



# Wireless Components

DVB-IF Mixer

TDA 6190 Version 1.2

Specification April 2000

<b>Revision History: Current Version:</b> April 2000		
Previous Version:Data Sheet		
Page (in previous Version)	Page (in current Version)	Subjects (major changes since last revision)

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## Product Info

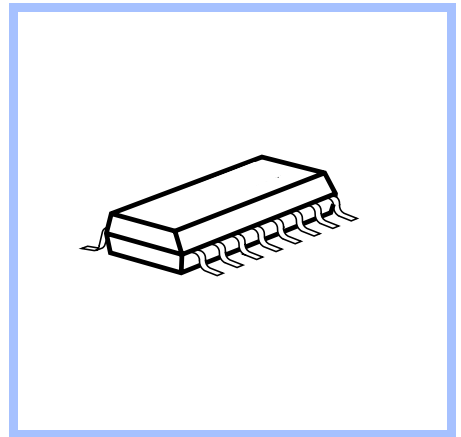
### General Description

The TDA 6190X, TDA 6190T and TDA 6190S are bipolar integrated circuits for amplification and down conversion of modulated IF signals used for DVB on cable or for terrestrial transmission.

### Features

- Input frequency range of 30 to 65 MHz
- TDA 6190X: Automatic gain control with integrated peak AGC detector
- TDA 6190T, TDA 6190S: External gain control for integrated variable gain amplifier
- TDA 6190S: reduced output level
- Output for adjustable delayed tuner AGC
- Integrated low noise VCO circuitry with external varactor diode or crystal

### Package



- Broadband outputs for the down converted IF signal
- Internal low noise reference voltage source
- Full ESD protection

### Application

- For use in TV or cable set-top receivers for Digital Video Broadcast.

### Ordering Information

Type	Ordering Code	Package
TDA 6190X	Q67100-V2005	P-DSO-16-1
TDA 6190X	Q67106-V2005 (tape and reel)	P-DSO-16-1
TDA 6190T	Q67036-A1073 (tape and reel)	P-DSO-16-1
TDA 6190S	Q67036-A1125 (tape and reel)	P-DSO-16-1

# 1

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# 2 Product Description

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## 2.1 Overview

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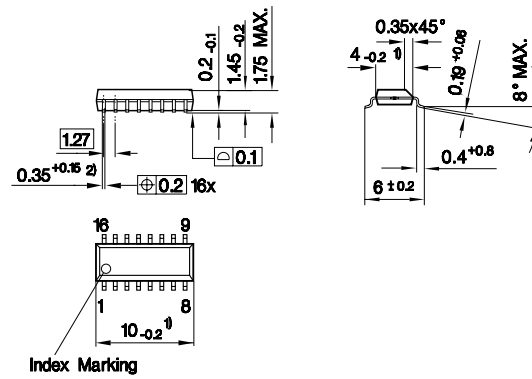
## 2.2 Application

- For use in TV or cable set-top receivers for Digital Video Broadcast.

## 2.3 Features

- Input frequency range of 30 to 65 MHz
- TDA 6190X: Automatic gain control with integrated peak AGC detector
- TDA 6190T, TDA 6190S: External gain control for integrated variable gain amplifier
- TDA 6190S: reduced output level
- Output for adjustable delayed tuner AGC
- Integrated low noise VCO circuitry with external varactor diode or crystal
- Broadband outputs for the down converted IF signal
- Internal low noise reference voltage source
- Full ESD protection

## 2.4 Package Outlines



- 1) Does not include plastic or metal protrusion of 0.15 max. per side
- 2) Lead width can be 0.61 max. in dambar area

