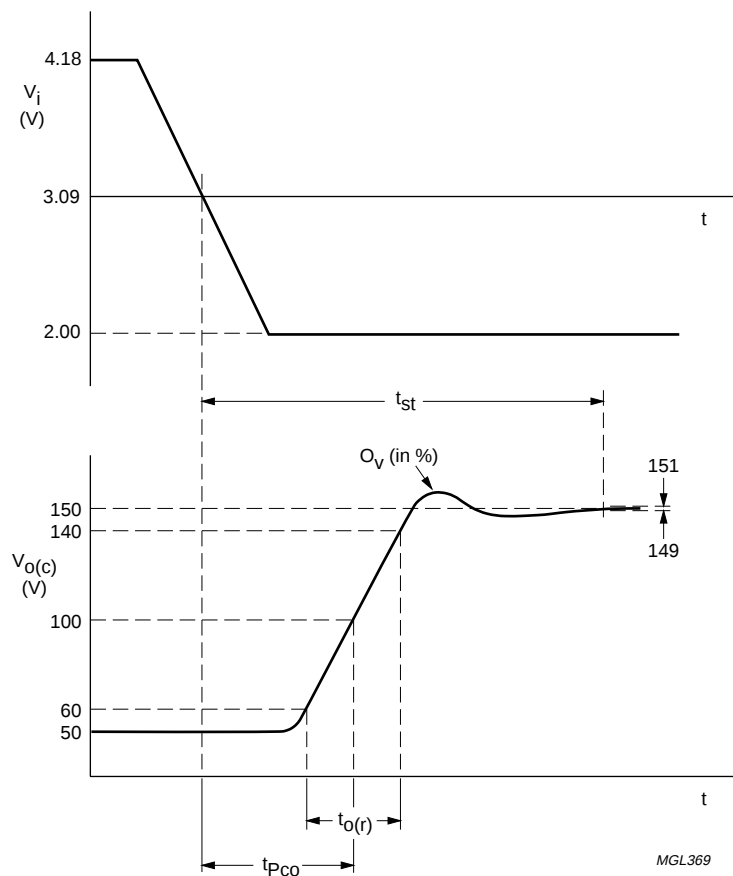


Fig.6 Output voltage (pins 7, 8 and 9) rising edge as a function of the AC input signal.

