AM Receiver IC with Demodulator

TDA 4001

DIP 18

The TDA 4001 has been designed to convert, amplify, and demodulate AM signals. In addition, the component provides a search tuning stop pulse.

Features

- Internal demodulation
- Search tuning stop signal
- Low total harmonic distortion
- Minimal IF leakage at the AF output
- 2-stage integrated low pass filter

Maximum ratings

Supply voltage	V_S	15	V
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−40 to 125	°C
Thermal resistance (system-air)	$R_{th\,SA}$	70	K/W

Operating range

Supply voltage	V_S	7 to 15	V
Ambient temperature	T_A	−25 to 85	°C

Characteristics

$V_S = 12$ V; $T_A = 25$ °C; $V_{iRF\,rms} = 1$ mV; $R_g = 50$ V; $f_{iRF} = 1$ MHz; referred to measurement circuit

		min	typ	max	
Current consumption	I_S		15		mA
AF output voltage $m = 0.8$ %	$V_{qAF\,rms}$		800		mV
$m = 0.3$ %	$V_{qAF\,rms}$		300		mV
$V_{iRF\,rms} = 15$ µV; $m = 0.8$ %	$V_{qAF\,rms}$	150		320	mV
$20 \lg \left(\frac{V_1}{V_2}\right)$ $V_1 = V_{qAF}$ at 30 mV $V_2 = V_{qAF}$ at 1 mV				3	dB
Total harmonic distortion $m = 0.8$ %	THD			2	%
$m = 0.3$ %	THD			1	%
$V_{iRF\,rms} = 30$ mV; $m = 0.8$ %	THD			5	%
Signal-to-noise ratio					
$m = 0.3$; $V_{iRF\,rms} = 10$ µV	$\frac{S+N}{N}$		6		dB
$m = 0.3$; $V_{iRF\,rms} = 1$ mV	$\frac{S+N}{N}$		46		dB
Reference voltage	V_{stab}		4.8		V
Oscillator voltage	$V_{OSC\,pp}$		100		mV
Counter output voltage	$V_{qC\,pp}$		100		mV
Input impedance RF input	Z_{iRF}		10/1.5		kΩ/pF
IF amplifier	Z_{iIF}		3.3/1.5		kΩ/pF
AFC offset current without signal	I_{AFC}			±10	µA
AFC offset current in the whole control range	ΔI_{AFC}			±10	µA
AFC output current $f_{iRF} = 1$ MHz ± 3 kHz	I_{AFC}		±80		µA
Search tuning stop output current	I_{q13}		2		mA
Search tuning stop output voltage	V_{q13}			0.4	V
Search tuning stop output voltage					
$V_{iRF} = 0$ V	V_{q13}	11			V
$f_{iRF} > 1$ MHz + 3 kHz	V_{q13}	11			V
$f_{iRF} < 1$ MHz − 3 kHz	V_{q13}	11			V

Additional data with respect to application[1])

