

# DATA SHEET

## **TEA6200**

**Integrated AM upconversion  
receiver**

Product specification  
File under Integrated Circuits, IC01

August 1989

**Integrated AM upconversion receiver****TEA6200****GENERAL DESCRIPTION**

The TEA6200 is an integrated AM upconversion receiver circuit with an IF of 10.7 MHz. Because of the high dynamic range of the RF prestage there is no tuned prestage. The whole selectivity is provided by crystal filters. The circuit is intended for use in AM radios with synthesizer tuning. The TEA6200 can handle RF signals up to 2 V RMS.

**Features**

- No pre-tuned selection is required
- No LW/MW switching
- RF input is protected from static discharge from the aerial
- Electronic standby switch
- Voltage controlled oscillator for synthesizer tuning
- IF output providing level information for search tuning.
- No alignment required.

**QUICK REFERENCE DATA**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage range	$V_P$	7.6	8.5	9.4	V
Supply current range	$I_P$	–	50	70	mA
AF output voltage with: RF at 1 MHz and 10 mV $f_m$ at 400 Hz and 30%	$V_{af}$	–	350	–	mV
AGC start	$V_{rf}$	30	50	80	$\mu$ V
AGC range	$\Delta V_{rf}$	–	95	–	dB

**PACKAGE OUTLINE**

20-lead dual in line; plastic (SOT146); SOT146-1; 1996 August 02.

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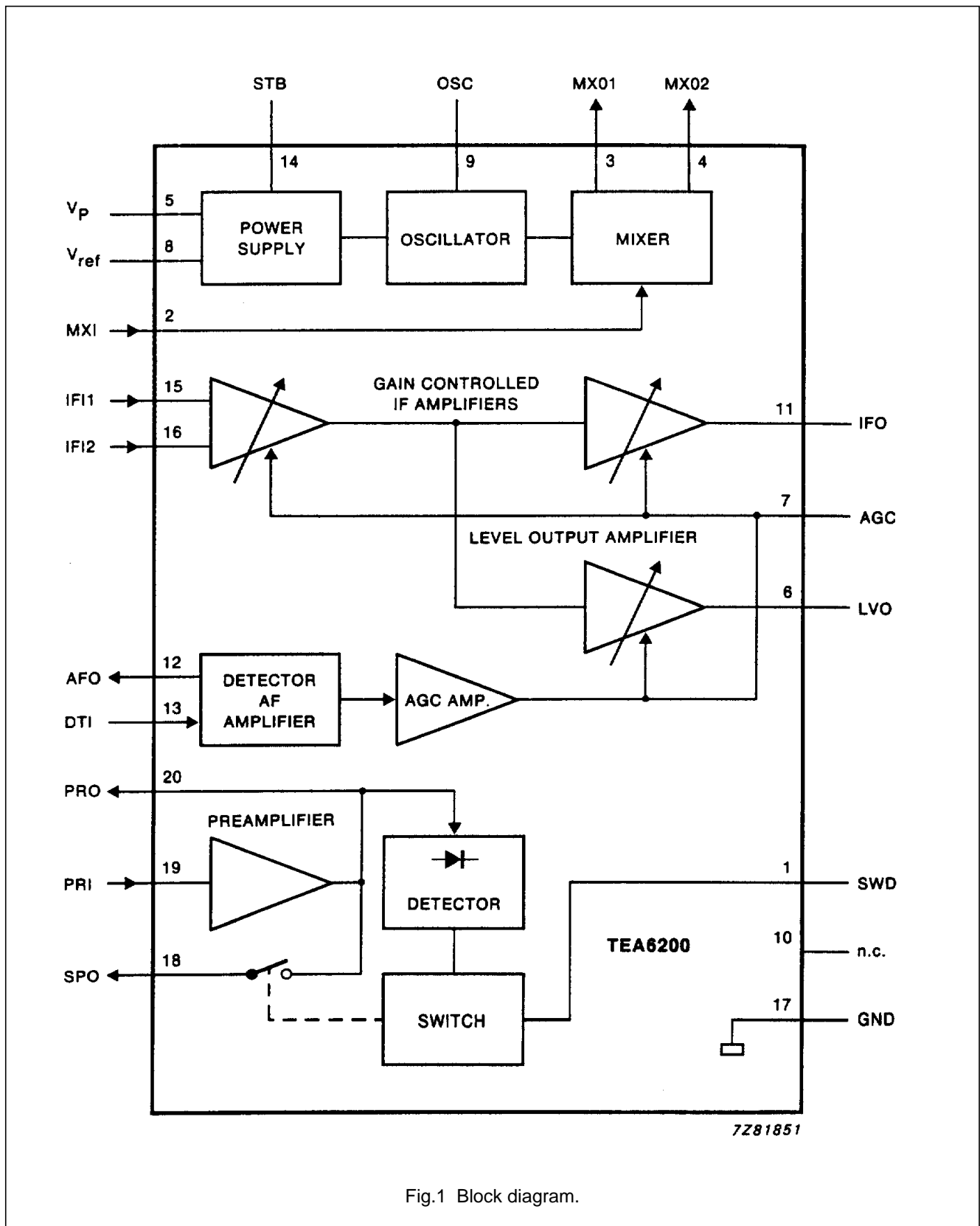


Fig.1 Block diagram.

