

# DATA SHEET

**TDA6107JF**

Triple video output amplifier

Product specification

2002 Oct 18

# Triple video output amplifier

# TDA6107JF

## FEATURES

- Typical bandwidth of 5.5 MHz for an output signal of 60 V (p-p)
- High slew rate of 900 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 50
- Black-Current Stabilization (BCS) circuit with voltage window from 1.8 to 6 V and current window from -100 μA to 10 mA
- Thermal protection
- Internal protection against positive flashover discharges appearing on the CRT.

## GENERAL DESCRIPTION

The TDA6107JF includes three video output amplifiers and is intended to drive the three cathodes of a colour CRT directly. 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.

## ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA6107JF	DBS9MPF	plastic DIL-bent-SIL medium power package with fin; 9 leads	SOT111-1

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BLOCK DIAGRAM

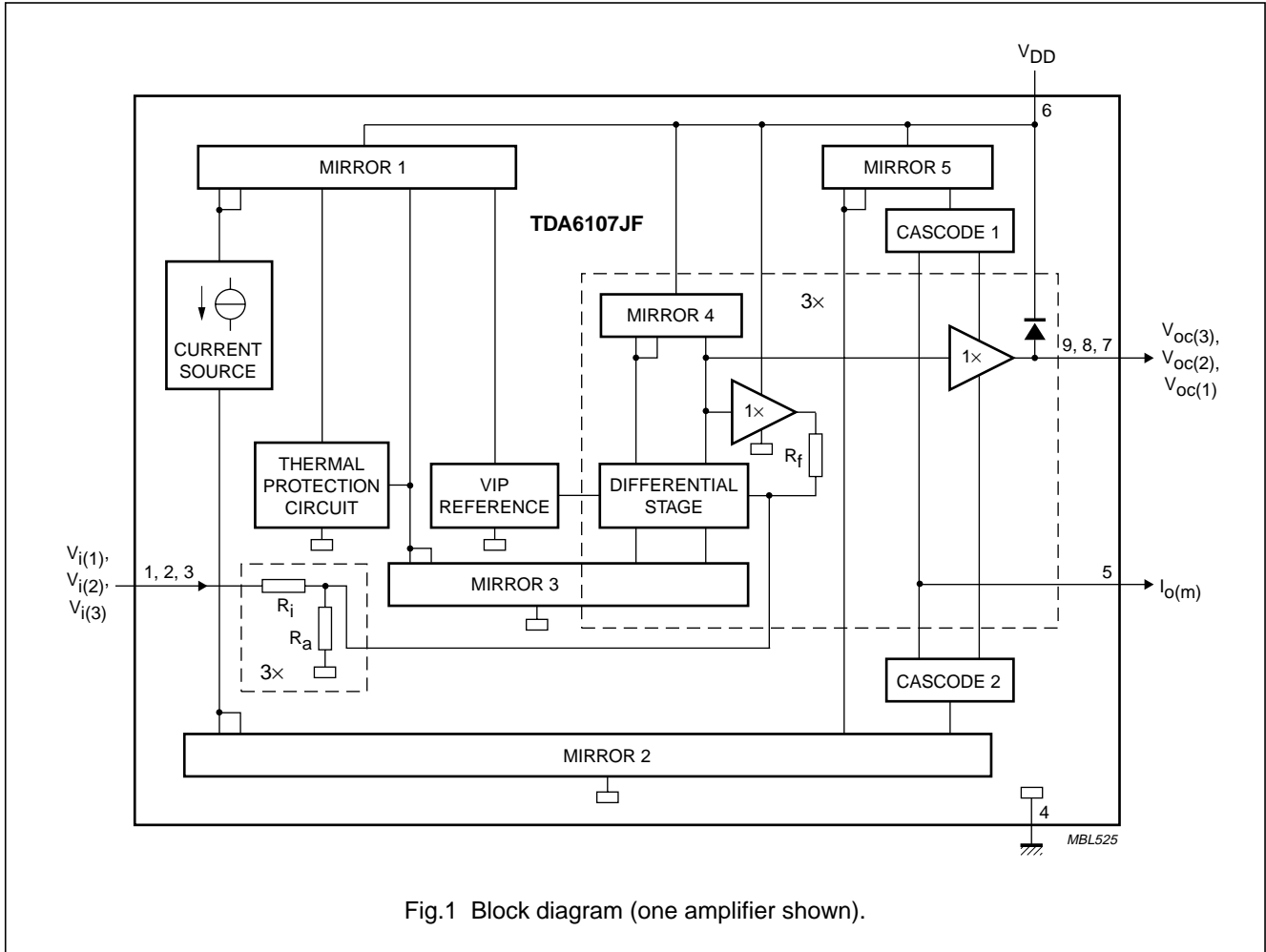


Fig.1 Block diagram (one amplifier shown).

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