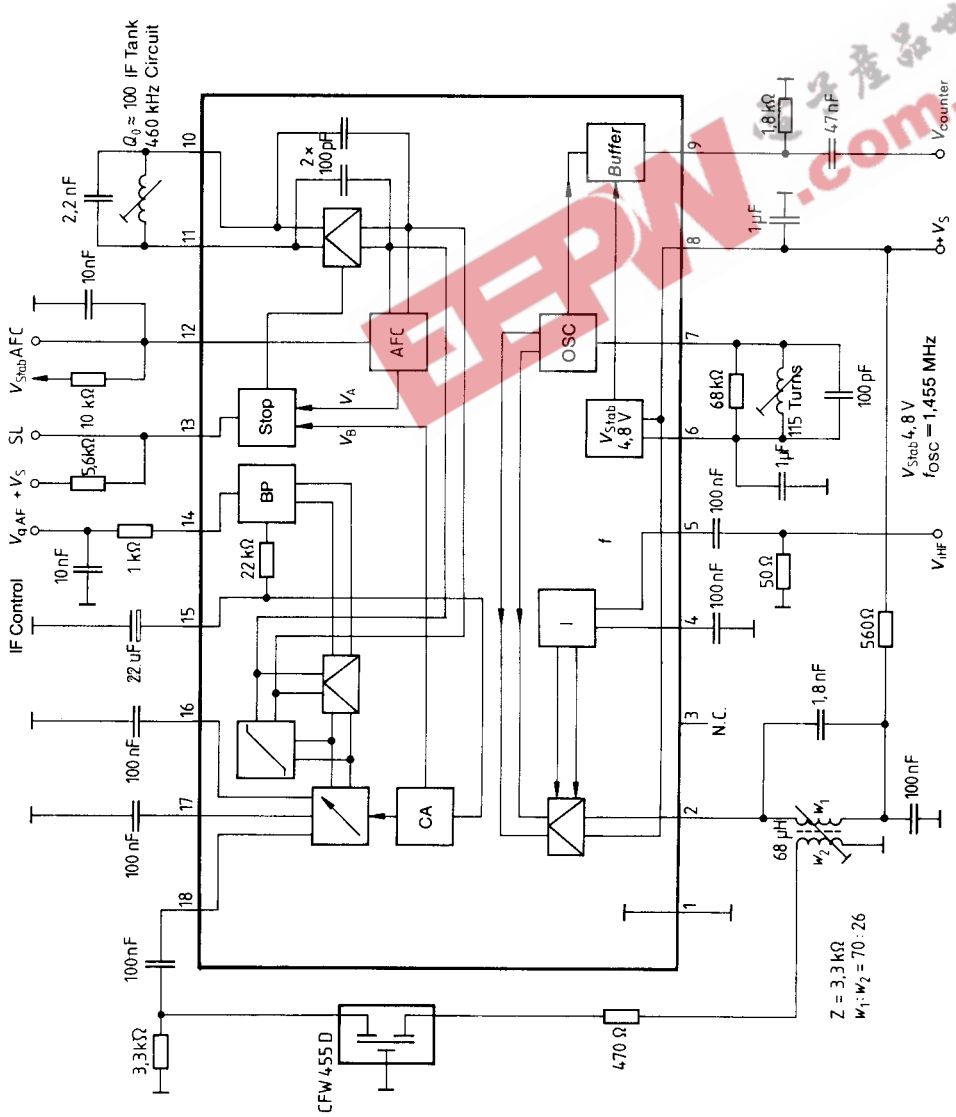
IF suppression	a_{IF}		40		dB
3 dB limit frequency of the integrated TP	f_G		5		kHz
Conversion gain	G_C		30		dB
AGC IF amplifier	$V_{iIF\,rms}$		100		µV
Control range ($\Delta V_{qAF} = 6$ dB)	a		60		dB
Input sensitivity V_{qAF} at $V_{iRF} \geq 0.7$; V_{qAF} at $V_{iRF} = 1$ mV	$V_{iRF\,rms}$		30		µV

Circuit description

The impedance converter forwards the input signal V_{iRF} to the symmetrical double balanced mixer. Subsequently the signal is converted to IF with the amplitude-controlled oscillator. An external filter forwards the IF signal to the controlled IF amplifier. The amplifier IF signal and the carrier signal will be converted to AF in the subsequent synchronous demodulator (SD). The 2-stage low pass filter forwards the available AF to the AF output. Via an additional limiter amplifier (LA), the AF uses the carrier signal to control the coincidence demodulator (CD). The output signal of the coincidence demodulator provides the stop pulse during exact tuning and sufficient field strength.

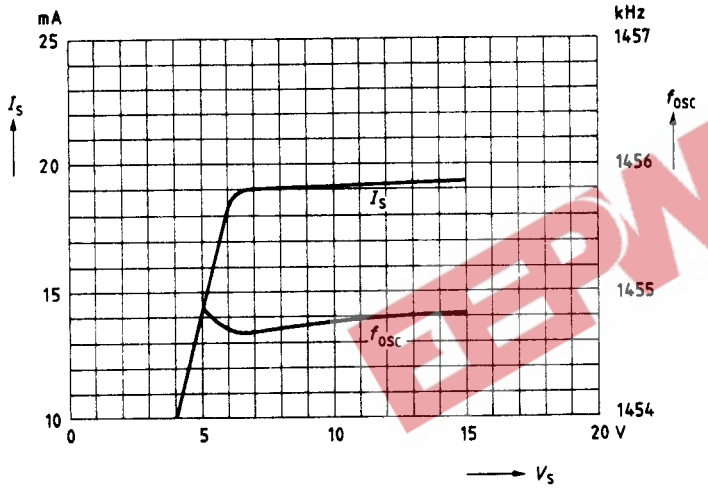
1) Data does not apply to series measurement processes.