Triple video output amplifier

TDA6108JF

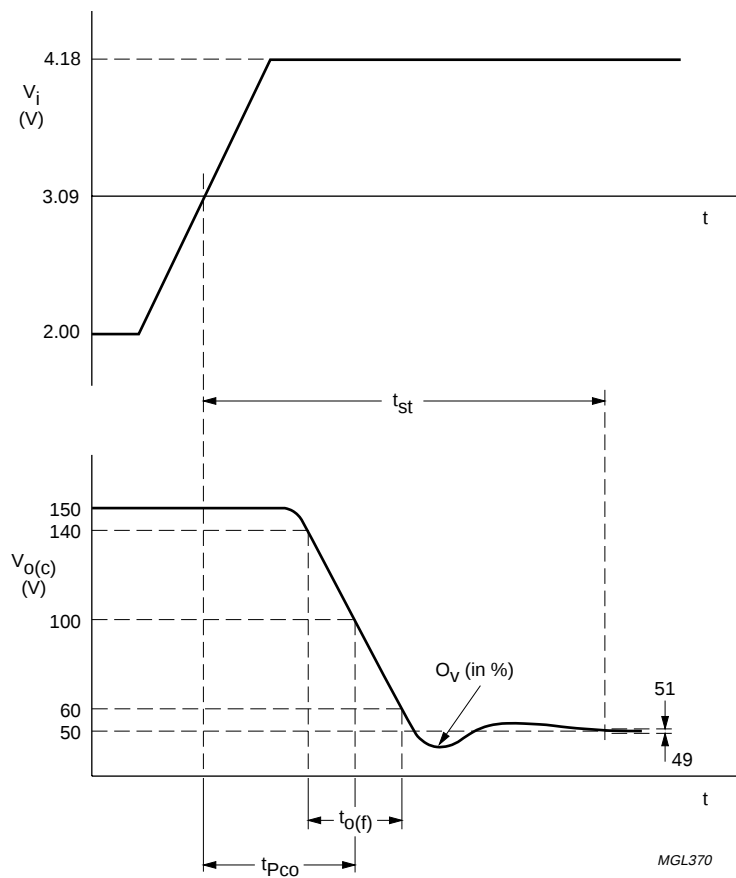


Fig.7 Output voltage (pins 7, 8 and 9) falling edge as a function of the AC input signal.

## Triple video output amplifier

## TDA6108JF

**External flashover protection**

For sufficient flashover protection it is necessary to apply an external diode and 100  $\Omega$  resistor for each channel. See application note "Application and Product description of TDA6107Q/N1" (report number AN96072).

To limit the diode current an external 1 k $\Omega$  carbon high-voltage resistor in series with the external diode 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 behaviour (e.g. foil); this capacitor must be placed as close as possible to pins 6 and 4, but definitely within 5 mm.
2. With a capacitor >3.3  $\mu$ F on the picture tube base print.

**Switch-off behaviour**

The switch-off behaviour of the TDA6108JF is controllable. This is due to the fact that the output pins of the TDA6108JF are still under control of the input pins for low power supply voltages (approximately 30 V and higher).

**Bandwidth**

The addition of the flash resistor produces a decreased bandwidth and increases rise and fall times. For further information, see Application note of the TDA6108JF.

**Dissipation**

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

The static dissipation of the TDA6108JF is due to voltage supply currents and load currents in the feedback network and CRT.

The static dissipation  $P_{stat}$  equals:

$$P_{stat} = V_{DD} \times I_{DD} + 3 \times V_{O(c)} \times I_{O(c)}$$

Where:

$V_{DD}$  = supply voltage

$I_{DD}$  = supply current

$V_{O(c)}$  = DC value of cathode voltage

$I_{O(c)}$  = DC value of cathode current.

The dynamic dissipation  $P_{dyn}$  equals:

$$P_{dyn} = 3 \times V_{DD} \times (C_L + C_{int}) \times f_i \times V_{o(c)(p-p)} \times \delta$$

Where:

$C_L$  = load capacitance

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

$f_i$  = input frequency

$V_{o(c)(p-p)}$  = output voltage (peak-to-peak value)

