

DATA SHEET

TEA5591A AM/FM radio receiver circuit

Product specification
File under Integrated Circuits, IC01

February 1990

AM/FM radio receiver circuit**TEA5591A**

GENERAL DESCRIPTION

The TEA5591A is a 24-pin integrated radio circuit, derived from the TEA5591 and is designed for use in AM/FM portable radios and clock radios. The TEA5591A differs from the TEA5591 in that it has:

- Separate IF input pins for AM and FM
- A split-up AM-IF stage (for distributed selectivity)
- An LED driver indicator

The main advantage of the TEA5591A is its ability to operate over a wide range of supply voltages (1.8 to 15 V) without any loss of performance.

The AM circuit incorporates:

- A double balance mixer
- A 'one-pin' oscillator with amplitude control operating in the 0.6 to 30 MHz frequency range
- A split-up IF amplifier
- A detector
- An AGC circuit which controls the IF amplifier and mixer.

The FM circuit incorporates:

- An RF input amplifier
- A double balanced mixer
- A 'one-pin' oscillator
- Two IF amplifiers (for distributed selectivity)
- A quadrature demodulator for a ceramic filter
- Internal AFC

Features

- LED AM/FM indicator
- A DC AM/FM switch facility
- Three separate stabilizers to enable operation over a wide range of supply voltages (1.8 to 15 V)
- All pins (except pin 10) are ESD protected

PACKAGE OUTLINE

24-lead shrink DIL; plastic (SOT234); SOT234-1; 1996 September 9.

AM/FM radio receiver circuit

TEA5591A

QUICK REFERENCE DATA

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage (pin 8)		V_P	1.8	–	15	V
Total current consumption						
AM part		I_P	–	14	–	mA
FM part		I_P	–	17	–	mA
Operating ambient temperature range		T_{amb}	–15	–	+ 60	°C
AM performance (pin 1)	note 1					
Sensitivity	$V_o = 10$ mV	V_i	–	3.5	–	μ V
	$(S + N)/N = 26$ dB	V_i	–	17	–	μ V
Signal-to-noise ratio	$V_i = 1$ mV	$(S + N)/N$	–	48	–	dB
AF output voltage		V_o	–	45	–	mV
Total harmonic distortion		THD	–	0.7	–	%
Signal handling	$m = 80\%$; THD = 8%	V_i	–	100	–	mV
FM performance (pin 2)	note 2					
Limiting sensitivity	–3 dB	V_i	–	2.3	–	μ V
Signal-to-noise ratio	$V_i = 2.5$ μ V	$(S + N)/N$	–	26	–	dB
	$V_i = 1$ mV	$(S + N)/N$	–	60	–	dB
AF output voltage		V_o	–	90	–	mV
Total harmonic distortion		THD	–	0.8	–	%
Signal handling		V_i	–	100	–	mV
AM suppression	100 μ V < V_i < 100 mV	AMS	–	40	–	dB

Notes to the quick reference data

- All parameters are measured in the application circuit (see Fig.4) at nominal supply voltage $V_P = 3$ V; $T_{amb} = 25$ °C; unless otherwise specified. RF conditions: Input frequency 1 MHz; 30% modulated with $f_{mod} = 1$ kHz; unless otherwise specified.
- All parameters are measured in the application circuit (see Fig.4) at nominal supply voltage $V_P = 3$ V; $T_{amb} = 25$ °C; unless otherwise specified. RF conditions: Input frequency 100 MHz; frequency deviation $\Delta f = 22.5$ kHz and $f_{mod} = 1$ kHz; unless otherwise specified.