Block diagram and measurement circuit

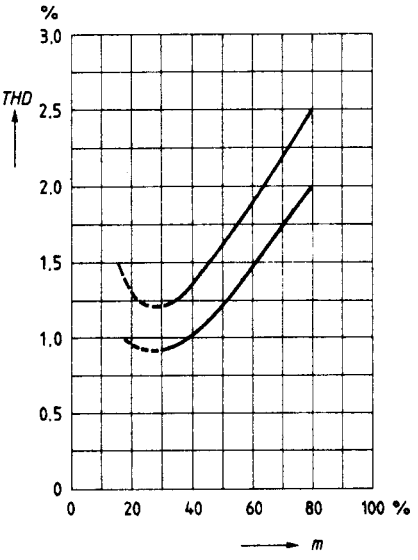


CA = Control Amplifier
BP = Band Pass
I = Impedance Converter

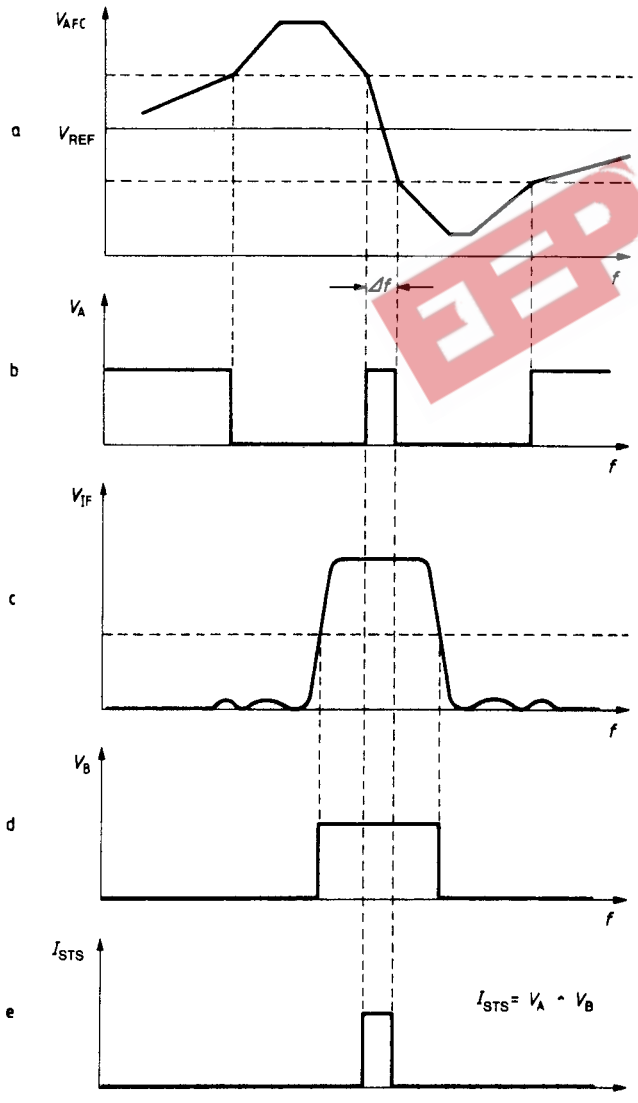
Oscillator frequency versus current consumption



Total harmonic distortion versus modulation factor
$V_S = 15$ V; $f_{mod} = 1$ kHz; $V_I = 1$ mV



Derivation of the AM-SL stop criterion



S Curve Simulation (Pin 12)

Comparator Threshold A

Δf = Stop Bandwidth

V_A = Output Voltage, Window Discriminator A

IF Selection (e.g. CFW 455)

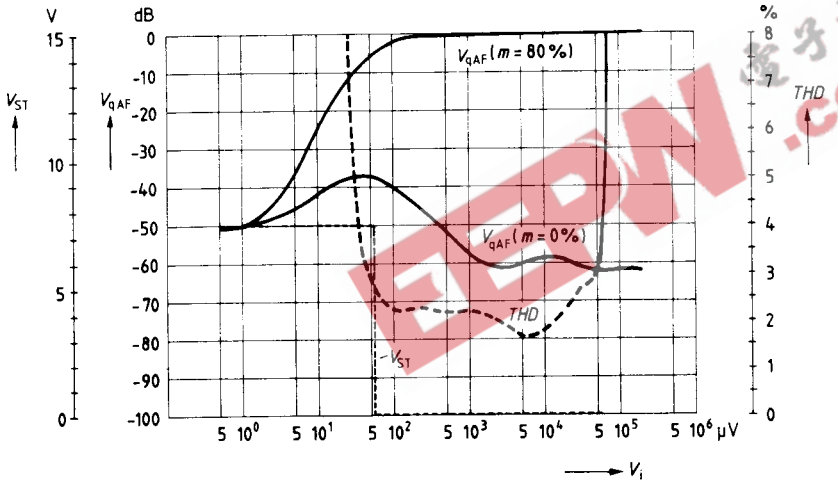
Comparator Threshold B

V_B = Output Voltage, Window Discriminator B

Search Tuning Stop Pulse (Pin 13)