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**PINNING**

1	SWD	switching delay
2	MXI	mixer input
3	MXO1	mixer output 1
4	MXO2	mixer output 2
5	V <sub>p</sub>	supply voltage
6	LVO	level output
7	AGC	AGC time constant
8	V <sub>ref</sub>	reference voltage
9	OSC	oscillator
10	n.c.	not internally connected*
11	IFO	IF output
12	AFO	AF output
13	DTI	detector input
14	STB	standby switch
15	IFI1	IF input 1
16	IFI2	IF input 2
17	GND	ground
18	SPO	switched prestage output
19	PRI	prestige input
20	PRO	prestige output

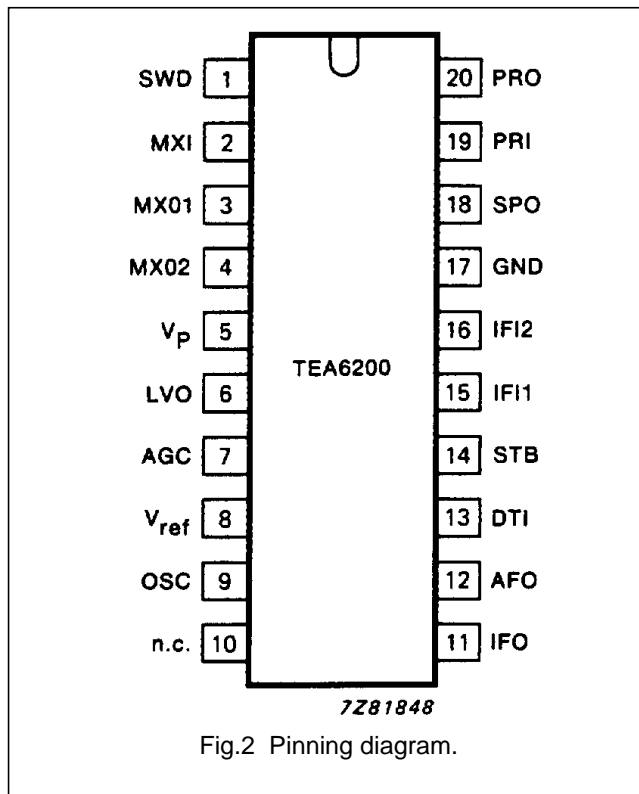


Fig.2 Pinning diagram.

\* Pin 10 must be connected to pin 5, 8 or 17.