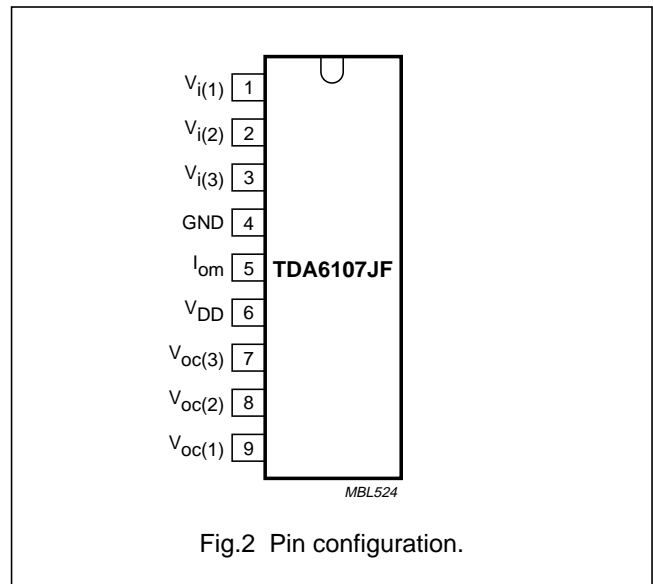


Fig.2 Pin configuration.

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**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 60134); 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 at pins 1 to 3	0	12	V
$V_{o(m)}$	measurement output voltage	0	6	V
$V_{oc}$	cathode output voltage	0	$V_{DD}$	V
$I_{ocsm(L)}$	LOW non-repetitive peak cathode output current at a flashover discharge of 100 $\mu$ C	0	3	A
$I_{ocsm(H)}$	HIGH non-repetitive peak cathode output current at a flashover discharge of 100 nC	0	6	A
$T_{stg}$	storage temperature	-55	+150	$^{\circ}$ C
$T_j$	junction temperature	-20	+150	$^{\circ}$ C
$V_{es}$	electrostatic handling voltage			
	Human Body Model (HBM)	-	3000	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 and can be found in the "Quality reference Handbook". The handbook can be ordered using the code 9397 750 00192.

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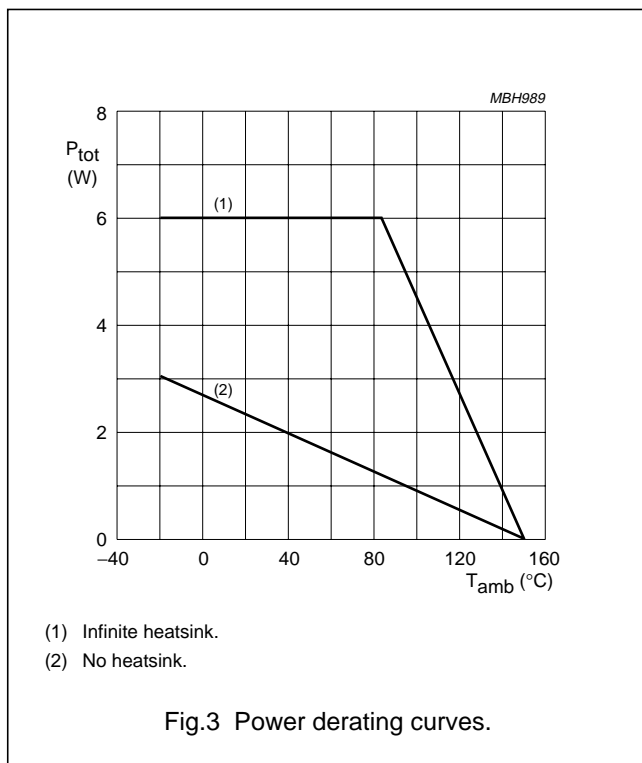
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**THERMAL CHARACTERISTICS**