AM/FM radio receiver circuit

TEA5591A

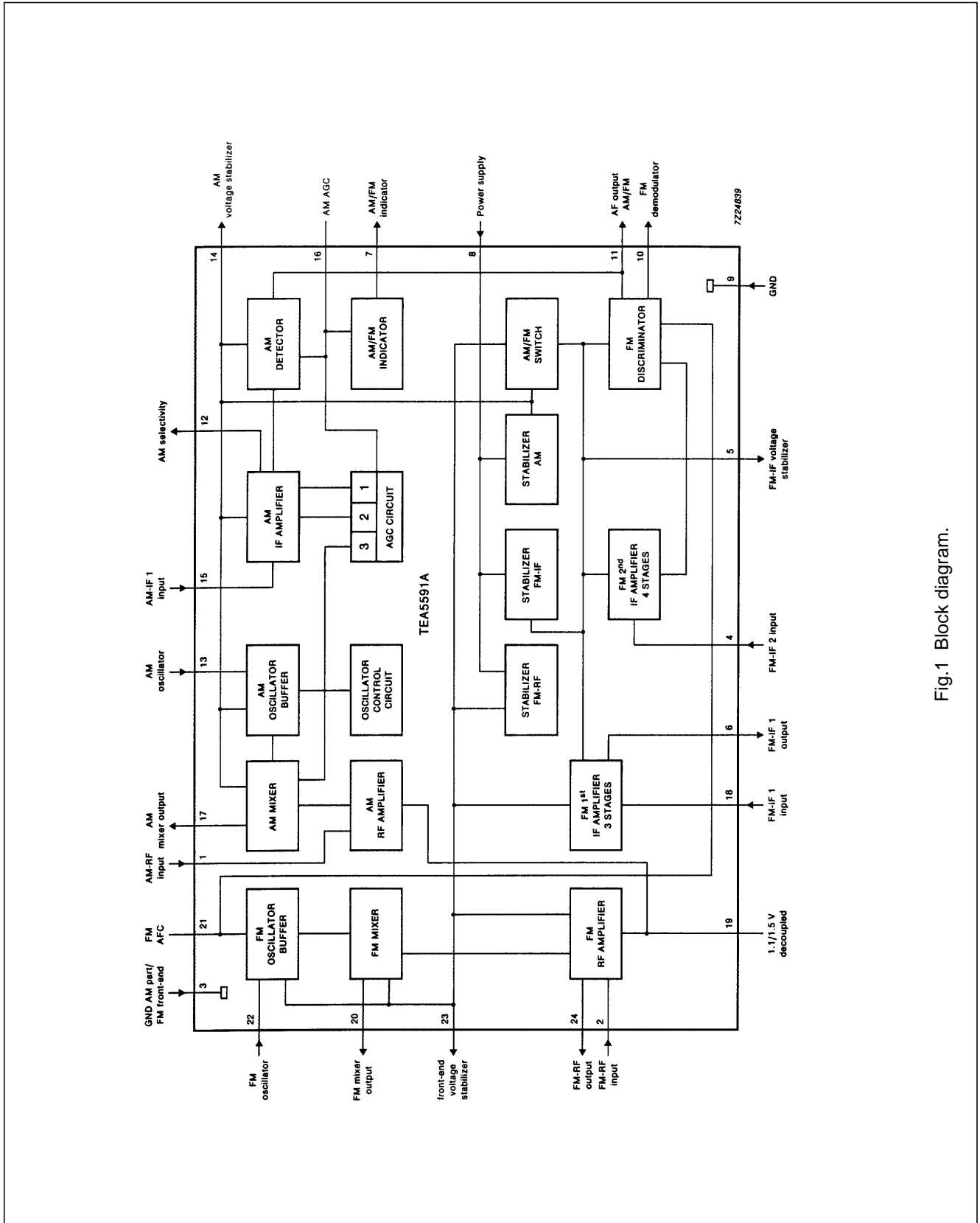


Fig.1 Block diagram.