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**RATINGS**

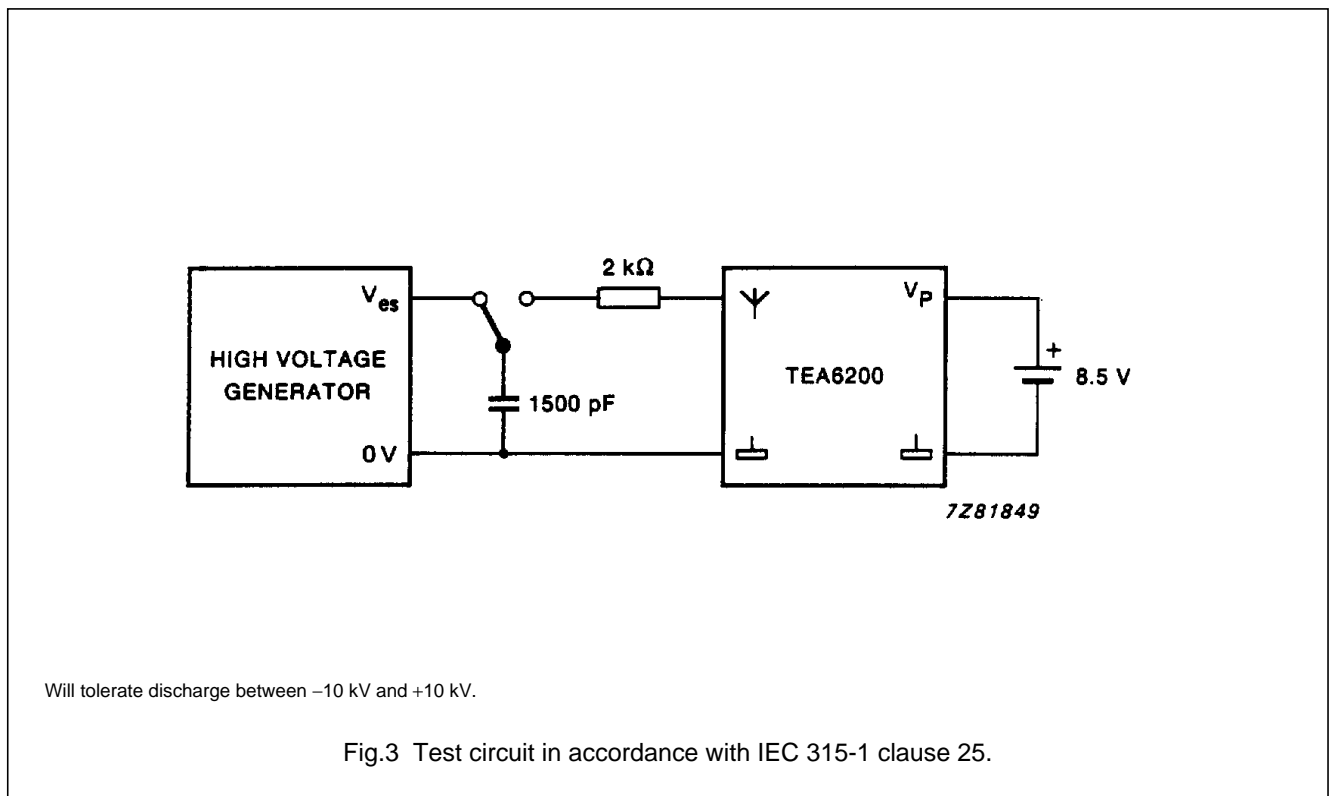
Limiting values in accordance with the Absolute Maximum System (IEC 134)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Supply voltage	$V_P$	–	12	V
Supply current	$I_P$	–	70	mA
Total power dissipation	$P_{tot}$	–	850	mW
Operating ambient temperature range	$T_{amb}$	–30	+ 85	°C
Storage temperature range	$T_{stg}$	–40	+ 150	°C
Electrostatic discharge voltage	$\pm V_{es}$	–	10	kV

**THERMAL RESISTANCE**

From junction to ambient

$$R_{th\ j-a} = 80\ K/W$$



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**DC CHARACTERISTICS** $V_P = 8.5\text{ V}$ ;  $V_{14} = V_P$ ; Signal in OFF condition; all voltages referenced to ground unless otherwise specified.

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Mixer input		$V_I$	–	4.0	–	V
Mixer output 1		$V_O$	–	8.5	–	V
Mixer output 2		$V_O$	–	8.5	–	V
Level output		$V_O$	–	8.5	–	V
AGC voltage		$V_{AGC}$	–	0.65	–	V
Reference voltage		$V_{ref}$	–	4.0	–	V
Oscillator DC voltage		$V_{OSC}$	–	4.0	–	V
Prestage input		$V_I$	–	1.2	–	V
Prestage output		$V_O$	–	3.2	–	V

**CHARACTERISTICS** $V_P = 8.5\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ;  $f_{RF} = 1\text{ MHz}$  at 10 mV RMS;  $Q_{OSC} = 50$ ; modulation = 400 Hz at 30%; insertion loss of filters: crystal filter = 1 dB; ceramic filter = 4 dB, all voltages referenced to ground unless otherwise specified.

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>Supply</b>						
Supply voltage range		$V_P$	7.6	8.5	9.4	V
Supply current range		$I_P$	–	50	70	mA
Guaranteed operating voltage		$V_P$	7.0	–	10.0	V
<b>Standby switch</b>						
ON voltage		$V_{14}$	3.2	–	$V_P$	V
OFF voltage		$V_{14}$	0	–	1	V
ON current		$ I_{14} $	–	–	10	$\mu\text{A}$
OFF current		$-I_{14}$	–	–	0.5	mA
Supply current	device OFF	$I_P$	–	–	10	mA
<b>Prestage</b>						
Switching threshold	modulation = 80%	$V_{rf}$	–	320	–	mV
Hysteresis		$V_{rf}$	1.5	3.5	5.5	dB
<b>Oscillator</b>						
Frequency range		$f_{osc}$	10.8	–	17.8	MHz
Oscillator amplitude		$V_{osc}$	200	420	–	mV
Tuned circuit selectivity		$Q_{OSC}$	20	50	–	–
<b>Mixer</b>						
Input capacitance		$C_{2-8}$	–	5	10	pF
Input impedance		$Z_{2-8}$	10	40	–	$k\Omega$
Conversion transconductance		$I_{3-4}/V_{2-8}$	–	3.8	–	S