p-dso-16.eps

Figure 2-1 P-DSO-16-1

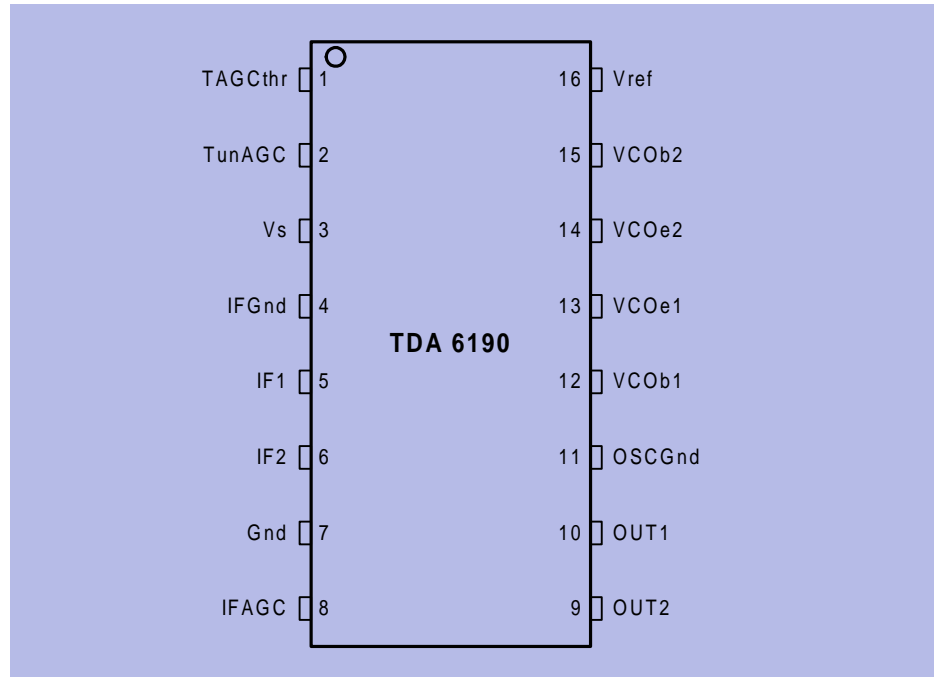
# 3 Functional Description

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### 3.1 Pin Configuration



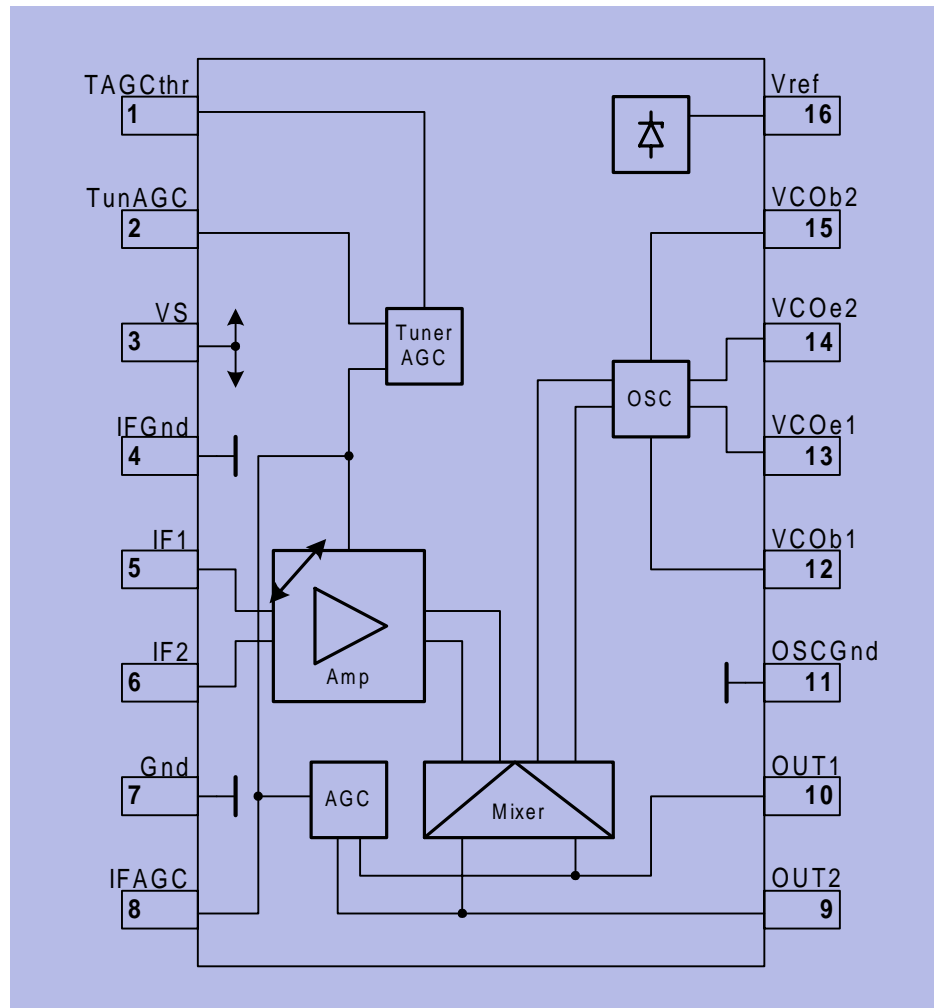
Pin\_config.wmf

Figure 3-1 Pin Configuration

### 3.2 Pin Definition and Function

Table 3-1 Pin Definition and Function		
Pin No.	Symbol	Function
1	TAGCthr	Tuner AGC threshold; delayed tuner AGC adjust input; if not required, connect to reference voltage Vref
2	TunAGC	Delayed Tuner AGC output; open npn transistor collector
3	Vs	Supply voltage
4	IFGnd	IF input Ground
5	IF1	IF input IF1; balanced to IF2
6	IF2	IF input IF2; balanced to IF1
7	Gnd	Ground
8 TDA 6190X	IFAGC	IF AGC filter; automatic gain control filter pin, low voltage corresponds to maximum gain
8 TDA 6190T, TDA 6190S	IFAGC	IF amplifier gain control input pin, low voltage corresponds to maximum gain
9	OUT2	buffered mixer output OUT2; balanced to OUT1
10	OUT1	buffered mixer output OUT1; balanced to OUT2
11	OSCGnd	Oscillator Ground
12	VCOb1	VCO base 1; balanced to VCOb2
13	VCOe1	VCO emitter 1; balanced to VCOe2
14	VCOe2	VCO emitter 2; balanced to VCOe1
15	VCOb2	VCO base 2; balanced to VCOb1
16	Vref	Reference voltage

### 3.3 Functional Block Diagram



Funct\_block.wmf

Figure 3-2 Functional Block Diagram

TDA 6190X: AGC active

TDA 6190T, TDA 6190S: AGC disabled, external gain control voltage to Pin 8

## 3.4 Functional Blocks

### 3.4.1 Power Supply, Reference Voltage

The 3.6 V low noise reference voltage  $V_{ref}$  is used as a reference for the adjustment of the delayed tuner AGC. The reference voltage has a low temperature coefficient and high line regulation.

### 3.4.2 DVB-IF Input Amplifier, AGC

The filtered IF signal is fed to the balanced input pins IF1 / IF2 of the gain controlled amplifier, where it is amplified and then down converted to the output frequency signals.

TDA 6190X: The control voltage for the gain-controlled amplifier at pin IFAGC is derived from a peak level detector at the down converted outputs.

TDA 6190T, TDA 6190S: The control voltage for the gain-controlled amplifier at pin IFAGC is applied from external source.

If the IFAGC control voltage level exceeds an adjustable value ( $TAGC_{thr}$ ), a sink current at TunAGC is generated which controls the tuner gain.