AM/FM radio receiver circuit

TEA5591A

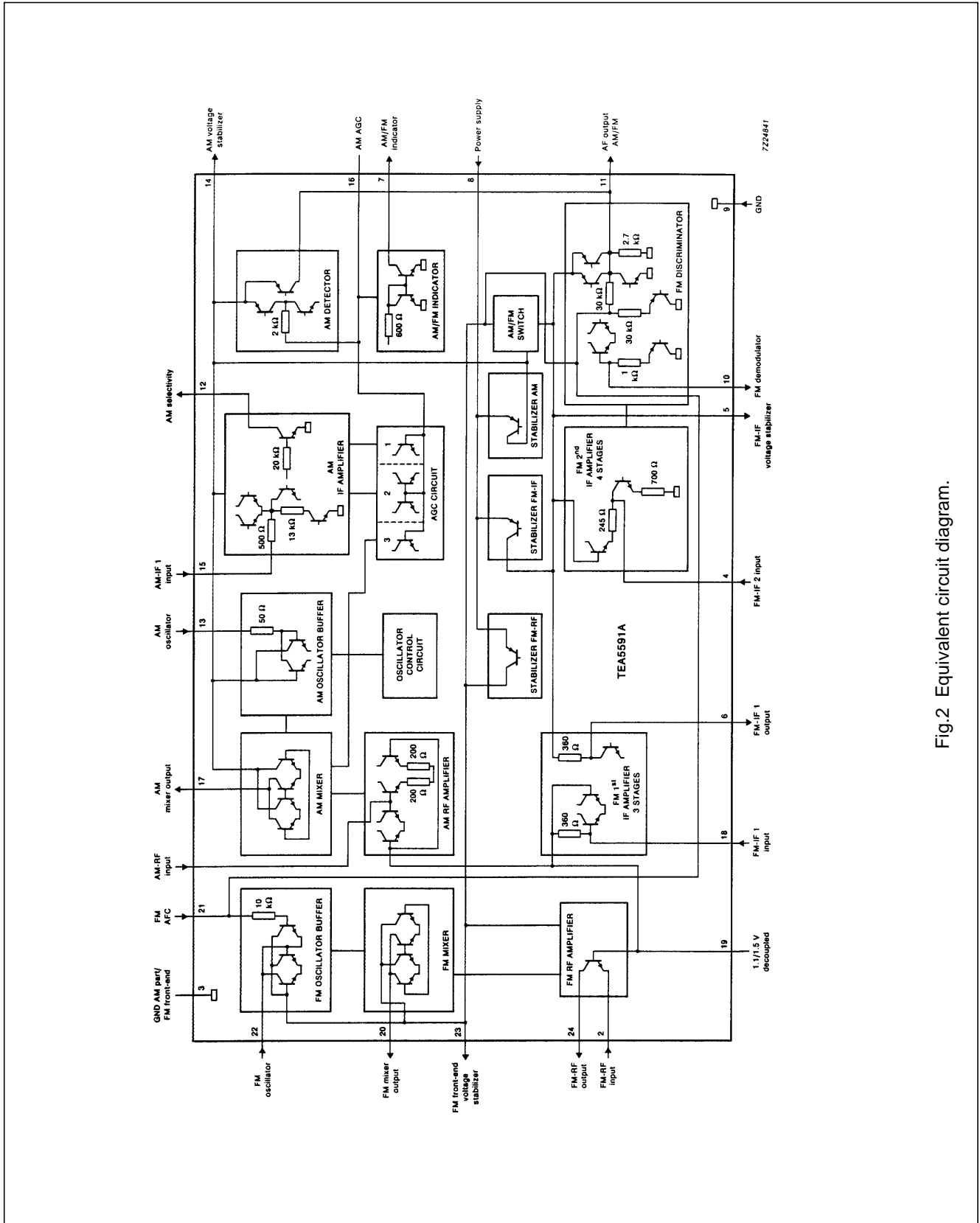
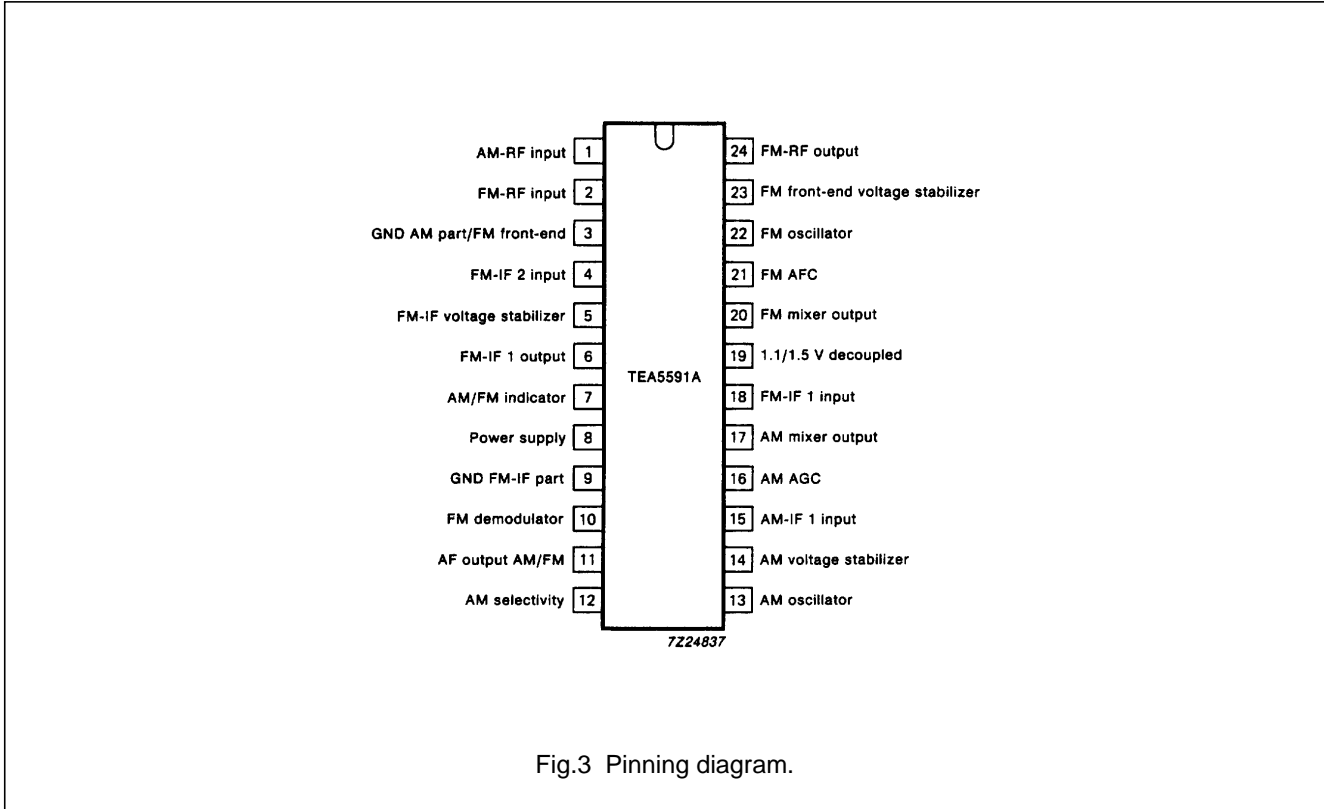