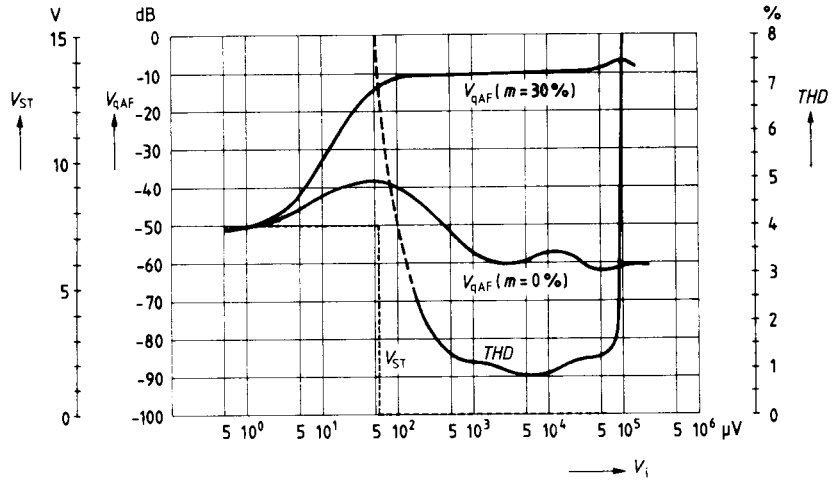
AF output voltage, total harmonic distortion, search tuning stop versus input voltage
$V_S = 15$ V, $f_{mod} = 1$ kHz, $f_i = 1$ MHz

0dB ≙ 775mV (rms)

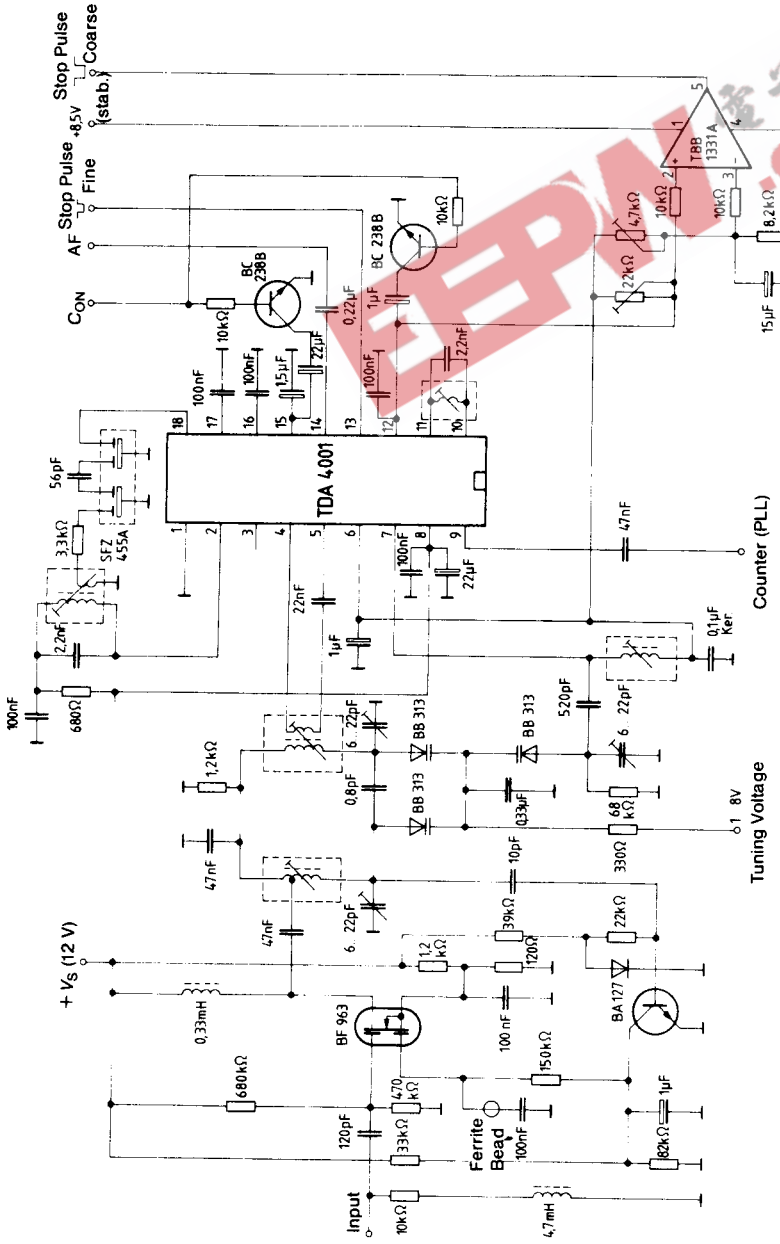


AF output voltage, total harmonic distortion, search tuning stop versus input voltage
$V_S = 15$ V; $f_{mod} = 1$ kHz, $f = 1$ MHz

0dB ≙ 775 mV (rms)



Application circuit



Plug-in location plan

Medium wave receiver with search tuning stop pulse