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		18	K/W

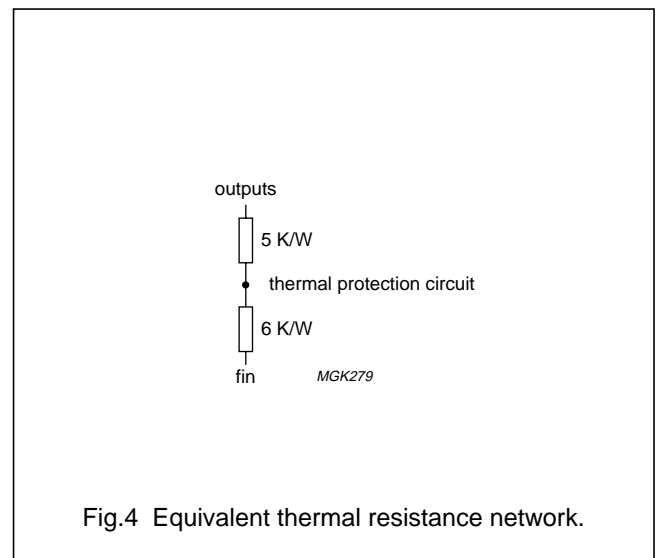
**Note**

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).



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**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		5.6	6.6	7.6	mA
$V_{ref(int)}$	internal reference voltage (input stage)		–	2.5	–	V
$R_i$	input resistance		–	3.6	–	k $\Omega$
G	gain of amplifier		47.5	51.0	55.0	
$\Delta G$	gain difference		–2.5	0	+2.5	
$V_{O(oc)}$	nominal output voltage at pins 7, 8 and 9 (DC value)	$I_i = 0$ $\mu$ A	116	129	142	V
$\Delta V_{O(oc)(offset)}$	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 three channels)	$I_{o(c)} = 0$ $\mu$ A; $1.5$ V < $V_i$ < $5.5$ V; $1.8$ V < $V_{o(m)}$ < $6$ V	–50	–	+50	$\mu$ A
$\Delta I_{o(m)}/\Delta I_{o(c)}$	linearity of current transfer (for three channels)	$-100$ $\mu$ A < $I_{o(c)}$ < $100$ $\mu$ A; $1.5$ V < $V_i$ < $5.5$ V; $1.8$ V < $V_{o(m)}$ < $6$ V	–0.9	–1.0	–1.1	
		$-100$ $\mu$ A $\leq I_{o(c)} < 10$ mA; $1.5$ V < $V_i$ < $5.5$ V; $1.8$ V < $V_{o(m)}$ < $4$ 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	–	20	–	mA
$V_{o(c)(min)}$	minimum output voltage (pins 7, 8 and 9)	$V_i = 7.0$ V; at $I_{o(c)} = 0$ mA; note 1	–	–	10	V
$V_{o(c)(max)}$	maximum output voltage (pins 7, 8 and 9)	$V_i = 1.0$ V; at $I_{o(c)} = 0$ mA; note 1	$V_{DD} - 15$	–	–	V
$B_S$	small signal bandwidth (pins 7, 8 and 9)	$V_{o(c)} = 60$ V (p-p)	–	5.5	–	MHz
$B_L$	large signal bandwidth (pins 7, 8 and 9)	$V_{o(c)} = 100$ V (p-p)	–	4.5	–	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; $t_r = t_f = 40$ ns (pins 1, 2 and 3); see Figs 6 and 7	–	60	–	ns