### 3.4.3 Oscillator

The symmetrical 4 pin voltage controlled oscillator feeds the mixer to generate the down converted DVB-IF signals. The frequency of the VCO is below or above the input frequency of the AGC amplifier. The control voltage for the external varactor diode is derived from the DVB processor.

### 3.4.4 Mixer and Output Buffers

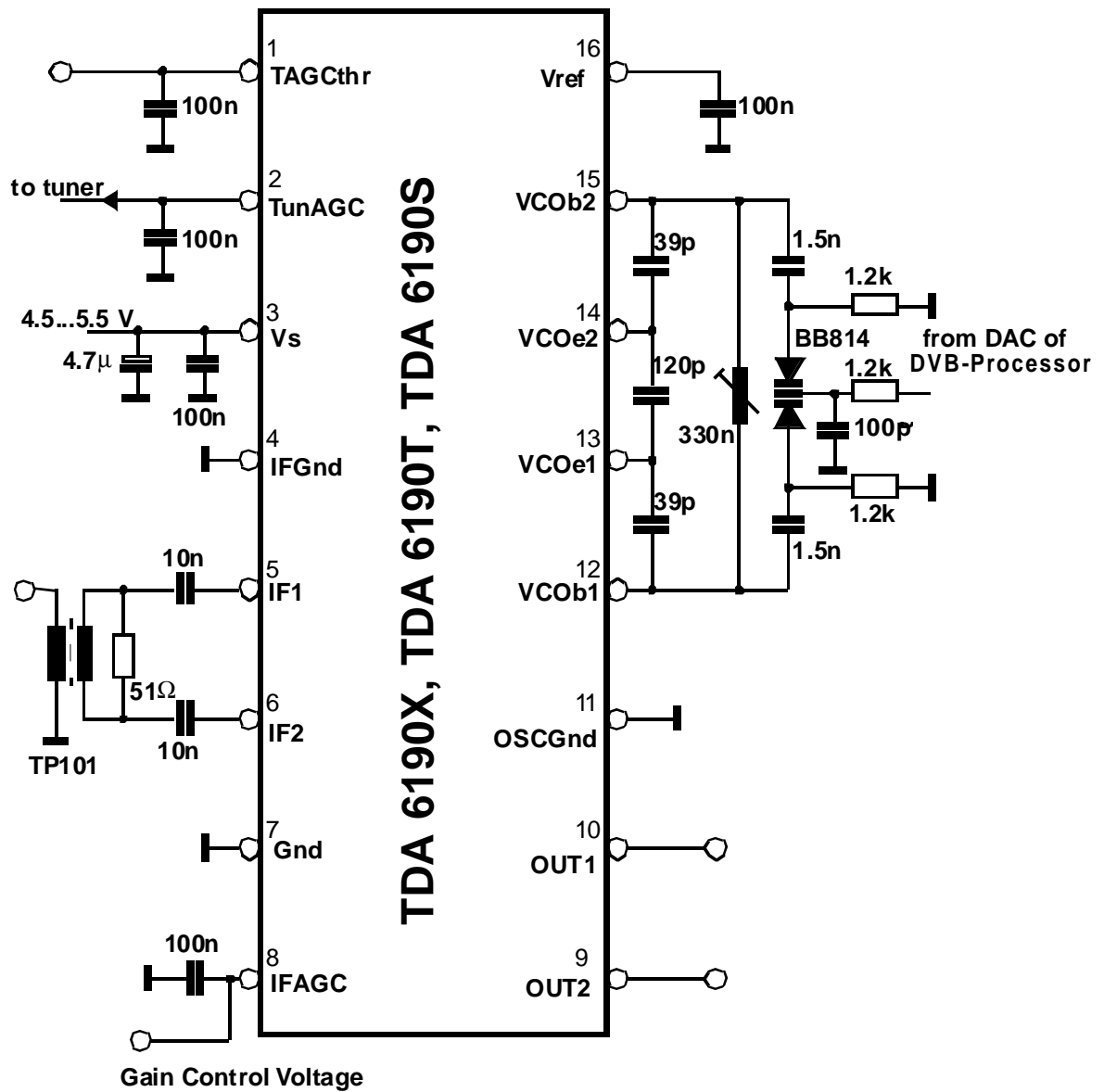
The mixer converts the filtered and amplified IF signal down to the low IF frequency. This frequency is fed to a balanced output pair OUT1 and OUT2.

