

# DATA SHEET

## **TEA5591A** AM/FM radio receiver circuit

Product specification  
File under Integrated Circuits, IC01

February 1990

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**AM/FM radio receiver circuit****TEA5591A**

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**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.

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## 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
<b>AM performance (pin 1)</b>	note 1					
Sensitivity	$V_o = 10$ mV	$V_i$	–	3.5	–	$\mu$ V
	$(S + N)/N = 26$ dB	$V_i$	–	17	–	$\mu$ 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
<b>FM performance (pin 2)</b>	note 2					
Limiting sensitivity	–3 dB	$V_i$	–	2.3	–	$\mu$ V
Signal-to-noise ratio	$V_i = 2.5$ $\mu$ 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	$100 \mu$ 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.

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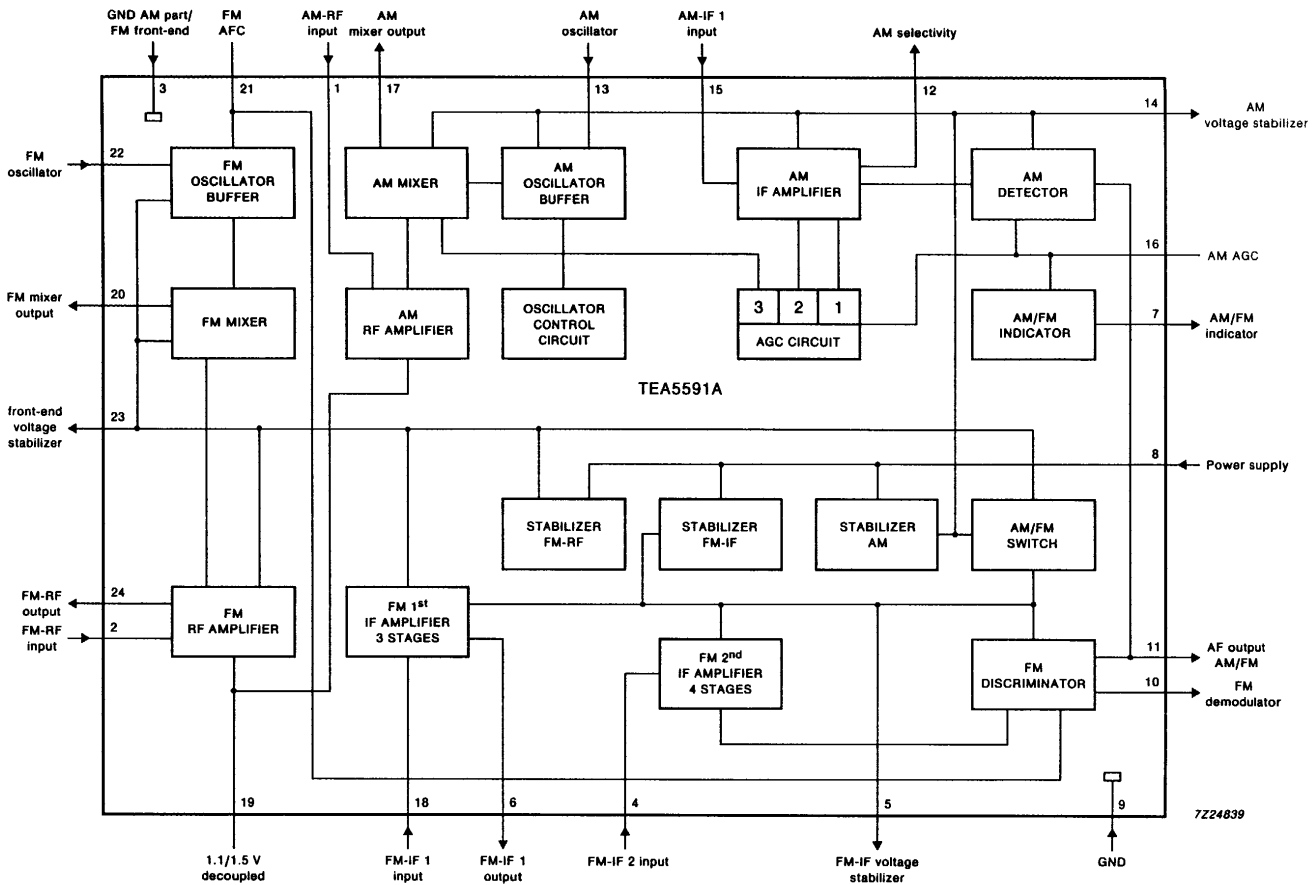


Fig.1 Block diagram.