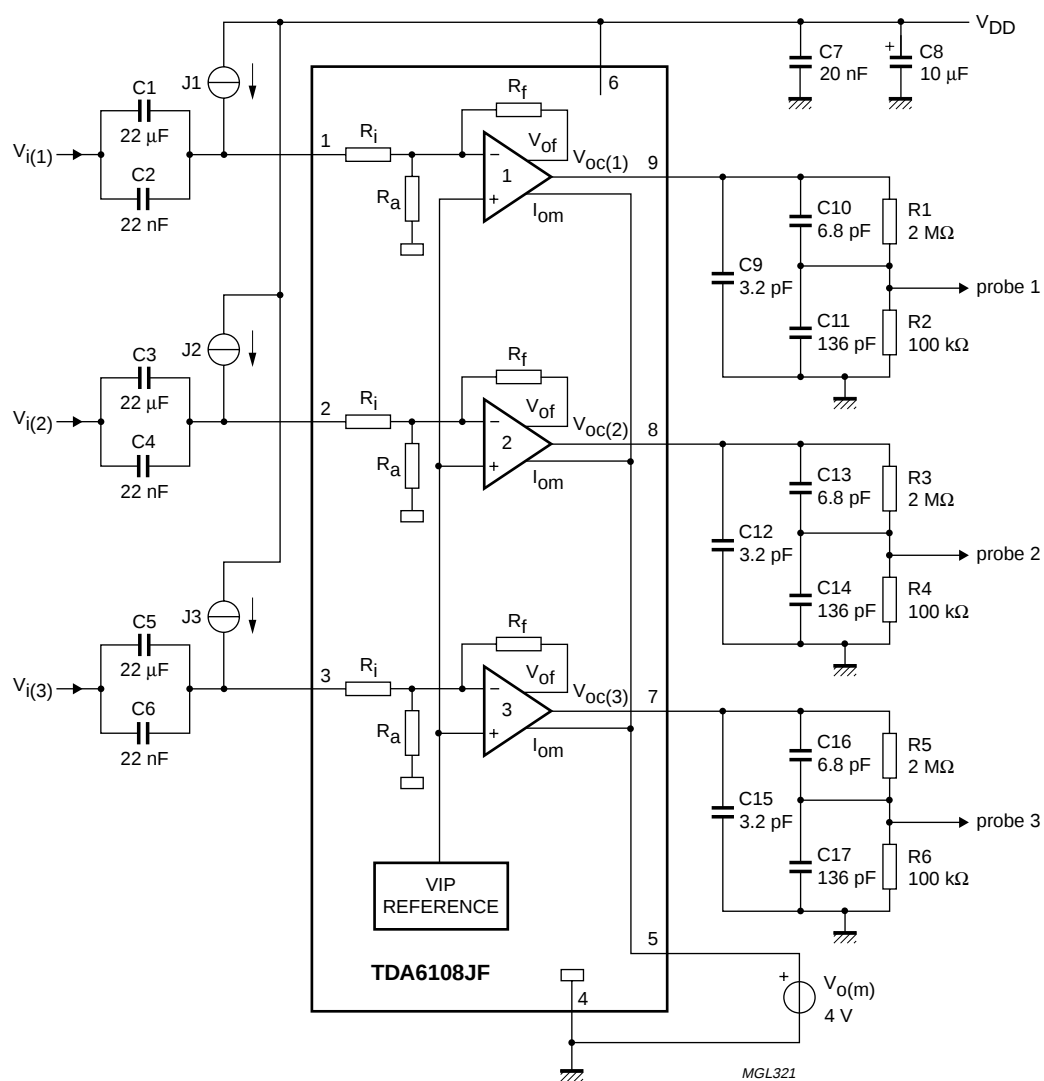
$\delta$  = non-blanking duty cycle.

The IC must be mounted on the picture tube base print to minimize the load capacitance  $C_L$ .