# 4 Applications

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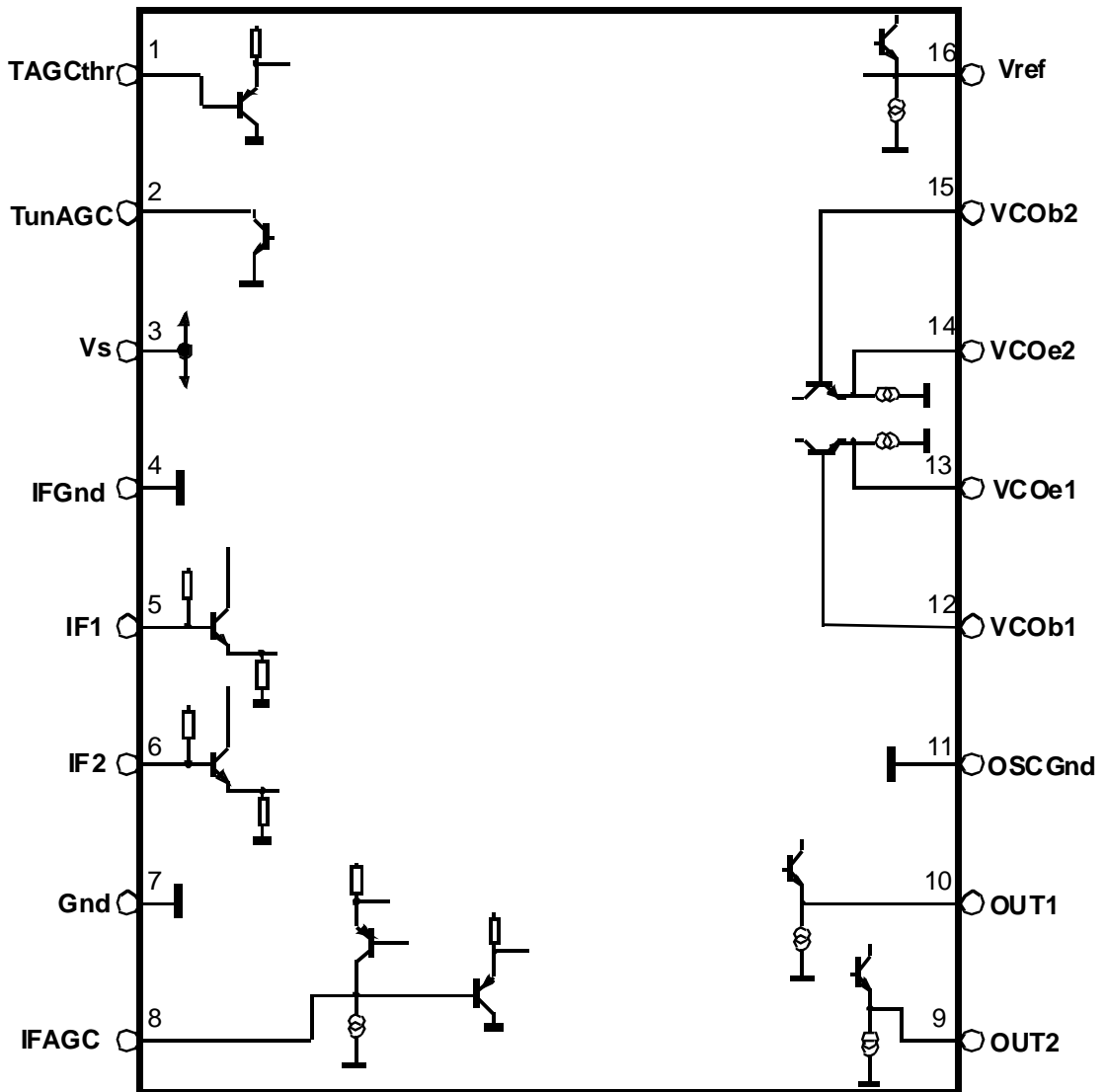
### 4.1 Test Circuit



test\_circuit1.wmf

Figure 4-1 Test Circuit

### 4.2 Equivalent I/O Schematic



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Figure 4-2 Equivalent I/O Schematic