# AM/FM radio receiver circuit

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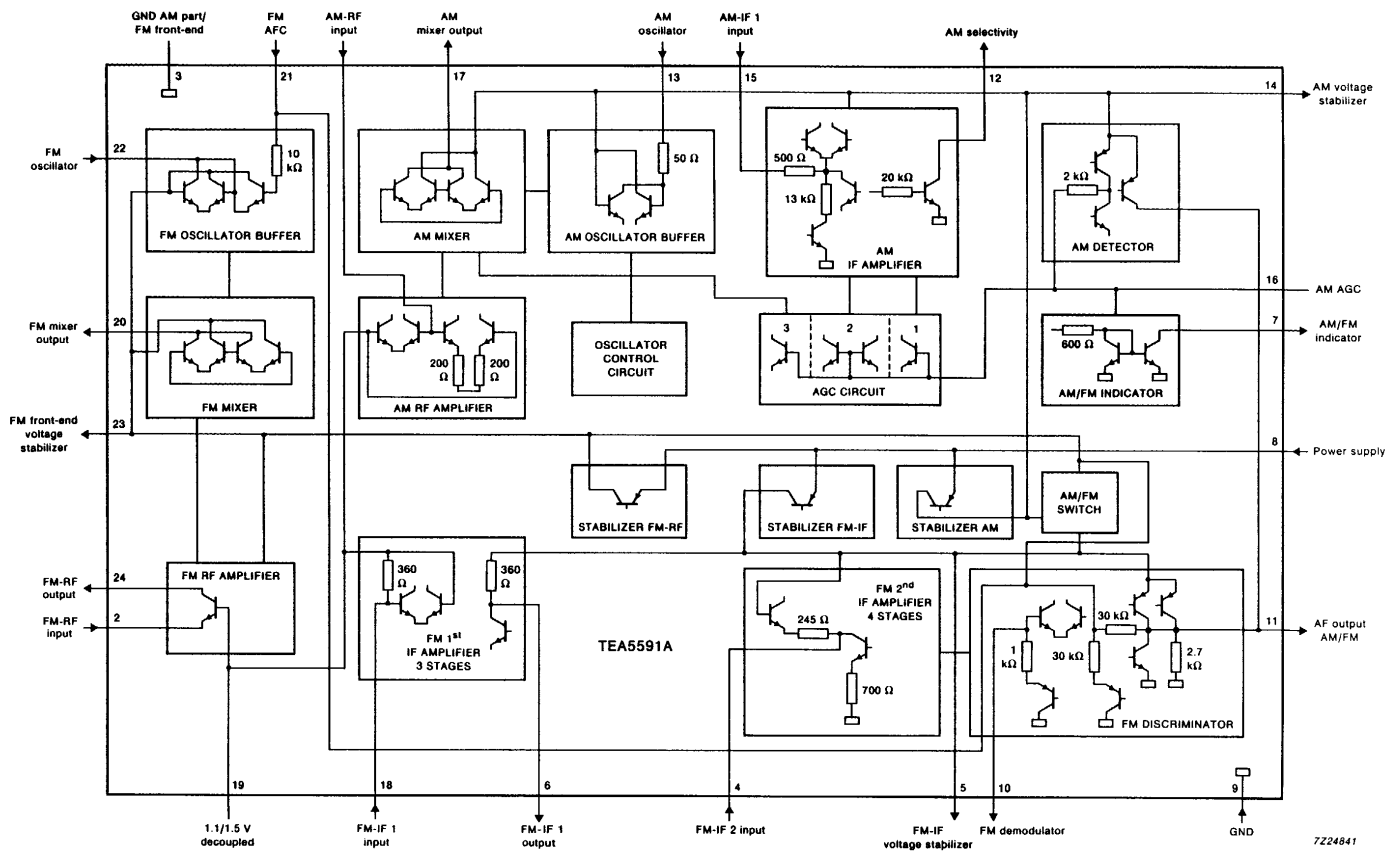


Fig.2 Equivalent circuit diagram.