## Triple video output amplifier

## TDA6108JF

## TEST AND APPLICATION INFORMATION



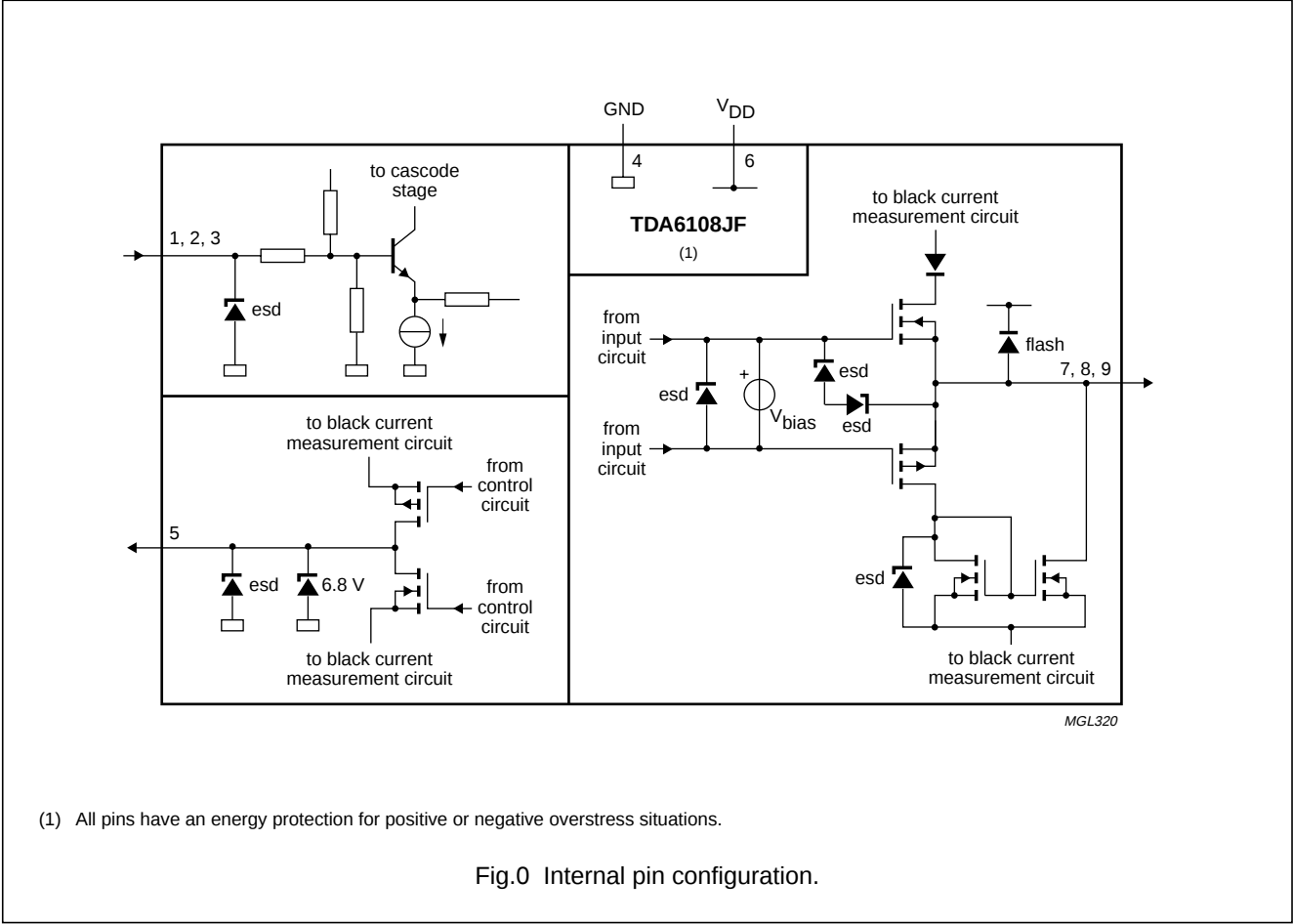
Current sources J1, J2 and J3 are to be tuned so that  $V_{oc}$  of pins 9, 8 and 7 is set to 100 V.

Fig.8 Test circuit.