Fig.2 Equivalent circuit diagram.

AM/FM radio receiver circuit

TEA5591A

PINNING



AM/FM radio receiver circuit

TEA5591A

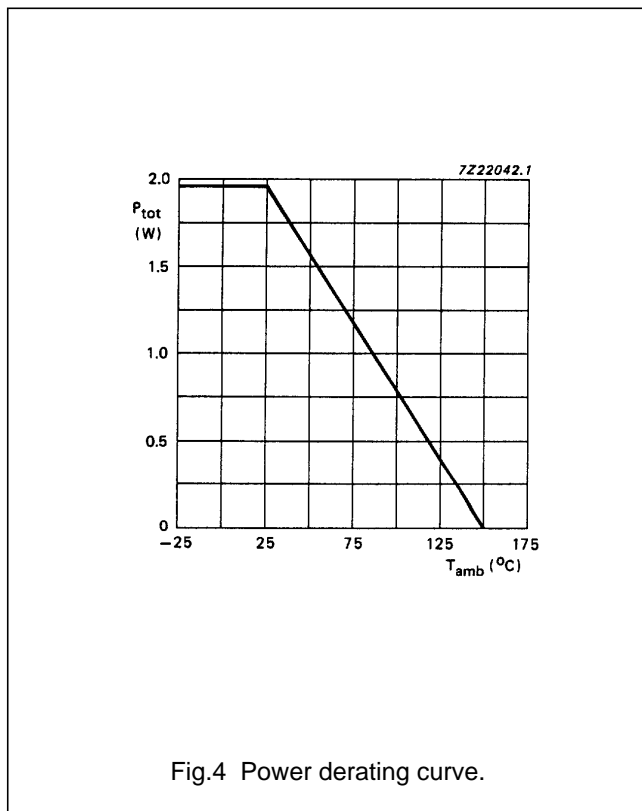
RATINGS

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

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Supply voltage (pin 8)	V_P	-	18	V
LED current (pin 7)	I_7	-	tbf	mA
Total power dissipation	P_{tot}	see Fig.4		
Storage temperature range	T_{stg}	-65	+150	°C
Operating ambient temperature range	T_{amb}	-15	+60	°C
Electrostatic handling ⁽¹⁾	V_{es}	-1000	+1000	V

Note

1. Equivalent to discharging a 100 pF capacitor through a 1500 Ω series resistor.



AM/FM radio receiver circuit

TEA5591A

DC CHARACTERISTICS

All voltages are referenced to pin 3 and pin 9; all input currents are positive; all parameters are measured in test set-up (see Fig.6) at nominal supply voltage $V_P = 3\text{ V}$; $T_{\text{amb}} = 25\text{ °C}$ unless otherwise specified