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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)	$V_{O(c)} = 100$ V (p-p) square wave; $f < 1$ MHz; $t_r = t_f = 40$ ns (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)	$V_{O(c)} = 50$ to 150 V square wave; $f < 1$ MHz; $t_f = 40$ ns (pins 1, 2 and 3); see Fig.6	67	91	113	ns
$t_{o(f)}$	cathode output fall time 90% output to 10% output (pins 7, 8 and 9)	$V_{O(c)} = 150$ to 50 V square wave; $f < 1$ MHz; $t_r = 40$ ns (pins 1, 2 and 3); see Fig.7	67	91	113	ns
$t_{st}$	settling time 50% input to 99% < output < 101% (pins 7, 8 and 9)	$V_{O(c)} = 100$ V (p-p) square wave; $f < 1$ MHz; $t_r = t_f = 40$ ns (pins 1, 2 and 3); see Figs 6 and 7	-	-	350	ns
SR	slew rate between 50 V to ( $V_{DD} - 50$ V) (pins 7, 8 and 9)	$V_i = 4$ V (p-p) square wave; $f < 1$ MHz; $t_r = t_f = 40$ ns (pins 1, 2 and 3)	-	900	-	V/ $\mu$ s
$O_v$	cathode output voltage overshoot (pins 7, 8 and 9)	$V_{O(c)} = 100$ V (p-p) square wave; $f < 1$ MHz; $t_r = t_f = 40$ ns (pins 1, 2 and 3); see Figs 6 and 7	-	2	-	%
PSRR	power supply rejection ratio	$f < 50$ kHz; note 2	-	55	-	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  $V_{O(oc)}$ .
2. The ratio of the change in supply voltage to the change in input voltage when there is no change in output voltage.

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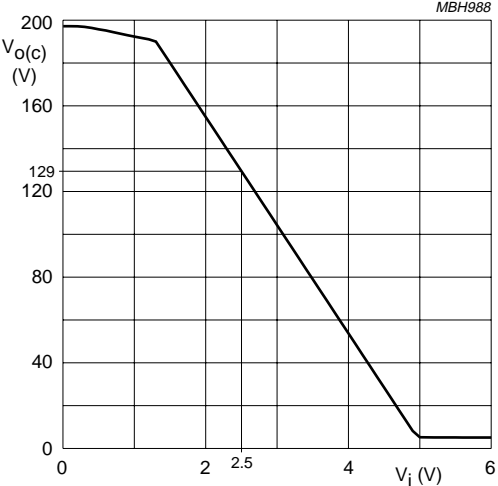


Fig.5 Typical DC-to-DC transfer of  $V_i$  to  $V_{oc}$ .



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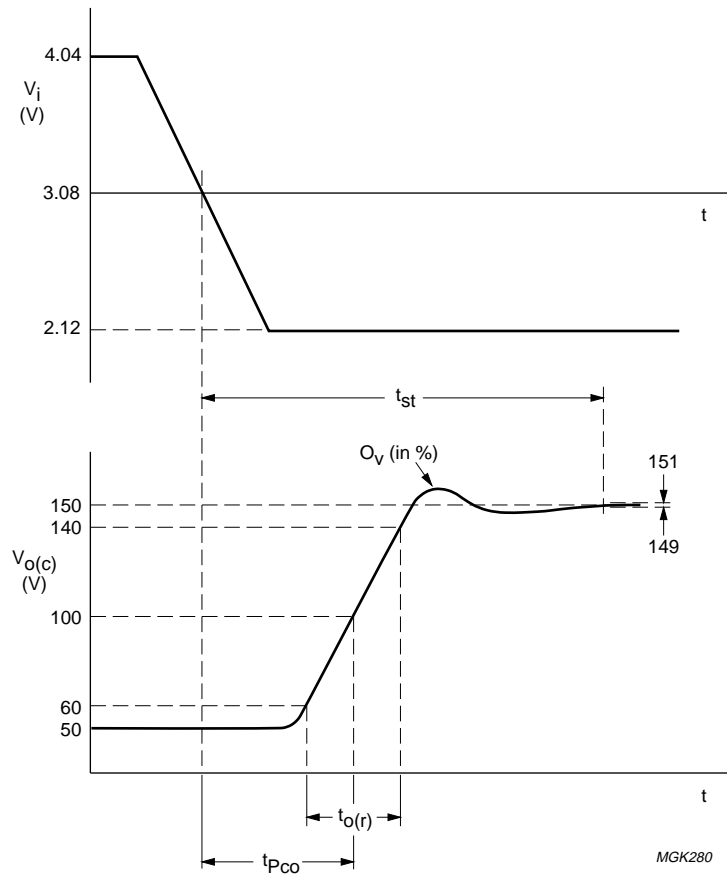


Fig.6 Output voltage (pins 7, 8 and 9) rising edge as a function of the AC input signal.