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PINNING

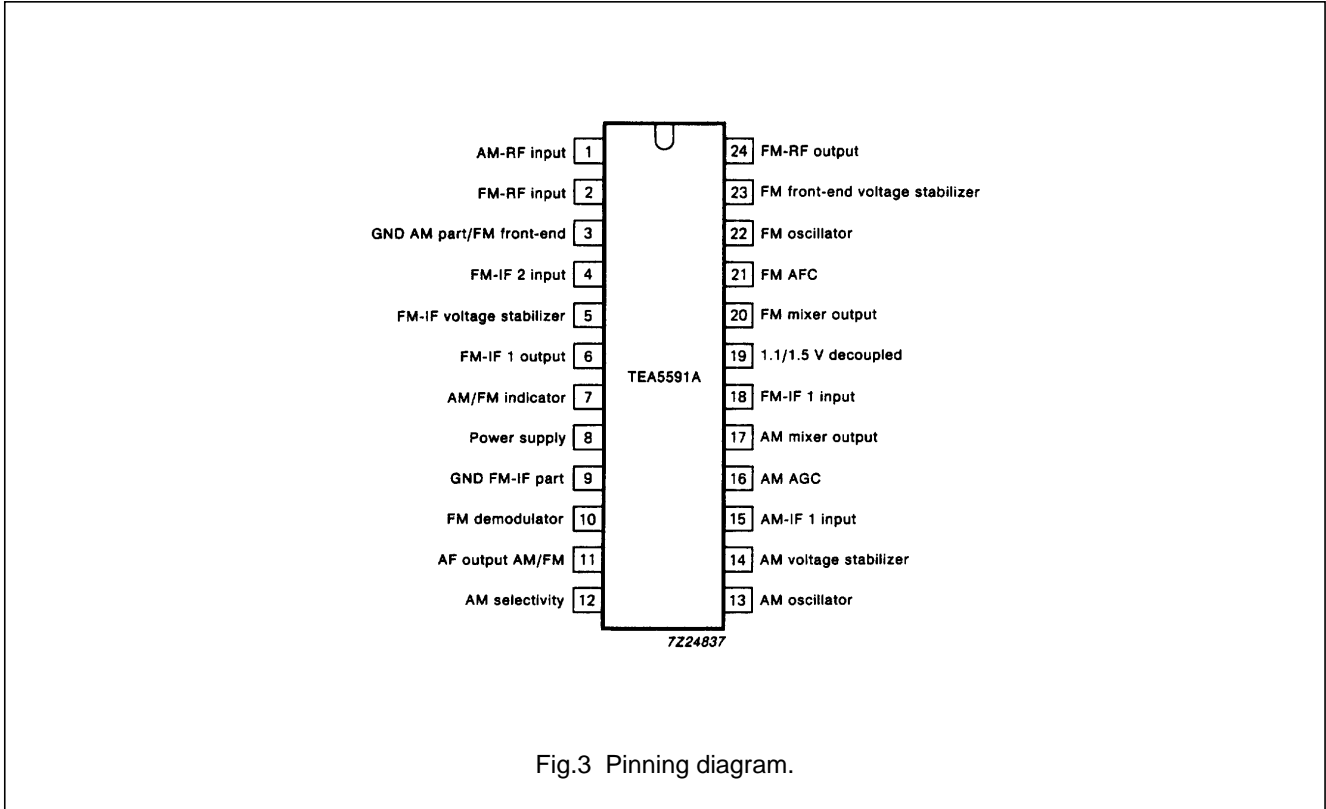


Fig.3 Pinning diagram.