Triple video output amplifier

TDA6108JF

INTERNAL CIRCUITRY



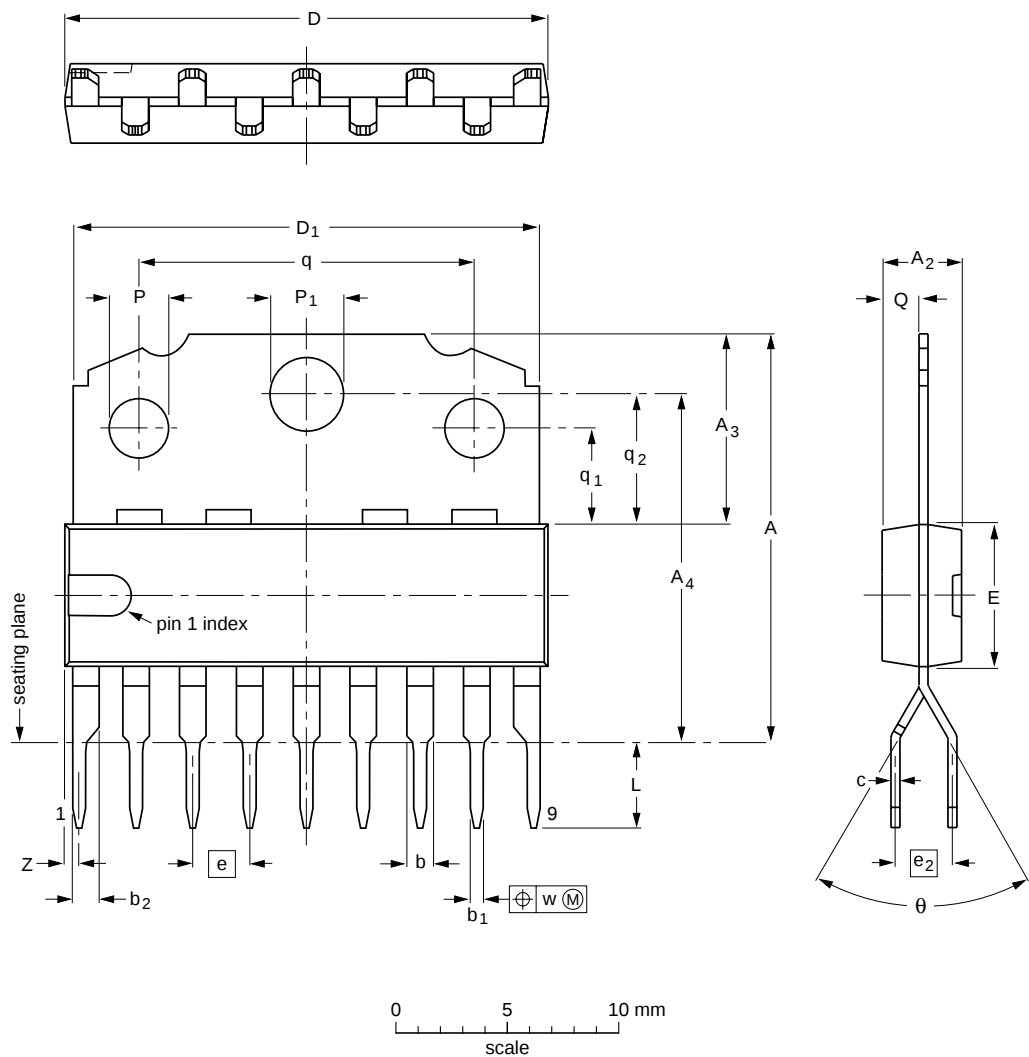
Triple video output amplifier

TDA6108JF

PACKAGE OUTLINE

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

SOT111-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A            | A <sub>2</sub><br>max. | A <sub>3</sub> | A <sub>4</sub> | b            | b <sub>1</sub> | b <sub>2</sub> | c            | D <sup>(1)</sup> | D <sub>1</sub> | E <sup>(1)</sup> | e            | e <sub>2</sub> | L            | P          | P <sub>1</sub> | Q            | q          | q <sub>1</sub> | q <sub>2</sub> | w   | Z <sup>(1)</sup><br>max.           | θ |
|------|--------------|------------------------|----------------|----------------|--------------|----------------|----------------|--------------|------------------|----------------|------------------|--------------|----------------|--------------|------------|----------------|--------------|------------|----------------|----------------|-----|------------------------------------|---|
| mm   | 18.5<br>17.8 | 3.7                    | 8.7<br>8.0     | 15.5<br>15.1   | 1.40<br>1.14 | 0.67<br>0.50   | 1.40<br>1.14   | 0.48<br>0.38 | 21.8<br>21.4     | 21.4<br>20.7   | 6.48<br>6.20     | 2.54<br>2.54 | 3.9<br>3.4     | 2.75<br>2.50 | 3.4<br>3.2 | 1.75<br>1.55   | 15.1<br>14.9 | 4.4<br>4.2 | 5.9<br>5.7     | 0.25           | 1.0 | 65 <sup>o</sup><br>55 <sup>o</sup> |   |

Note  
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|-------|------|--|------------------------|----------------------|
|                    | IEC        | JEDEC | EIAJ |  |                        |                      |
| SOT111-1           |            |       |      |  |                        | 92-11-17<br>95-03-11 |

## Triple video output amplifier

## TDA6108JF

**SOLDERING****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.

**Soldering by dipping or by solder wave**

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joints for more than 5 seconds.