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PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>IF amplifier</b>						
Input impedance		$R_{16-15}$	10	–	–	$k\Omega$
Input capacitance		$C_{16-15}$	–	–	5	pF
Output impedance		$Z_{11}$	230	330	430	$\Omega$
<b>Detector</b>						
	note 2					
Input impedance		$Z_{13}$	265	380	500	$\Omega$
Output impedance		$Z_{12}$	7	10	14	$k\Omega$
Output level		$V_{af}$	250	350	500	mV
<b>Reference voltage</b>						
Voltage	$V_P = 8.5 V$	$V_8$	3.8	4.0	4.2	V
Output impedance		$Z_8$	–	20	–	$\Omega$
Ripple rejection		$\frac{\Delta V_P}{\Delta V_8}$	40	–	–	dB
<b>Level output pin 6</b>						
	see Fig.5					
Output impedance		$Z_6$	–	1	–	$k\Omega$
Output voltage	$V_{rf} = 70 \mu V$	$V_6$	0.5	0.7	1.0	mV
Output voltage	$V_{rf} = 2 mV$	$V_6$	–	15	–	mV
<b>RF sensitivity</b>						
RF input	$(S + N)/N = 6 dB$	$V_{rf}$	–	11	20	$\mu V$
	$(S + N)/N = 26 dB$	$V_{rf}$	–	110	150	$\mu V$
	$(S + N)/N = 46 dB$	$V_{rf}$	–	1100	2000	$\mu V$
	RF = 150 kHz					
	$(S + N)/N = 26 dB$	$V_{rf}$	–	200	–	$\mu V$
<b>Output signal</b>						
AF output voltage	$V_{rf} = 10 mV$	$V_{af}$	250	350	500	mV
	$V_{rf} = 20 \mu V$	$V_{af}$	–	100	–	mV
Total distortion	$V_{rf} = 1 mV$ ; modulation = 80%	$d_{tot}$	–	3	5	%
Signal plus noise-to-noise ratio	RF = 10 mV to 1 V	$(S + N)/N$	53	57	–	dB
Ripple rejection	$V_P = 8.5 V + V_r$ 20 Hz < fR < 20 kHz $V_{rms} = 40 mV$	$\frac{\Delta V_P}{\Delta V_{af}}$	20	–	–	dB

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PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>Large signal handling</b>						
Aerial input voltage	THD = 10%; modulation = 80%	$V_{rf}$	2	3	–	V
AGC range of preamplifier switch			–	12	–	dB
Switching threshold	modulation = 80%	$V_{rf}$	–	320	–	mV
Hysteresis	modulation = 80%	$V_{rf}$	1.5	3.5	5.5	dB
Ripple rejection of preamplifier	20 Hz < $f_R$ < 1.5 MHz	$\frac{\Delta V_P}{\Delta V_{20}}$	–	40	–	dB
<b>AGC</b>						
AGC range			–	95	–	dB
Change of $V_{af}$	100 $\mu$ V < $V_{rf}$ < 2 V		–	2	3	dB
AGC start		$V_{rf}$	30	50	80	$\mu$ V
<b>Intermodulation free dynamic range</b>						
Long wave second order	350/250 kHz input noise level = –99 dBm	I MFDR 2	72	82	–	dB
third order	input noise level = –99 dBm	I MFDR 3	–	86	–	dB
Medium wave second order	650/1550 kHz input noise level = –104 dBm	I MFDR 2	74	84	–	dB
third order	1.25/1.4 MHz input noise level = –104 dBm	I MFDR 3	–	90	–	dB

**Notes to the characteristics**

- The prestage is connected to the aerial by a 6 MHz low-pass filter that decouples unwanted aerial cable resonance frequencies. The large dynamic range of the prestage is achieved by use of a transimpedance amplifier with a feedback loop consisting of an equivalent aerial capacitance and a feedback capacitor. When large RF signals are received the feedback capacitance in the loop is increased and the gain subsequently reduced, (see Fig.4).

$$\text{Voltage gain for small signals} \quad G_V = V_{rf} \times \frac{C_{ae}}{C_1}$$