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage		V_P	1.8	3.0	15	V
Voltages (FM)						
pin 2		V_2	–	0.90	–	V
pin 4		V_4	–	0.85	–	V
pin 5		V_5	–	1.60	–	V
pin 6		V_6	–	1.48	–	V
pin 10		V_{10}	–	1.05	–	V
pin 18		V_{18}	–	1.60	–	V
pin 19		V_{19}	–	1.58	–	V
pin 21		V_{21}	–	0.69	–	V
pin 23		V_{23}	–	1.60	–	V
Voltages (AM)						
pin 14		V_{14}	–	1.60	–	V
pin 16		V_{16}	–	1.54	–	V
pin 19		V_{19}	–	1.10	–	V
Total current consumption	note 1					
AM part		I_P	–	14	19	mA
FM part		I_P	–	17	23	mA

Note to the DC characteristics

- Without LED current.

AM/FM radio receiver circuit

TEA5591A

AC CHARACTERISTICS

All parameters are measured in test set-up (see Fig.6) at nominal supply voltage $V_P = 3\text{ V}$; $T_{\text{amb}} = 25\text{ }^\circ\text{C}$ unless otherwise specified

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
AM part						
<i>AM front end</i>						
(pin 1 to 17)	note 1					
Conversion						
transconductance	$V_i = 10\text{ mV}$ $V_{\text{AGC}}(\text{pin } 16) = V_{14} - 0.1\text{ V}$	S_C	9.3	12	13.5	mA/V
	$V_i = 10\text{ mV}$ $V_{\text{AGC}}(\text{pin } 16) = V_{14} - 0.45\text{ V}$	S_C	0.75	1.1	1.3	mA/V
IF suppression						
	note 2 $V_i = 10\text{ mV}$	α	20	26	–	dB
<i>Oscillator (pin 13)</i>						
Voltage						
	$f = 1.5\text{ MHz}$	V_{osc}	110	175	200	mV
	$f = 1.5\text{ MHz}$ $V_P = 1.5\text{ V}$	V_{osc}	60	160	–	mV
<i>IF and detector part</i>						
(pin 15 to 11)	note 3					
IF sensitivity;						
AF output voltage	no AGC; $V_i = 45\text{ }\mu\text{V}$	V_o	12	20	55	mV
Signal + noise to noise						
ratio for an IF input	no AGC; $V_i = 45\text{ }\mu\text{V}$	$S + N/N$	23	25	–	dB
AF output voltage	$V_i = 1\text{ mV}$	V_o	35	45	60	mV
Total harmonic						
distortion	$V_i = 10\text{ mV}$ $m = 80\%$	THD	–	1	2.2	%
<i>LED-indicator circuit</i>						
(pin 7)						
Output current						
	$V_i = 0\text{ V}$	I_{ind}	–	(8)	(8)	μA
	$V_i = 1\text{ mV}$	I_{ind}	(8)	(8)	–	mA
<i>Overall performance</i>						
(pin 1 to 11)	note 4					
Total harmonic						
distortion	$V_i = \text{(8)}\text{ mV}$	THD	–	4.5	8	%
FM part						
<i>FM front end</i>						
(pin 2 to 20)	note 5					
Conversion						
transconductance	$V_i = 1\text{ mV}$	S_C	7.5	11	13.5	mA/V

AM/FM radio receiver circuit

TEA5591A

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
<i>Oscillator (pin 22)</i>						
Voltage	V_{AFC} (pin 21) = 0.8 V	V_{osc}	155	200	245	mV
	$V_{AFC} = 0.8$ V $V_P = 1.5$ V	V_{osc}	60	120	–	mV
AFC control; change in oscillator frequency	$V_{AFC} = 0.8$ V	f	–	111.2	–	MHz
	$\Delta V_{AFC} = -0.6$ V	Δf	–	+420	–	kHz
	$\Delta V_{AFC} = +0.6$ V	Δf	–	–620	–	kHz
<i>IF and demodulator part (pin 18 to 11)</i>						
IF sensitivity;	note 6					
AF output voltage	note 7					
Signal + noise to noise ratio for an IF input	$V_i = 100$ μ V	V_o	–3	–1	0	dB
	$V_i = 100$ μ V; out of limiting	S + N/N	26	30	–	dB
AF output voltage	$V_i = 1$ mV	V_o	75	90	120	mV
Total harmonic distortion	$\Delta f = 75$ kHz $V_i = 50$ mV	THD	–	3	–	%
<i>LED-indicator circuit (pin 7)</i>						
Output current	$V_i = 0$ V	I_{ind}	–	–	20	μ A
	$V_i = 1$ mV	I_{ind}	0.6	1	1.9	mA