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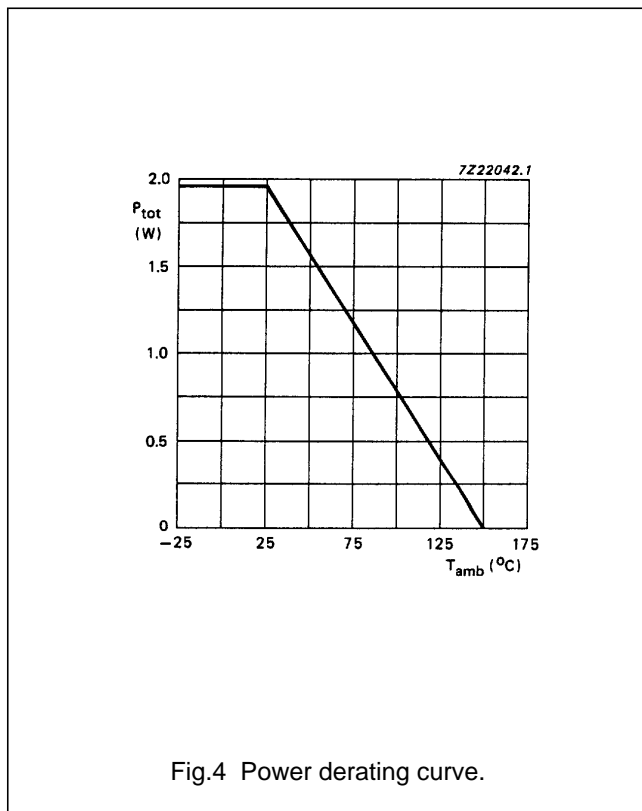
**RATINGS**

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 <sup>(1)</sup>	$V_{es}$	-1000	+1000	V

**Note**

1. Equivalent to discharging a 100 pF capacitor through a 1500  $\Omega$  series resistor.



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**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
<b>Voltages (FM)</b>						
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
<b>Voltages (AM)</b>						
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.



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**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
<b>AM part</b>						
<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 $V_i = 10\text{ mV}$	$\alpha$	20	26	–	dB
<i>Oscillator (pin 13)</i>						
Voltage						
	$f = 1.5\text{ MHz}$	$V_{\text{osc}}$	110	175	200	mV
	$f = 1.5\text{ MHz}$ $V_P = 1.5\text{ V}$	$V_{\text{osc}}$	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						
	$V_i = 0\text{ V}$	$I_{\text{ind}}$	–	(8)	(8)	$\mu\text{A}$
	$V_i = 1\text{ mV}$	$I_{\text{ind}}$	(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	%
<b>FM part</b>						
<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

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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	$\Delta f$	–	+420	–	kHz
	$\Delta V_{AFC} = +0.6$ V	$\Delta f$	–	–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	$V_i = 100$ $\mu$ V	$V_o$	–3	–1	0	dB
	$V_i = 100$ $\mu$ 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	$\mu$ A
	$V_i = 1$ mV	$I_{ind}$	0.6	1	1.9	mA