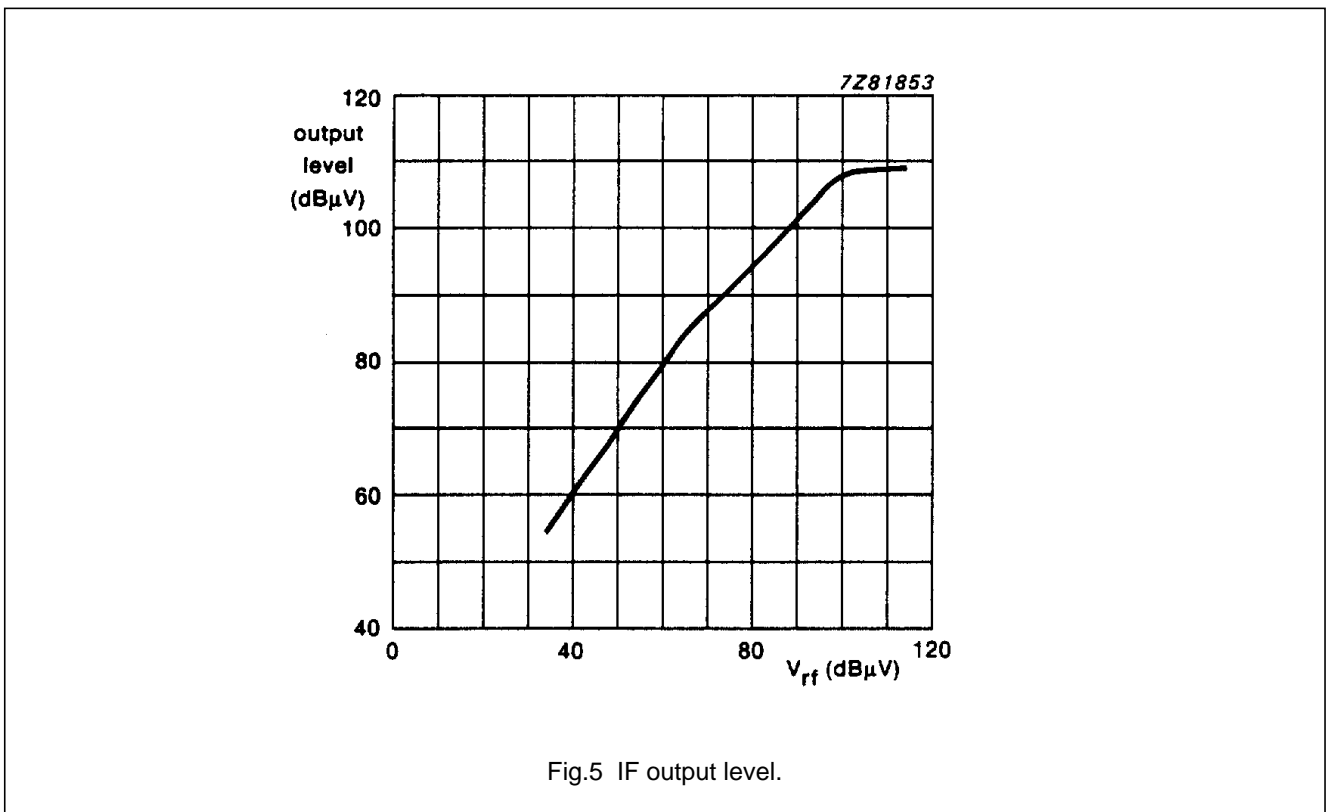
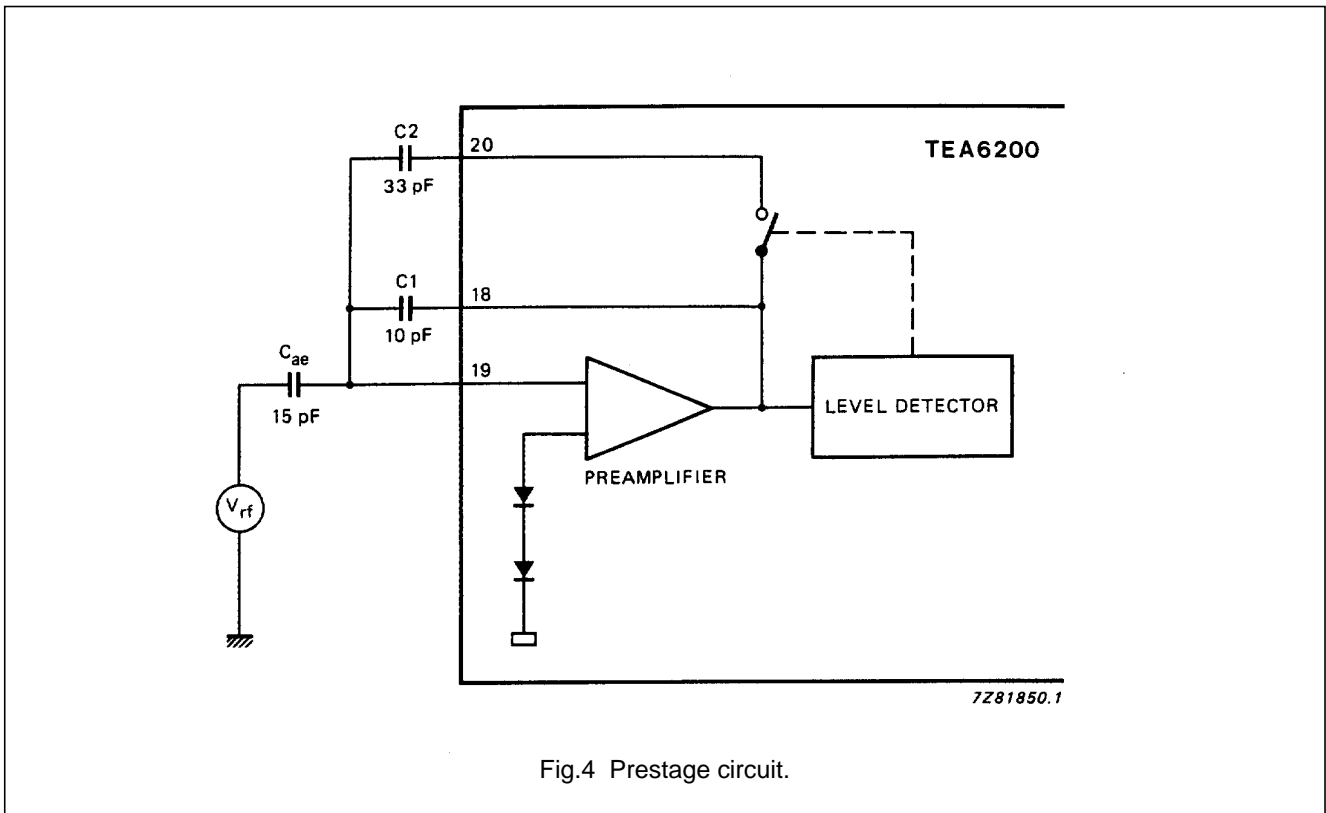
$$\text{Voltage gain for large signals} \quad G_V = V_{rf} \times \frac{C_{ae}}{C_1 + C_2}$$