Notes to the AC characteristics

- Input frequency = 1 MHz; output frequency = 468 kHz.
- $$\alpha = \frac{(V_o \text{ at } f_i = 1\text{MHz})}{(V_o \text{ at } f_i = 468\text{kHz})}$$
- Input frequency = 468 kHz; m = 30% modulated with $f_{mod} = 1$ kHz; unless otherwise specified.
- Front-end connected to IF plus detector part. Input frequency = 1 MHz; m = 80% modulated with $f_{mod} = 1$ kHz.
- Input frequency = 100 MHz; output frequency = 10.7 MHz.
- Input frequency = 10.7 MHz; frequency deviation, $\Delta f = 22.5$ kHz and $f_{mod} = 1$ kHz; unless otherwise specified.
- Reference: AF output voltage = 0 dB at $V_i = 1$ mV.
- Value to be fixed.

AM/FM radio receiver circuit

TEA5591A

APPLICATION AND TEST INFORMATION

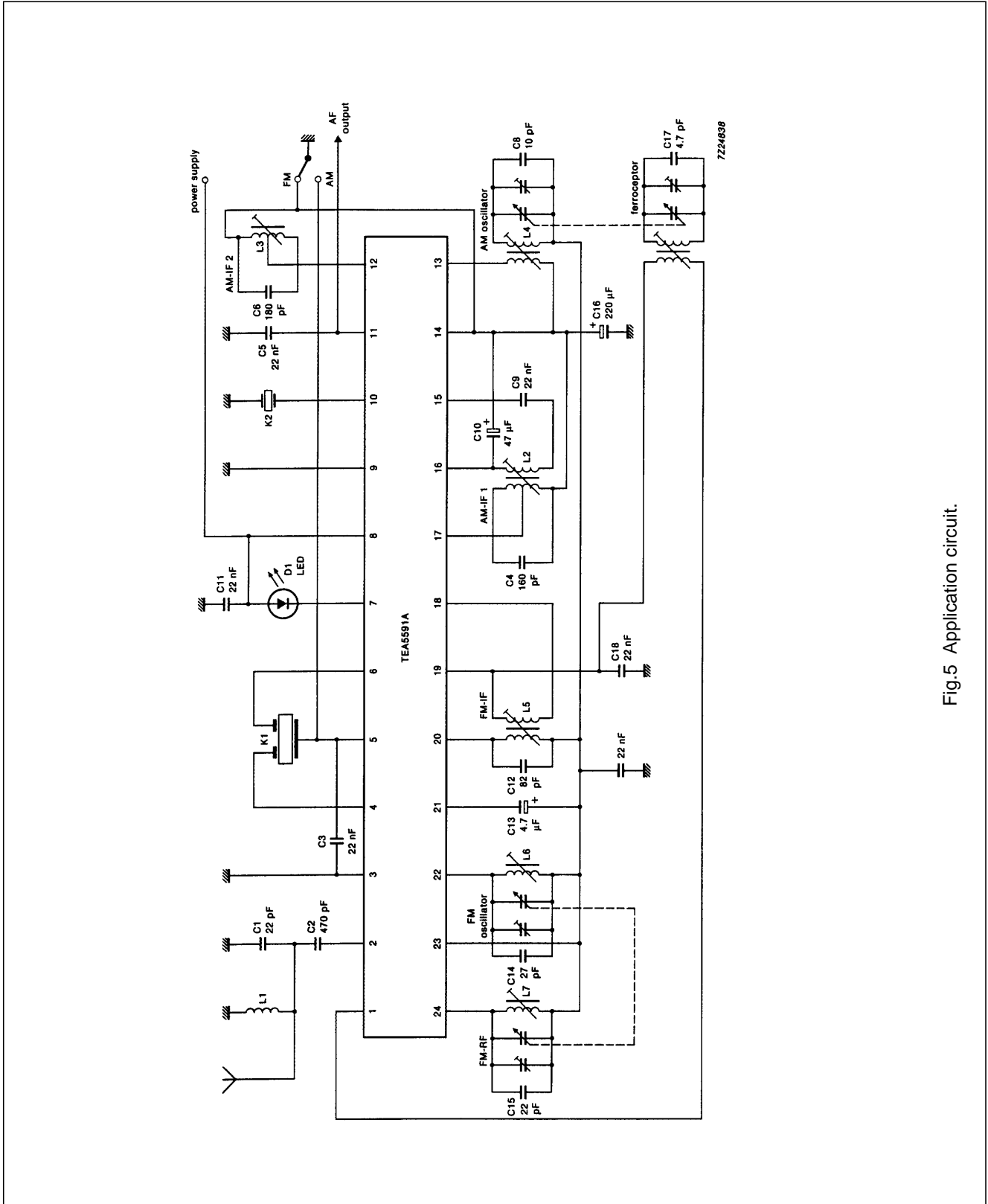


Fig.5 Application circuit.