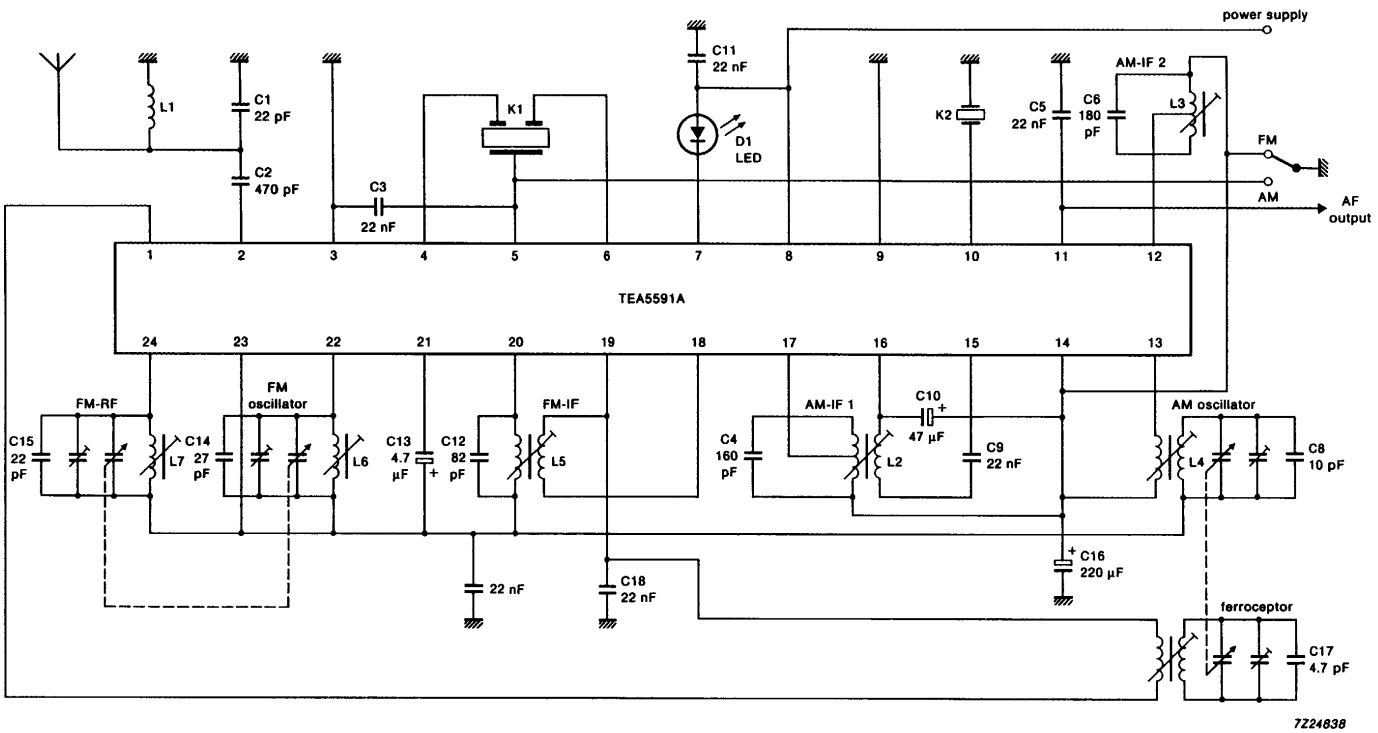
**Notes to the AC characteristics**

- 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 = 10.7 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.

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## APPLICATION AND TEST INFORMATION

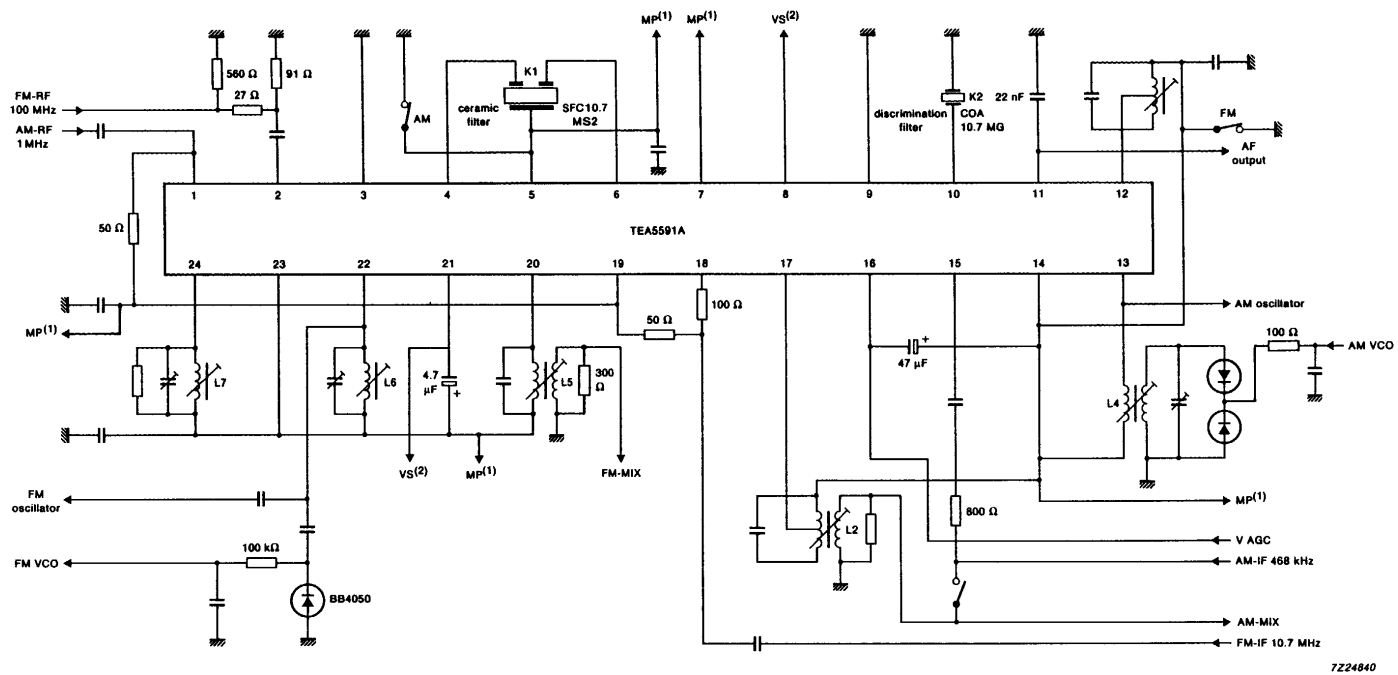


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Fig.5 Application circuit.