- To protect the demodulator and the AGC circuitry, against parasitic oscillation in the IF section, a ceramic filter is connected between the IF output and detector input.



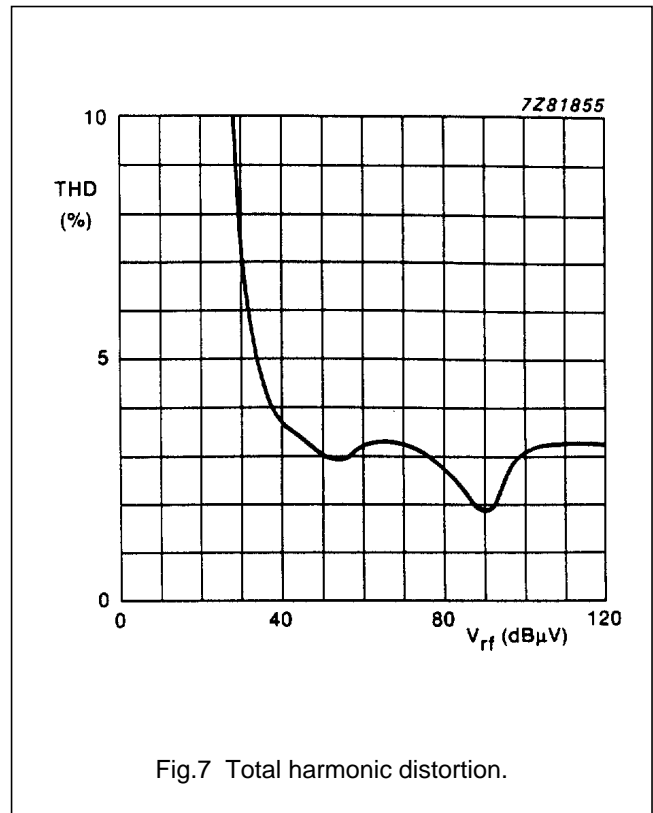
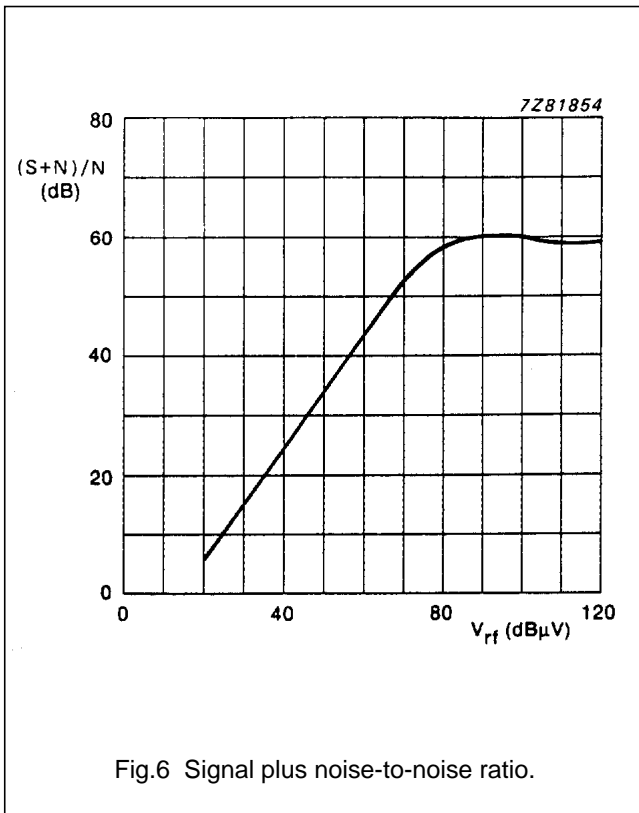
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APPLICATION INFORMATION