### 4.3 Application Circuit 1 (Evaluation Board)

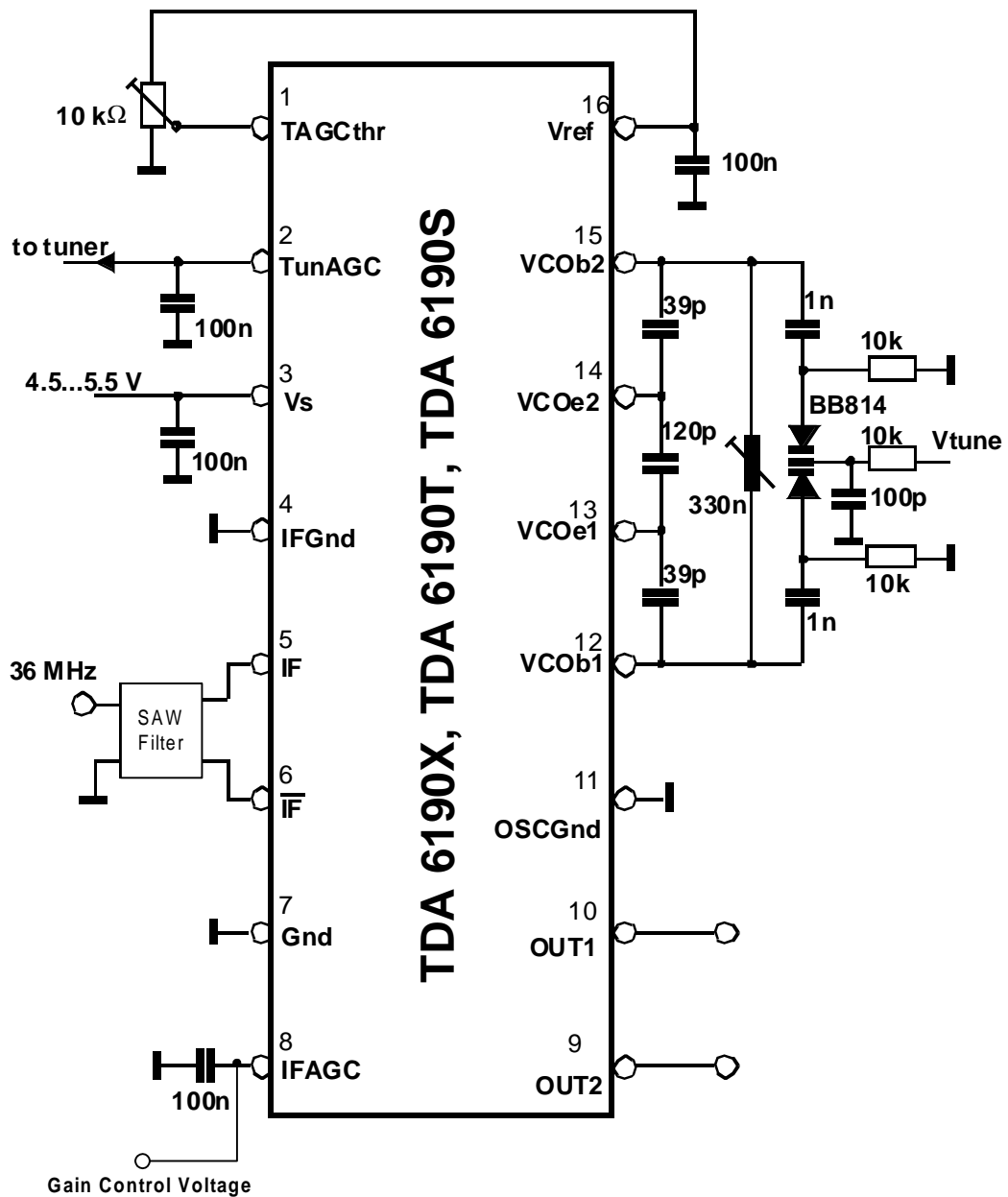


Figure 4-3 Application Circuit 1 (Evaluation Board)

Appl\_1.wmf



### 4.4 Application Circuit 2

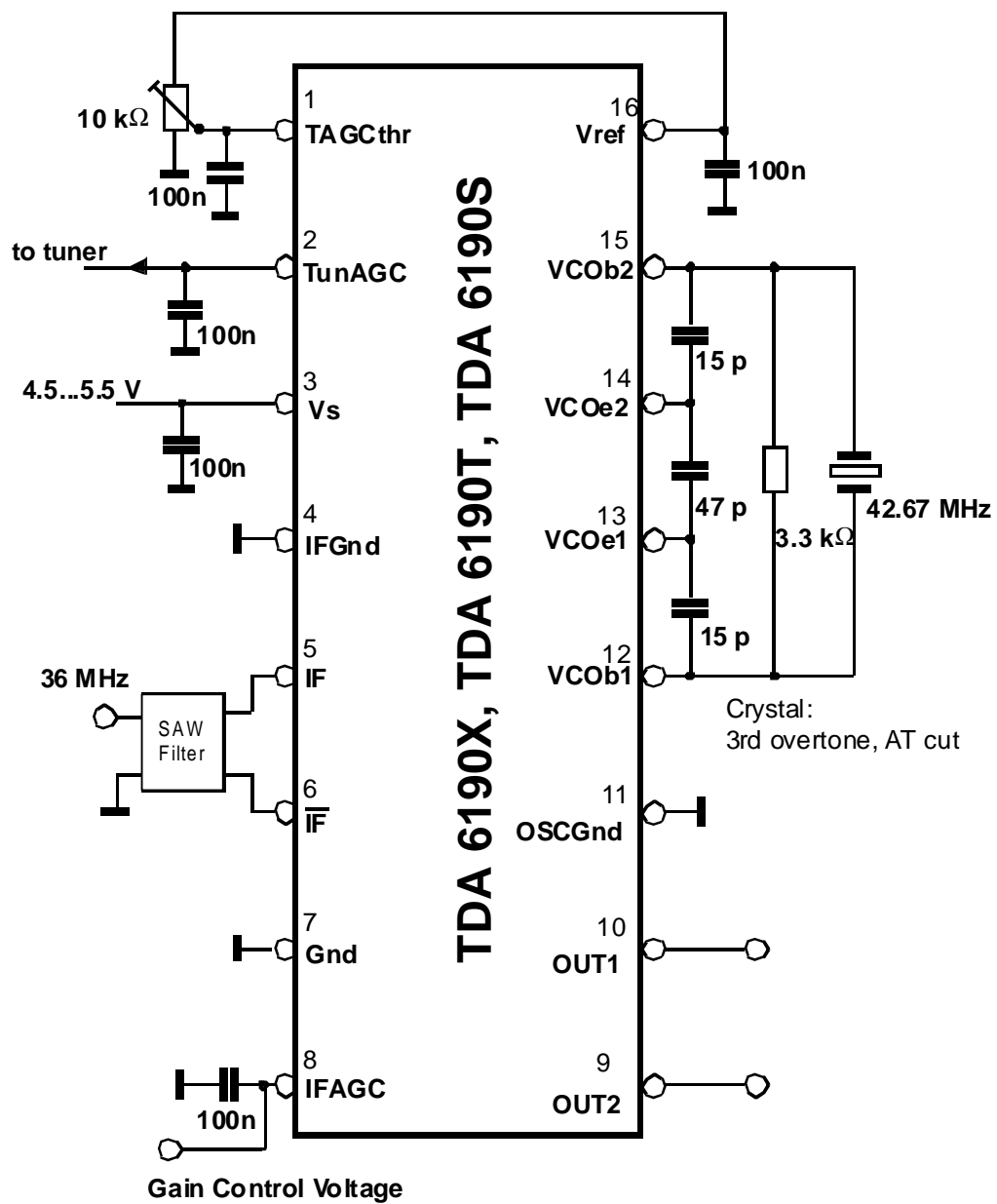


Figure 4-4 Application Circuit 2

Appl\_2.wmf

# 5 Reference

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## 5.1 Electrical Data

### 5.1.1 Absolute Maximum Ratings

*The maximal ratings may not be exceeded under any circumstances, not even momentary and individual, as permanent damage to the IC will result.*