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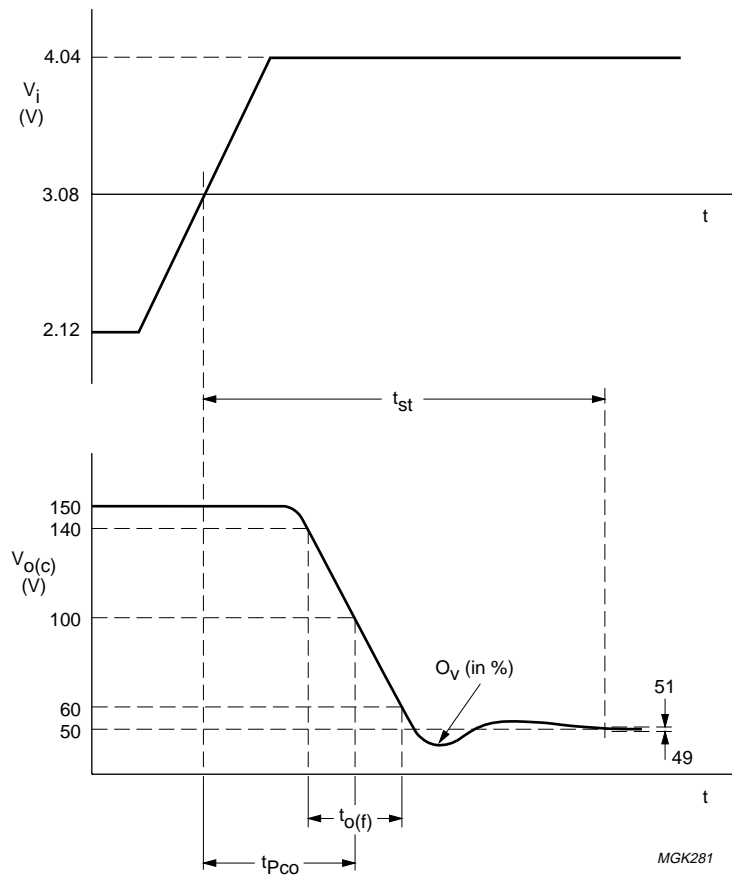


Fig.7 Output voltage (pins 7, 8 and 9) falling edge as a function of the AC input signal.

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### Cathode output

The cathode output is protected against peak current (caused by positive voltage peaks during high-resistance flash) of 3 A maximum with a charge content of 100  $\mu\text{C}$  <sup>(1)</sup>.

The cathode is also protected against peak currents (caused by positive voltage peaks during low-resistance flash) of 6 A maximum with a charge content of 100 nC <sup>(1)</sup>.

The DC voltage of  $V_{\text{DD}}$  (pin 6) must be within the operating range of 180 to 210 V during the peak currents.

### Flashover protection

The TDA6107JF incorporates protection diodes against CRT flashover discharges that clamp the cathodes output voltage up to a maximum of  $V_{\text{DD}} + V_{\text{diode}}$ .

To limit the diode current an external 1.5 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 <sup>(1)</sup>).

$V_{\text{DD}}$  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  $\mu\text{F}$  on the picture tube base print, depending on the CRT size.

### Switch-off behaviour

The switch-off behaviour of the TDA6107JF is controllable. This is because the output pins of the TDA6107JF 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 the rise and fall times; see "Application Note AN96072".

### 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 TDA6107JF 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 voltage

$I_{\text{OC}}$  = DC value of cathode 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

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

$\delta$  = non-blanking duty cycle.