Notes Fig. 8.

COMPONENT	CIRCUIT IDENTITY	SUPPLIER REFERENCE
(1) Crystal filters	XTAL	NDK 10T 7 BA
(2) Ceramic filter	SFE	Murata E 10 7 S
(3) Transformer	T1	Toko 7PS-1078 JK
(4) Variable capacitance diode.	D1	BB609, BB809 or BBY40
(5) Oscillator coil	L1	Toko 7PS-1077 X

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APPLICATION INFORMATION

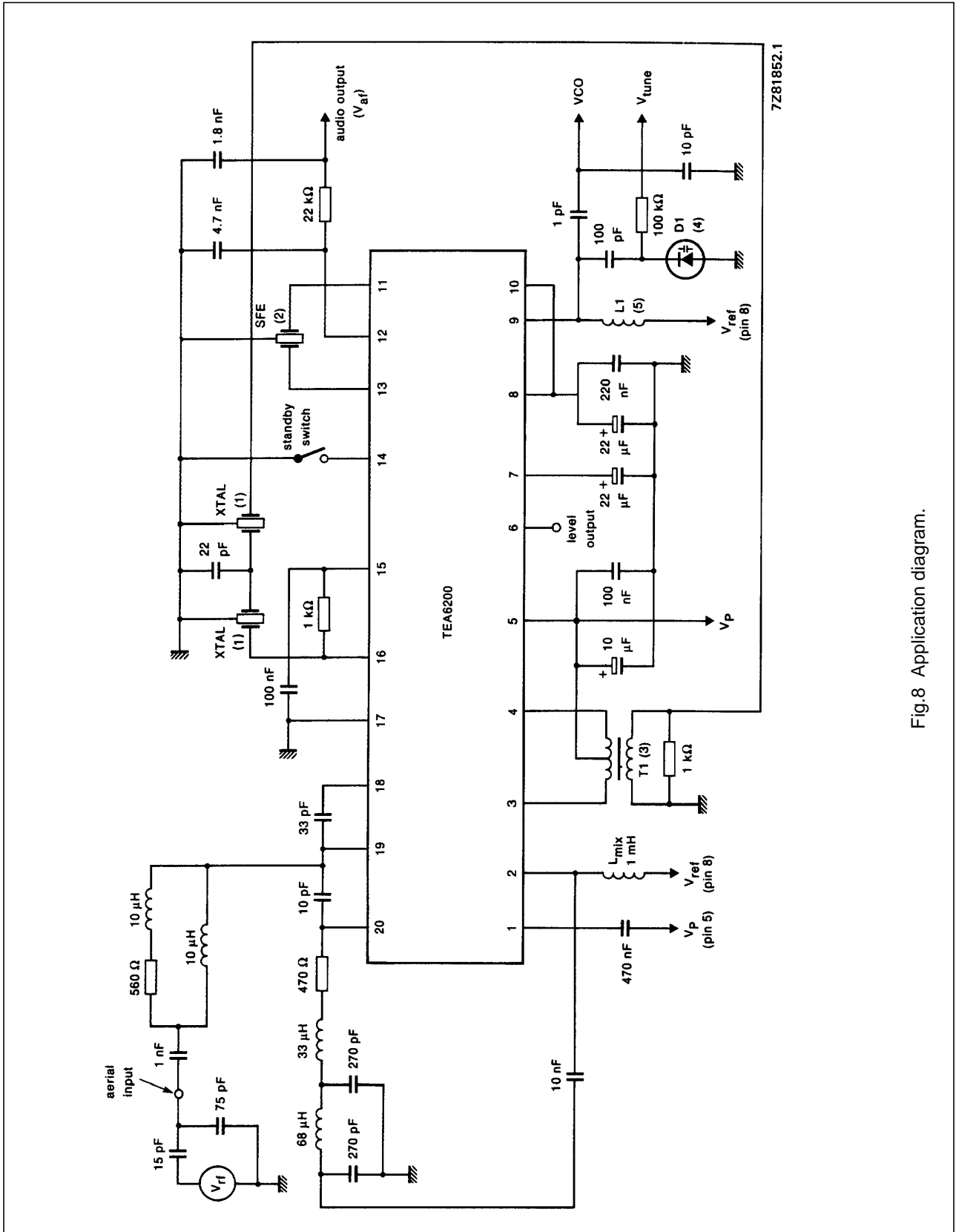


Fig.8 Application diagram.

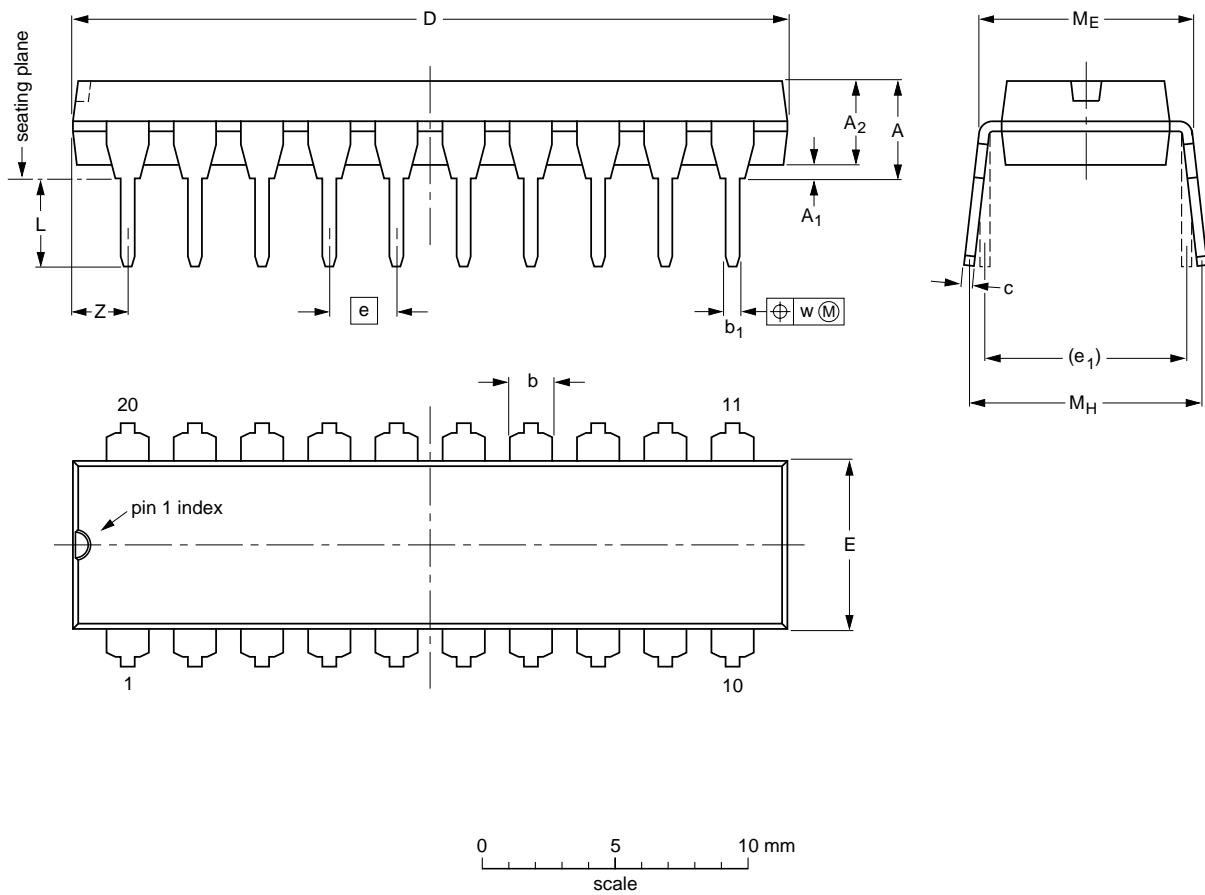
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PACKAGE OUTLINE

DIP20: plastic dual in-line package; 20 leads (300 mil)

SOT146-1



DIMENSIONS (inch dimensions are derived from the original mm 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	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.0
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

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			
SOT146-1			SC603			92-11-17 95-05-24

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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

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.	

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