AM/FM radio receiver circuit

TEA5591A

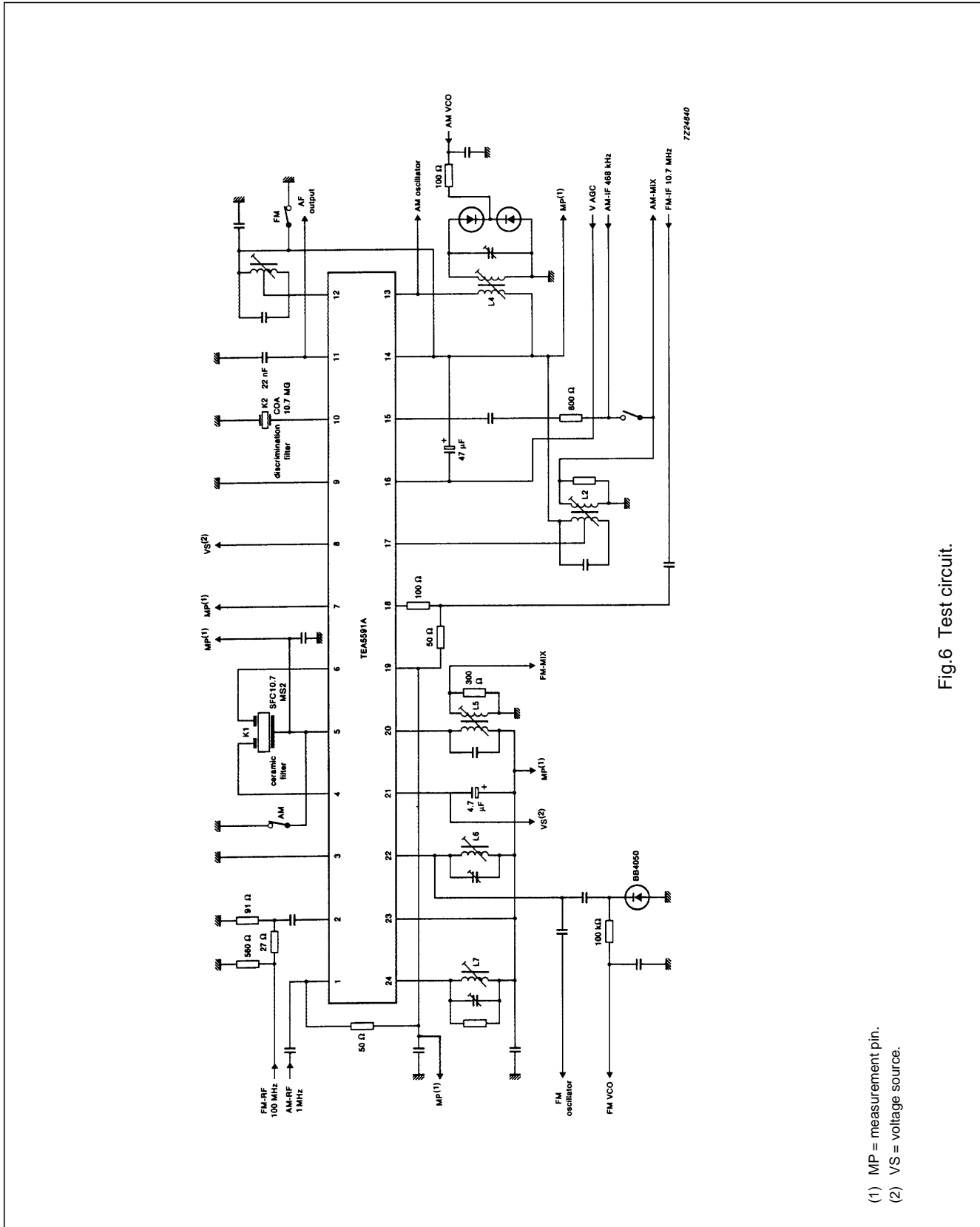


Fig.6 Test circuit.