Ambient Temperature under bias:  $T_A = -20$  to  $+80^\circ\text{C}$

**Table 5-1 Absolute Maximum Ratings**

Parameter	Symbol	Limit Values		Unit	Test Conditions
		min	min		
Reference current	$I_{Vref}$	-10	1	mA	
Tuner AGC output	$V_{TunAGC}$	-0.3	13,2	V	
IFAGC	$V_{IFAGC}$	-0.3	Vref	V	
IF input	$V_{IF1/IF2}$	-0.3	4	V	
Supply voltage	$V_{Vs}$	-0.3	6	V	
Mixer outputs	$I_{OUT1/OUT2}$	-5	1	mA	
VCO	$V_{VCO}$	-0.3	4	V	
VCO	$I_{VCO}$	-3		mA	
Tuner AGC threshold	$V_{TAGCthr}$	-0.3	Vref	V	
Junction temperature	$T_j$		125	$^\circ\text{C}$	
Storage temperature	$T_{stg}$	-40	125	$^\circ\text{C}$	
Thermal resistance	$R_{th SA}$		110	K/W	
ESD protection *)	$V_{ESD}$	-4	+4	kV	HBM

\*) according to MIL STD 883D, method 3015.7 and EOS/ESD assn. standard S5.1 - 1993

All values are referred to Ground (pin), unless stated otherwise.

All ground pins must be connected externally.

All currents flowing into the IC are positive, out of the IC are negative.

## 5.1.2 Operating Range

*Within the operational range the IC operates as described in the circuit description.*

*The AC / DC characteristic limits are not guaranteed.*

**Table 5-2 Operating Range**

Parameter	Symbol	Limit Values		Unit	Test Conditions
		min	max		
Supply voltage	$V_{Vs}$	4.5	5.5	V	
Input frequency range of IF Amplifier (-3 dB)	$f_{IF1/IF2}$	30	70	MHz	
Mixer output bandwidth (-1 dB)	$B_{OUT1/OUT2}$	11		MHz	
VCO frequency range	$f_{VCO}$	25	80	MHz	depends on application
Ambient temperature	$T_A$	-20	80	°C	

### 5.1.3 AC/DC Characteristics

**Table 5-3 Supply Voltage  $V_S = 5V$ , Ambient temperature  $T_{amb} = 25\text{ }^\circ\text{C}$** 

Parameter	Symbol	Limit Values			Unit	Test Conditions
		Min	Typ	Max		
<b>1. Power Supply, Reference Voltage</b>						
Current consumption $V_S$	$I_{V_S}$	35	50	65	mA	
Reference voltage $V_{ref}$	$V_{V_{ref}}$	3.3	3.6	3.8	V	
$V_{ref}$ line regulation	$\Delta V_{refLine}$			30	mV	$V_{V_S} = 4.5$ to $5.5$ V
$V_{ref}$ load regulation	$\Delta V_{refLoad}$			30	mV	$I_{V_{ref}} = -0.5$ to $0.5$ mA
$V_{ref}$ vs temperature	$\Delta V_{refTem}$ $p$	-30	10	30	mV	$T_A = 0$ to $70\text{ }^\circ\text{C}$
<b>2. DVB-IF Input Amplifier, AGC</b>						
<b>Static Characteristics</b>						
IF input voltage	$V_{IF1/IF2}$	3.2	3.6	3.9	V	
IFAGC voltage ( $AGC_{min} = gain_{max}$ )	$V_{IFAGCg-max}$	0		0.5	V	
IFAGC voltage ( $AGC_{max} = gain_{min}$ )	$V_{IFAGCg-min}$	2.5		3.9	V	
Tuner AGC threshold active	$V_{TAGCthr}$	0		2.0	V	
Tuner AGC threshold disable	$V_{TAGCthr-dis}$	3.0		$V_{V_S}$	V	
Tuner AGC threshold current	$I_{TAGCthr}$	-1		1	$\mu\text{A}$	$V_{TAGCthr} = 0$ V
Tuner AGC output current	$I_{TunAG-Con}$	2.5	3.5	5	mA	$V_{TunAGC} = 0.5$ V; $V_{IFAGC} = 1.5$ V; $V_{TAGCthr} = 1$ V
Tuner AGC output current	$I_{TunAG-Coff}$	0		10	$\mu\text{A}$	$V_{TunAGC} = 13.2$ V; $V_{IFAGC} = 1.5$ V; $V_{TAGCthr} = 2$ V
<b>Dynamic Characteristics</b>						
Minimum IF input level (max. gain)	$V_{min}$ $IF1/IF2$	40	44	48	$\text{dB}\mu\text{V}$	$f_{IF1/IF2} = 36$ MHz (sine); $V_{IFAGC} = 0.4$ V; TDA 6190X: $V_{OUT1} - V_{OUT2}$ set to $2 \times 1V_{pp}$ TDA 6190T: $V_{OUT1} - V_{OUT2}$ set to $2 \times 1V_{pp}$ TDA 6190S: $V_{OUT1} - V_{OUT2}$ set to $2 \times 560\text{mV}_{pp}$
Maximum IF input level (min. gain)	$V_{max}$ $IF1/IF2$	88	92	96	$\text{dB}\mu\text{V}$	$f_{IF1/IF2} = 36$ MHz (sine); $V_{IFAGC} = 2.4$ V; TDA 6190X: $V_{OUT1} - V_{OUT2}$ set to $2 \times 1V_{pp}$ TDA 6190T: $V_{OUT1} - V_{OUT2}$ set to $2 \times 1V_{pp}$ TDA 6190S: $V_{OUT1} - V_{OUT2}$ set to $2 \times 560\text{mV}_{pp}$