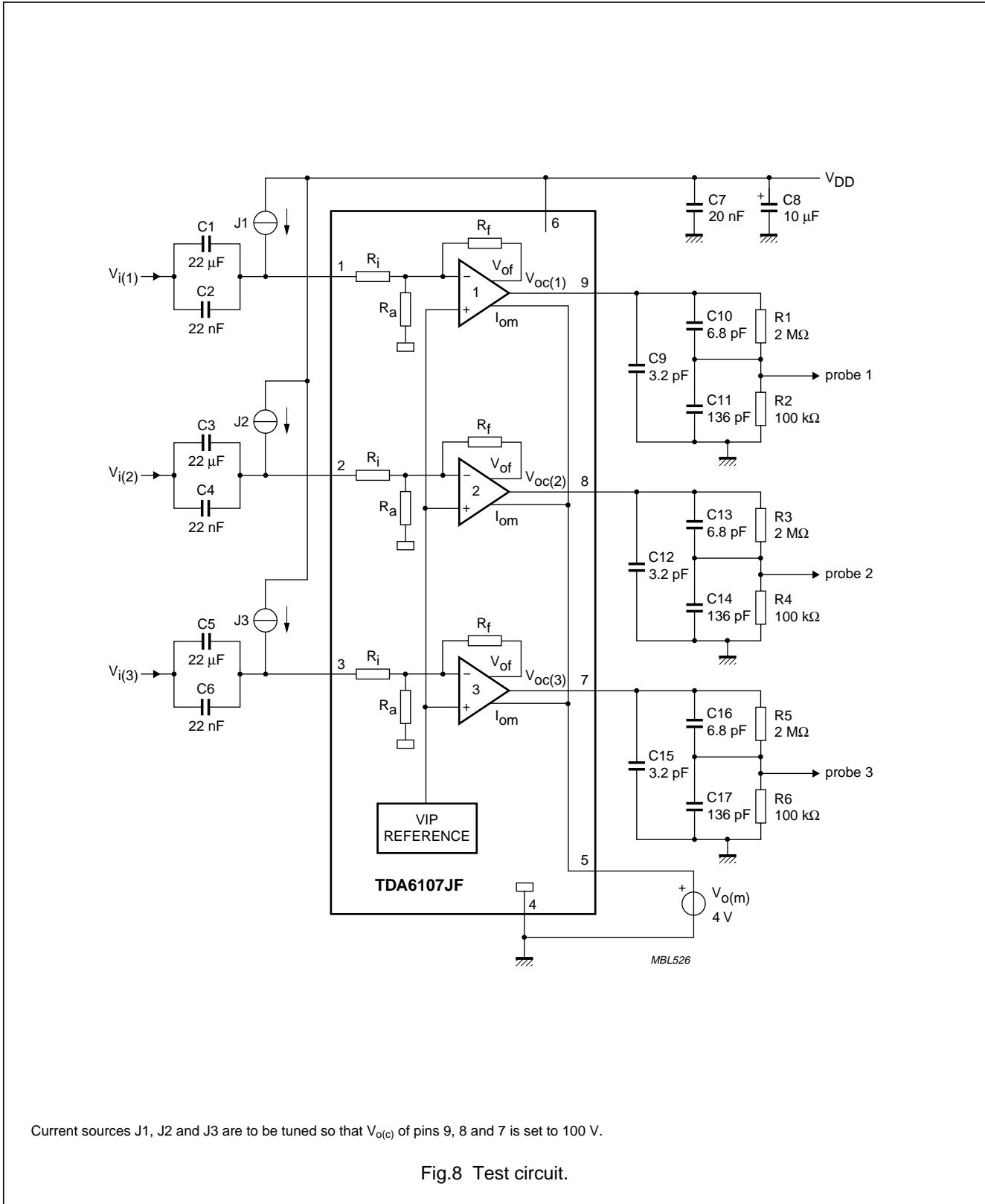
The IC must be mounted on the picture tube base print to minimize the load capacitance  $C_{\text{L}}$ .

(1) External protection against higher currents is described in "Application Note AN96072".