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

Fig.6 Test circuit.

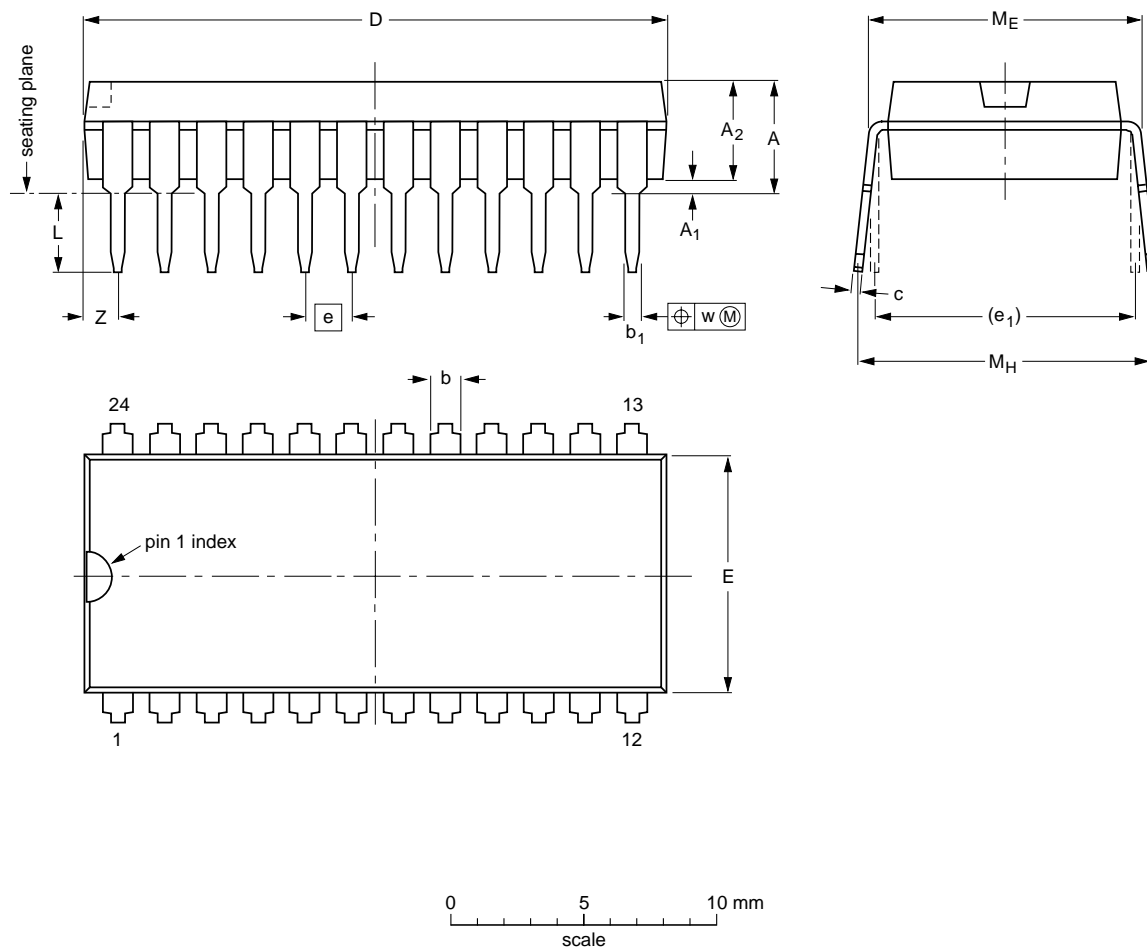
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PACKAGE OUTLINE

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

SOT234-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> 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

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**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**

<b>Data sheet status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

**LIFE SUPPORT APPLICATIONS**

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