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.

**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 and 400 °C, contact may be up to 5 seconds.

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

| PACKAGE                   | SOLDERING METHOD |                         |
|---------------------------|------------------|-------------------------|
|                           | DIPPING          | WAVE                    |
| DBS, DIP, HDIP, SDIP, SIL | suitable         | suitable <sup>(1)</sup> |

**Note**

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

**DEFINITIONS**

| Data sheet status                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Objective specification                                                                                                                                                                                                                                                                                                                                                                                                                                   | This data sheet contains target or goal specifications for product development.       |
| Preliminary specification                                                                                                                                                                                                                                                                                                                                                                                                                                 | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification                                                                                                                                                                                                                                                                                                                                                                                                                                     | This data sheet contains final product specifications.                                |
| Limiting values                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                       |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). 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. |                                                                                       |
| Application information                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                       |
| Where application information is given, it is advisory and does not form part of the specification.                                                                                                                                                                                                                                                                                                                                                       |                                                                                       |

**LIFE SUPPORT APPLICATIONS**

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

---

Triple video output amplifier

TDA6108JF

---

**NOTES**

# Philips Semiconductors – a worldwide company

**Argentina:** see South America

**Australia:** 3 Figtree Drive, HOMEBUSH, NSW 2140,  
Tel. +61 2 9704 8141, Fax. +61 2 9704 8139

**Austria:** Computerstr. 6, A-1101 WIEN, P.O. Box 213,  
Tel. +43 1 60 101 1248, Fax. +43 1 60 101 1210

**Belarus:** Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,  
220050 MINSK, Tel. +375 172 20 0733, Fax. +375 172 20 0773

**Belgium:** see The Netherlands

**Brazil:** see South America

**Bulgaria:** Philips Bulgaria Ltd., Energoproject, 15th floor,  
51 James Bourchier Blvd., 1407 SOFIA,  
Tel. +359 2 68 9211, Fax. +359 2 68 9102

**Canada:** PHILIPS SEMICONDUCTORS/COMPONENTS,  
Tel. +1 800 234 7381, Fax. +1 800 943 0087

**China/Hong Kong:** 501 Hong Kong Industrial Technology Centre,  
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,  
Tel. +852 2319 7888, Fax. +852 2319 7700

**Colombia:** see South America

**Czech Republic:** see Austria

**Denmark:** Sydhavnsgade 23, 1780 COPENHAGEN V,  
Tel. +45 33 29 3333, Fax. +45 33 29 3905

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,  
Tel. +358 9 615 800, Fax. +358 9 6158 0920

**France:** 51 Rue Carnot, BP317, 92156 SURESNES Cedex,  
Tel. +33 1 4099 6161, Fax. +33 1 4099 6427

**Germany:** Hammerbrookstraße 69, D-20097 HAMBURG,  
Tel. +49 40 2353 60, Fax. +49 40 2353 6300

**Hungary:** see Austria

**India:** Philips INDIA Ltd, Band Box Building, 2nd floor,  
254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025,  
Tel. +91 22 493 8541, Fax. +91 22 493 0966

**Indonesia:** PT Philips Development Corporation, Semiconductors Division,  
Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510,  
Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

**Ireland:** Newstead, Clonskeagh, DUBLIN 14,  
Tel. +353 1 7640 000, Fax. +353 1 7640 200

**Israel:** RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,  
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