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TEST AND APPLICATION INFORMATION



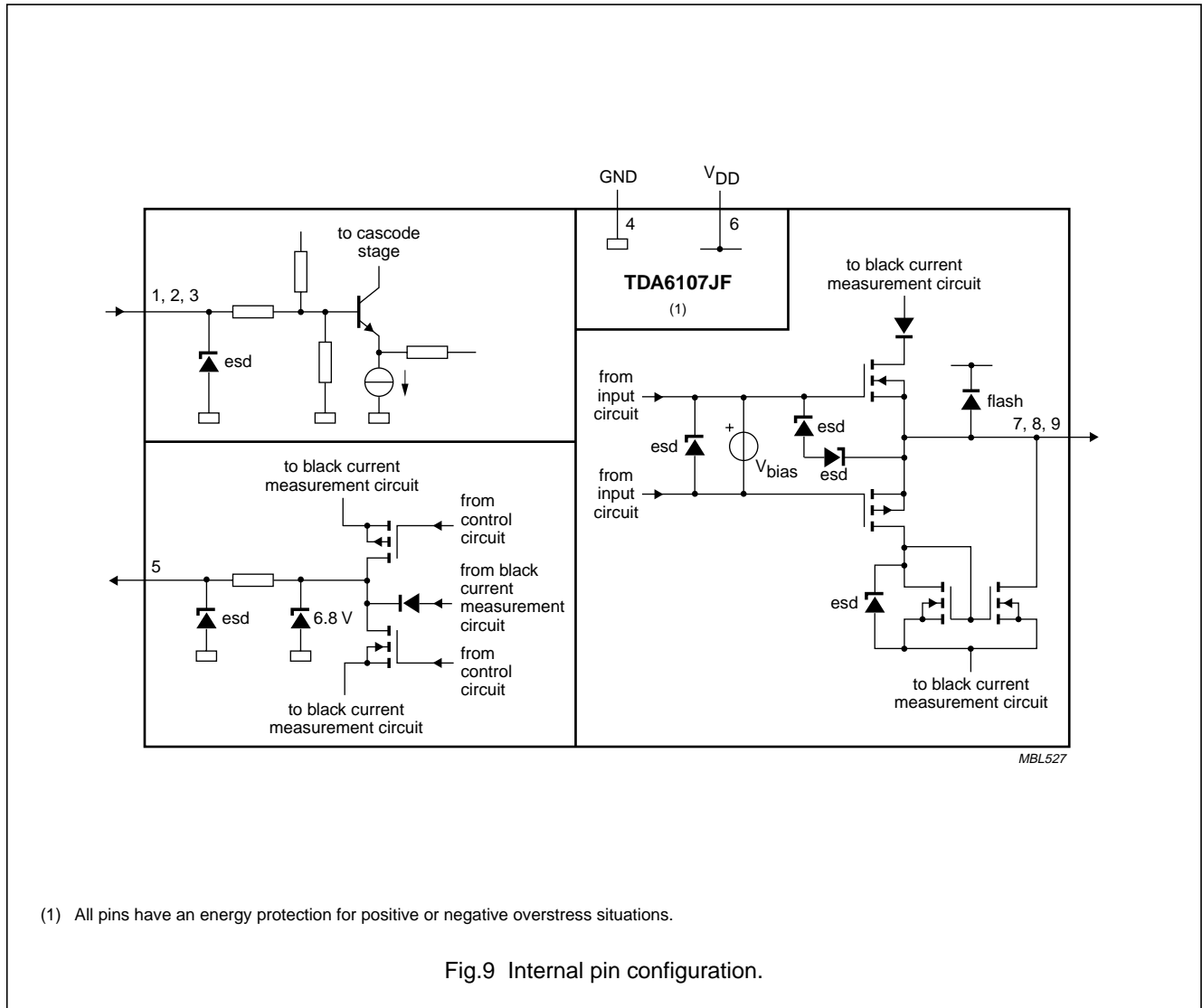
Current sources J1, J2 and J3 are to be tuned so that  $V_{o(c)}$  of pins 9, 8 and 7 is set to 100 V.

Fig.8 Test circuit.