**Table 5-3 Supply Voltage  $V_S = 5V$ , Ambient temperature  $T_{amb} = 25\text{ }^\circ\text{C}$  (continued)**

Parameter	Symbol	Limit Values			Unit	Test Conditions
		Min	Typ	Max		
Input impedance *)	$R_{IF1/IF2}$ $C_{IF1/IF2}$	1.5	2.0 1.5	2.5	k $\Omega$ pF	balanced input
maximum slope of delayed tuner AGC	$\Delta I_{TunAGC} / \Delta V_{IFAGC}$	27	40	54	mA/V	$V_{IFAGC}=1.8$ to $2.1V$ $V_{TAGCthr}=1.9V$ $V_{TunAGC}=0.5V$

\*) design related values

### 3. Oscillator

#### Static Characteristics

VCO voltage	$V_{VCOb1}/V_{VCOb2}$	2.1	2.4	2.7	V	
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#### Dynamic Characteristics

VCO input admittance <sup>a</sup>	$Y=G+jB$					VCO, 39/120/39pF
Real part	$G_{VCOb1}/b2$		-1.3		mS	$f_{VCO} = 25$ MHz
Imag. part	$B_{VCOb1}/b2$		1.8		mS	$f_{VCO} = 25$ MHz
Real part	$G_{VCOb1}/b2$		-1.9		mS	$f_{VCO} = 55$ MHz
Imag. part	$B_{VCOb1}/b2$		5.8		mS	$f_{VCO} = 55$ MHz
Oscillator level	$V_{VCOb1}/b2$		107		dB $\mu$ V	$f_{VCO} = 43$ MHz
Oscillator range	$f_{VCO}$	25		60	MHz	depends on application
Oscillator frequency variation range	$\Delta f_{VCO}$	4	6		MHz	Application Circuit 1 $V_{tune} = 0.5$ to $3V$
Oscillator phase noise @ 10 kHz	$\Delta\Phi_{VCO}$		-105		dBc/Hz	Application Circuit 1 $f_{VCO} = 43$ MHz

### 4. Mixer, Output Buffers

#### Static Characteristics

Demodulator output DC level TDA 6190X, TDA 6190T	$V_{OUT1}/OUT2$	$V_{Vs} - 2.5$	$V_{Vs} - 2.0$	$V_{Vs} - 1.5$	V	
Demodulator output DC level TDA 6190S	$V_{OUT1}/OUT2$	$V_{Vs} - 2.3$	$V_{Vs} - 1.8$	$V_{Vs} - 1.3$	V	
Demodulator output sink current	$I_{OUT1}/OUT2$	1.4	2.0	2.8	mA	

**Table 5-3 Supply Voltage  $V_S = 5V$ , Ambient temperature  $T_{amb} = 25\text{ }^\circ\text{C}$  (continued)**

Parameter	Symbol	Limit Values			Unit	Test Conditions
		Min	Typ	Max		
<b>Dynamic Characteristics</b>						
Dynamic Characteristics TDA 6190T: output voltage $V_{OUT1}$ - $V_{OUT2}$ set to 2 x 1Vpp TDA 6190S: output voltage $V_{OUT1}$ - $V_{OUT2}$ set to 2 x 560mVpp						
TDA 6190X: Demodulator AC output voltage	$V_{OUT1}$	0.9	1.0	1.1	$V_{pp}$	$f_{IF} = 36\text{ MHz}$ ; $f_{VCO} = 43\text{ MHz}$ ; $R_L \geq 10\text{ k}\Omega$ ; $CL \leq 10\text{ pF}$ ; $V_{IF1/IF2} = 60\text{ dB}\mu\text{V}$
TDA 6190X: Demodulator AC output voltage	$V_{OUT2}$	0.9	1.0	1.1	$V_{pp}$	$f_{IF} = 36\text{ MHz}$ ; $f_{VCO} = 43\text{ MHz}$ ; $R_L \geq 10\text{ k}\Omega$ ; $CL \leq 10\text{ pF}$ ; $V_{IF1/IF2} = 60\text{ dB}\mu\text{V}$
Mixer output bandwidth (-1 dB)	$B_{OUT1}/$ $B_{OUT2}$	11			MHz	$f_{VCO} = 43\text{ MHz}$ ; $R_L \geq 10\text{ k}\Omega$ ; $CL \leq 10\text{ pF}$ ; $V_{IF1/IF2} = 60\text{ dB}\mu\text{V}$
Intermodulation	$a_{IM}$	40	48		dB	$f_{VCO} = 43\text{ MHz}$ ; $R_L \geq 10\text{ k}\Omega$ ; $CL \leq 10\text{ pF}$ ; $V_{f1} = V_{f2} = 60\text{ dB}\mu\text{V}$ $f_{1\text{ IF1/IF2}} = 37\text{ MHz}$ ; $f_{2\text{ IF1/IF2}} = 38\text{ MHz}$ ; OUT1/OUT2: balanced
Harmonic distortion	THD		-60	-50	dB	$f_{VCO} = 43\text{ MHz}$ ; $R_L \geq 10\text{ k}\Omega$ ; $CL \leq 10\text{ pF}$ ; $V_{IF1/IF2} = 70\text{ dB}\mu\text{V}$ $f_{IF1/IF2} = 39.5\text{ MHz}$ OUT1/OUT2: balanced
Buffer output impedance	$R_{OUT1}$		25	100	$\Omega$	$f_{OUT1/OUT2} = 11\text{ MHz}$
Buffer output impedance	$R_{OUT2}$		25	100	$\Omega$	$f_{OUT1/OUT2} = 11\text{ MHz}$