- (1) MP = measurement pin.
- (2) VS = voltage source.

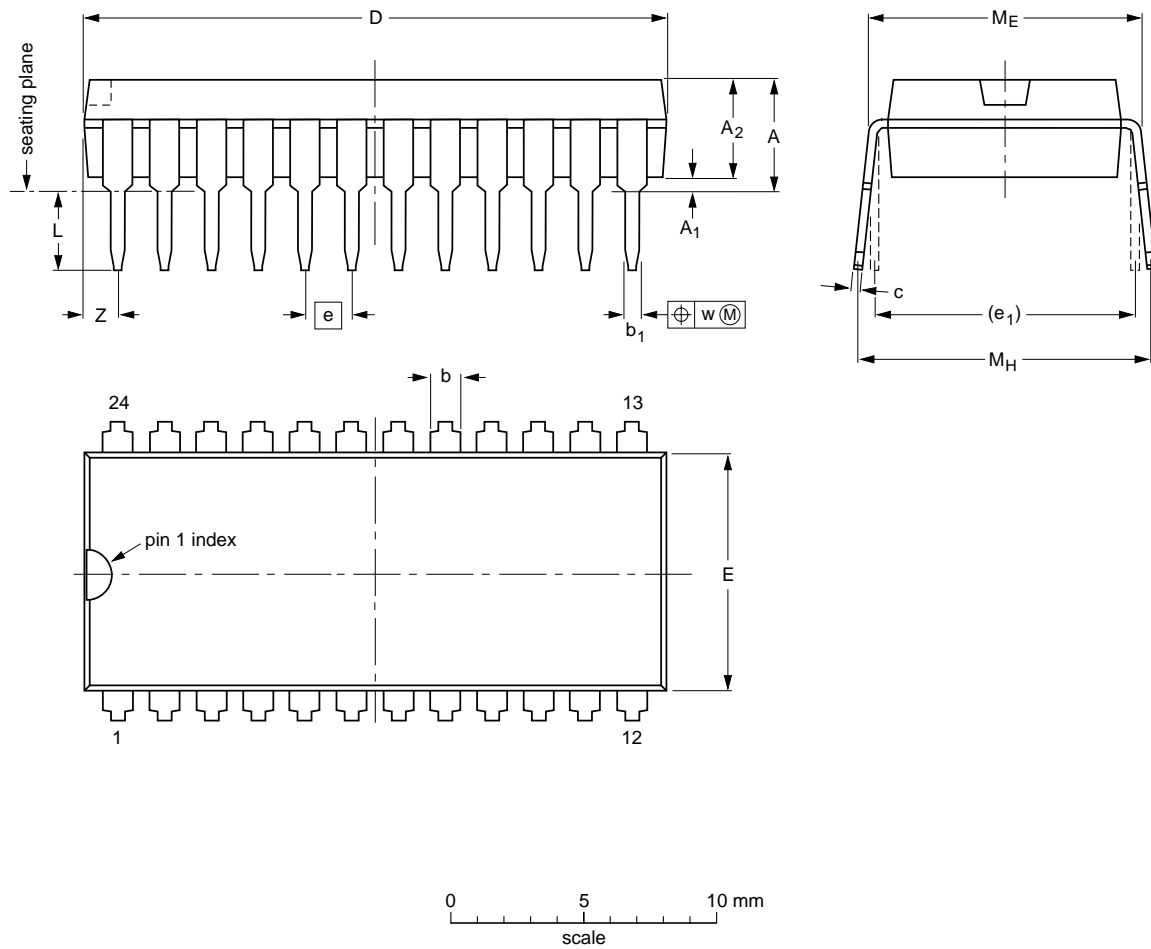
AM/FM radio receiver circuit

TEA5591A

PACKAGE OUTLINE

SDIP24: plastic shrink dual in-line package; 24 leads (400 mil)

SOT234-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A ₁ min.	A ₂ max.	b	b ₁	c	D ⁽¹⁾	E ⁽¹⁾	e	e ₁	L	M _E	M _H	w	Z ⁽¹⁾ max.
mm	4.7	0.51	3.8	1.3 0.8	0.53 0.40	0.32 0.23	22.3 21.4	9.1 8.7	1.778	10.16	3.2 2.8	10.7 10.2	12.2 10.5	0.18	1.6

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			
SOT234-1						92-11-17 95-02-04

AM/FM radio receiver circuit

TEA5591A

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our "IC Package Databook" (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint 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.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, 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.

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.