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INTERNAL CIRCUITRY



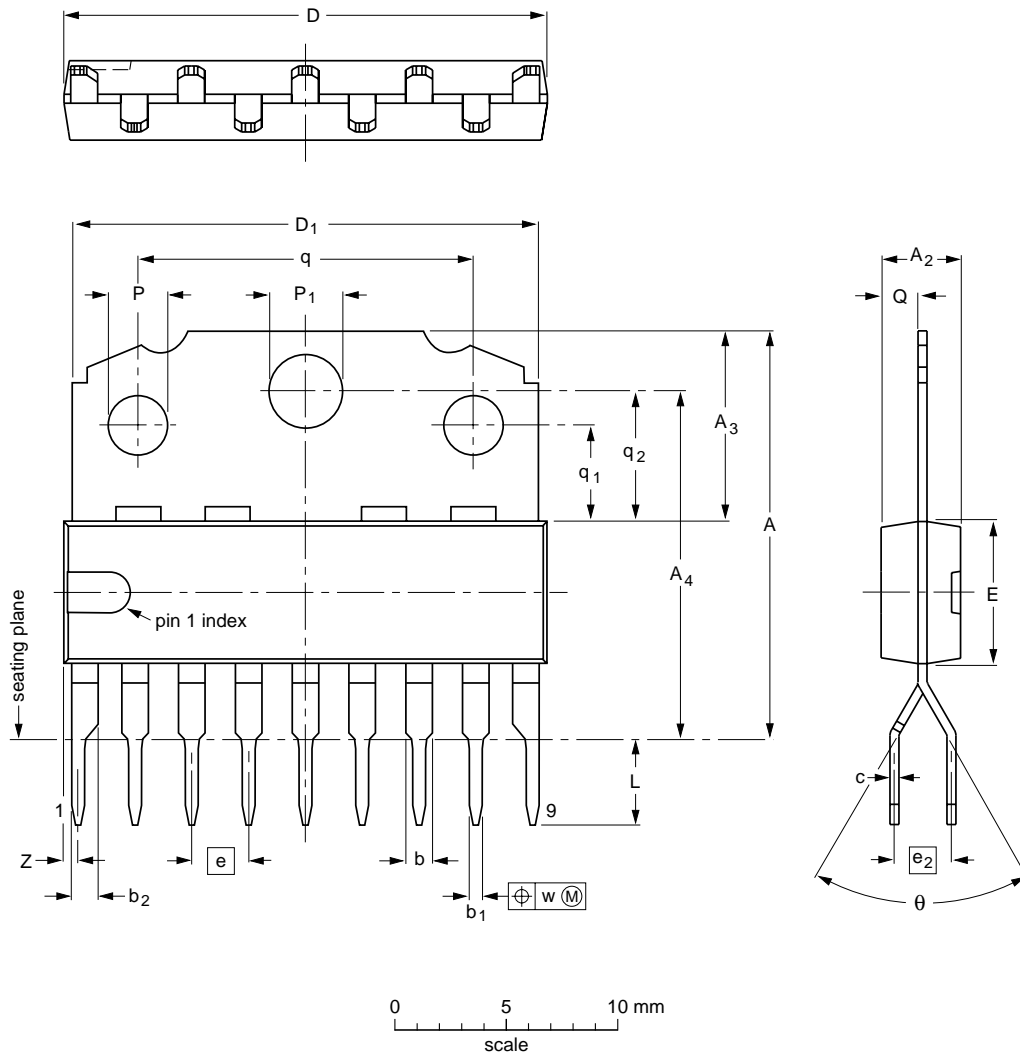
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PACKAGE OUTLINE

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> 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> max.	$\theta$
mm	18.5 17.8	3.7	8.7 8.0	15.5 15.1	1.40 1.14	0.67 0.50	1.40 1.14	0.48 0.38	21.8 21.4	21.4 20.7	6.48 6.20	2.54 2.54	2.54	3.9 3.4	2.75 2.50	3.4 3.2	1.75 1.55	15.1 14.9	4.4 4.2	5.9 5.7	0.25	1.0	65° 55°

Note

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

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

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**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.

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## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(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.
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## Notes

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

## 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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**NOTES**

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**NOTES**

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