### 5.3 Bill of material

Table 5-4 Bill of material for Application Circuit 1

Component	Type / Value	Material / Raster	Outline / Case	Supplier	Ordering Code Nr.
R01	10k		0805	S&M	
R02	10k		0805	S&M	
R03	10k		0805	S&M	
C01	100n	X7R	0805	S&M	
C02	100n	X7R	0805	S&M	
C03	100n	X7R	0805	S&M	
C04	100n	X7R	0805	S&M	
C05	100n	X7R	0805	S&M	
C06	39p	COG	0805	S&M	
C07	120p	COG	0805	S&M	
C08	39p	COG	0805	S&M	
C09	1n	X7R	0805	S&M	
C10	1n	X7R	0805	S&M	
C11	1µF	5mm	MKT	S&M	
C12	100p	COG	0805	S&M	
C13	4n7	X7R	0805	S&M	
Tr01	10k		Potentiom.		
Tr02	10k		Potentiom.		
SAW01	X6966M		SAW Filter	S&M	
D01	BB814		Var. Diode		
L01	330nH		Filter adjust.	TOKO	T1369Z
IC01	TDA6190X		P-DSO-16-1	Infineon	Q6600-S-T

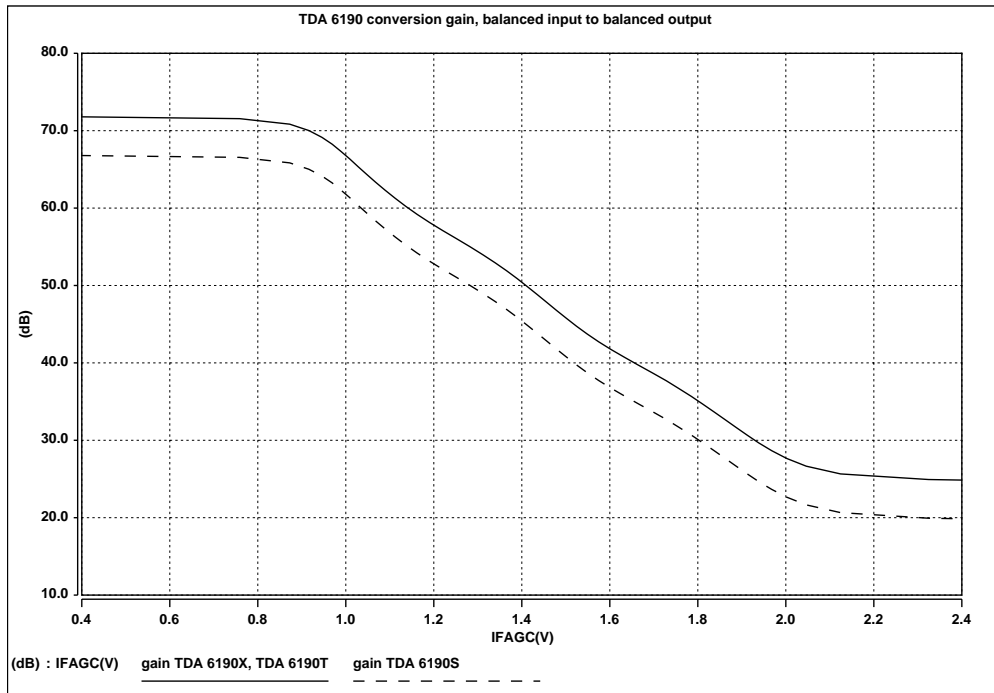
#### Mechanical Parts

1 x PCB

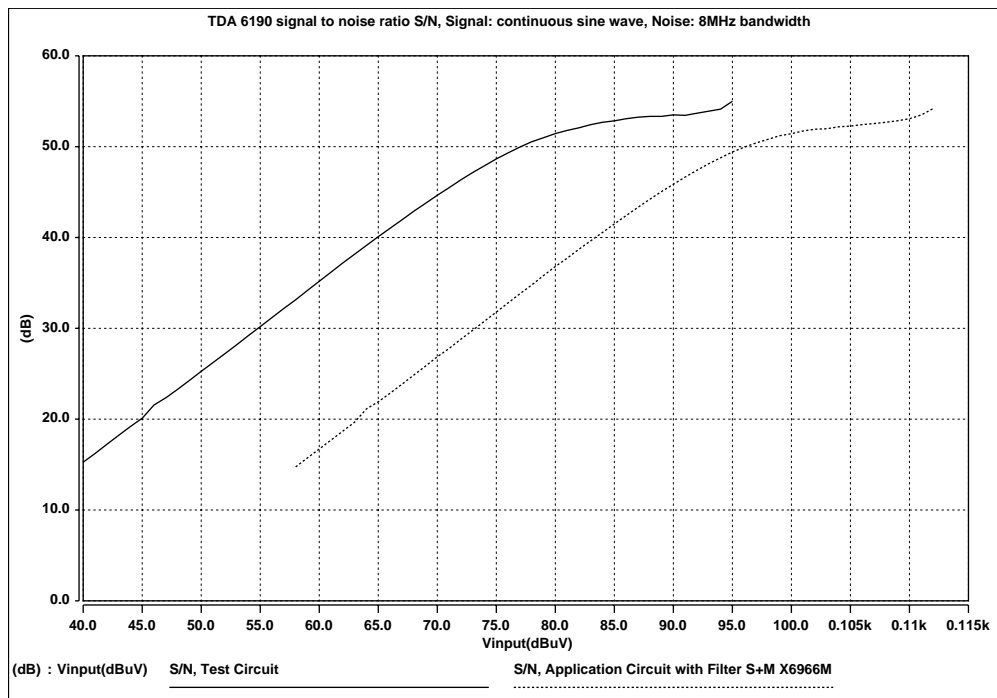
8 x Soldering Pin 1 mm (Stocko)

1 x BNC-Jack (PCB Mounting)

## 5.4 Typical Characteristics



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