**Italy:** PHILIPS SEMICONDUCTORS, Via Casati, 23 - 20052 MONZA (MI),  
Tel. +39 039 203 6838, Fax +39 039 203 6800

**Japan:** Philips Bldg 13-37, Kohnan 2-chome, Minato-ku,  
TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5057

**Korea:** Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,  
Tel. +82 2 709 1412, Fax. +82 2 709 1415

**Malaysia:** No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,  
Tel. +60 3 750 5214, Fax. +60 3 757 4880

**Mexico:** 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,  
Tel. +9-5 800 234 7381, Fax +9-5 800 943 0087

**Middle East:** see Italy

**Netherlands:** Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,  
Tel. +31 40 27 82785, Fax. +31 40 27 88399

**New Zealand:** 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,  
Tel. +64 9 849 4160, Fax. +64 9 849 7811

**Norway:** Box 1, Manglerud 0612, OSLO,  
Tel. +47 22 74 8000, Fax. +47 22 74 8341

**Pakistan:** see Singapore

**Philippines:** Philips Semiconductors Philippines Inc.,  
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,  
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

**Poland:** Al.Jerozolimskie 195 B, 02-222 WARSAW,  
Tel. +48 22 5710 000, Fax. +48 22 5710 001

**Portugal:** see Spain

**Romania:** see Italy

**Russia:** Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,  
Tel. +7 095 755 6918, Fax. +7 095 755 6919

**Singapore:** Lorong 1, Toa Payoh, SINGAPORE 319762,  
Tel. +65 350 2538, Fax. +65 251 6500

**Slovakia:** see Austria

**Slovenia:** see Italy

**South Africa:** S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,  
2092 JOHANNESBURG, P.O. Box 58088 Newville 2114,  
Tel. +27 11 471 5401, Fax. +27 11 471 5398

**South America:** Al. Vicente Pinzon, 173, 6th floor,  
04547-130 SÃO PAULO, SP, Brazil,  
Tel. +55 11 821 2333, Fax. +55 11 821 2382

**Spain:** Balmes 22, 08007 BARCELONA,  
Tel. +34 93 301 6312, Fax. +34 93 301 4107

**Sweden:** Kottbygatan 7, Akalla, S-16485 STOCKHOLM,  
Tel. +46 8 5985 2000, Fax. +46 8 5985 2745

**Switzerland:** Allmendstrasse 140, CH-8027 ZÜRICH,  
Tel. +41 1 488 2741 Fax. +41 1 488 3263

**Taiwan:** Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,  
TAIPEI, Taiwan Tel. +886 2 2134 2886, Fax. +886 2 2134 2874

**Thailand:** PHILIPS ELECTRONICS (THAILAND) Ltd.,  
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,  
Tel. +66 2 745 4090, Fax. +66 2 398 0793

**Turkey:** Yukari Dudullu, Org. San. Blg., 2.Cad. Nr. 28 81260 Umraniye,  
ISTANBUL, Tel. +90 216 522 1500, Fax. +90 216 522 1813

**Ukraine:** PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,  
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

**United Kingdom:** Philips Semiconductors Ltd., 276 Bath Road, Hayes,  
MIDDLESEX UB3 5BX, Tel. +44 208 730 5000, Fax. +44 208 754 8421

**United States:** 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,  
Tel. +1 800 234 7381, Fax. +1 800 943 0087

**Uruguay:** see South America

**Vietnam:** see Singapore

**Yugoslavia:** PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,  
Tel. +381 11 62 5344, Fax.+381 11 63 5777

**For all other countries apply to:** Philips Semiconductors,  
International Marketing & Sales Communications, Building BE-p, P.O. Box 218,  
5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

**Internet:** <http://www.semiconductors.philips.com>

© Philips Electronics N.V. 1999

SCA 68

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands

545004/200/03/pp16

Date of release: 1999 Oct 29

Document order number: 9397 750 06486

*Let's make things better.*

**Philips  
Semiconductors**



**PHILIPS**