

**Multi Media Tuner**  
NTSC M/N(JPN) & FM Radio

TAPE-H091F

# SPECIFICATION

**TAPE-H091F**

**Multimedia tuner**

**NTSC-System M/N(JPN) & FM Radio**

**Multi Media Tuner**  
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**FEATURES**

Systems **NTSC M/N(JPN) & FM Radio Stereo**

True 5V device (low power dissipation)

PLL controlled tuning

Full frequency range from channel 2 (55.25MHz) to channel 69 (801.25MHz)

True - synchronous vision IF demodulator (PLL)

Demodulated video output, AF sound output, second sound IF output, FM Radio stereo output

I<sup>2</sup>C- bus control of tuning, address selection, AFC status Information (Built-in 5-level A/D converter for AFC) ,

Broad system selection.

Complies with FCC(US), JIS(Japan).

Small horizontally mounted metal housing.

**DESCRIPTION**

The **TAPE – H091F** styles of front-ends are designed to meet a wide range of RF applications in the PC Multi-media environment.

The **TAPE – H091F** types are available with single 75ohm input for TV and FM Radio reception. The input connector is available in either standard phono (female socket) or F-connector.

The **TAPE - H091F** consists of a tuner section and an IF section, which are all designed on a single PCB.

The tuner section is equipped with 3 tuned RF MOSFET input stages, with a 3-band balanced mixer and oscillator. IC containing the oscillators, mixers and IF amplifier.

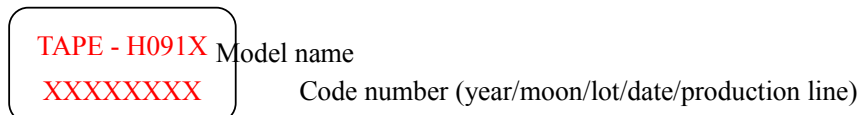
Tuning and band switching in the tuner section are done with a digital programmable PLL tuning system. This enables tuning with step-size programmable between 31.25 kHz, 50 kHz or 62.5 kHz. A DC-DC converter Circuit is built tuner section to provide the tuning voltage, thus making only 5V device.

The IF section uses a true synchronous vision IF demodulator (PLL) with SAW filter in front of it. The analog AFC voltage is fed to the 5-level A/D converter in the PLL IC, so that the AFC status can be read via the I<sup>2</sup>C-bus.

**ORDERING INFORMATION**

TYPE	DESCRIPTION
<b>TAPE – H001F</b>	Standard F-connector. (TV ANT, FM Radio ANT.)
<b>TAPE – H091F</b>	Long F-connector. (TV ANT, FM Radio ANT.)
<b>TAPE – H001P</b>	Standard phono socket.(TV ANT, FM Radio ANT)

**MARKING**



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**INTERMEDIATE FREQUENCIES**

SYSTEM	FREQUENCY (MHz) <sup>[1]</sup>
	M/N(JPN)
Picture carrier	45.75
Color	42.17
Sound	41.25
Radio IF (RIF) Frequency (External)	10.70

Notes :

[1] The oscillator frequency is above the input signal frequency.

**CHANNEL COVERAGE**

- Low band : 48.25 to 160.00MHz.
- Mid band : 160.00 to 442.00MHz.
- High band : 442.00 to 801.25MHz.
- FM band : 88.00 to 108.00MHz.

**PIN DESCRIPTION**

SYMBOL	PIN	DESCRIPTION
RF AGC	1	RF AGC (Display only)
V <sub>T</sub>	2	Tuning voltage (Display only)
V <sub>cc</sub> (B <sub>TU</sub> )	3	Supply voltage tuner section +5 V
SCL	4	I <sup>2</sup> C bus serial clock
SDA	5	I <sup>2</sup> C bus serial data
AS	6	I <sup>2</sup> C bus address select
IF 1	7	Not Connected
IF 2	8	Not Connected
FM Audio (Right)	9	FM Radio audio output (Right)
FM Audio (Left)	10	FM Radio audio output (Left)
2 <sup>nd</sup> SIF	11	Second IF sound output
Video	12	Composite video base band signal output
V <sub>cc</sub> (B <sub>IF</sub> )	13	Supply voltage IF section +5 V
Audio	14	AF sound output

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**LIMITING VALUES**

Limiting values under operational conditions

The tuner can be guaranteed to function properly under the following conditions.

Symbol	PARAMETER	PIN	MIN.	TYP.	MAX.	UNIT
V <sub>cc(B<sub>TU</sub>)</sub>	Tuner section Supply voltage		4.75	5.0	5.25	V
V <sub>cc(B<sub>TU</sub>)</sub> [ripple]	Peak-to-peak ripple	3				
	Voltage allowable (at 5V ±5%); note 1		-	-	5	□
	20 Hz to 100 kHz		-	-	10	
	> 100 kHz to 200 kHz		-	-	10	
I <sub>TU</sub>	Supply current		-	100	150	□
V <sub>SCL</sub>	SCL bus input voltage	4	-0.3	-	+5.25	V
V <sub>SDA</sub>	SDA bus input voltage	5	-0.3	-	+5.25	V
I <sub>SDA</sub>	SDA bus current (open collector)		-1	-	+5	□
I <sub>AS</sub>	Address select voltage; note2	6	-	-	+5.25	V
V <sub>Right(FM)</sub>	FM Right output DC voltage	9	-	1.0	-	V
Z <sub>Right(FM)</sub>	FM Right output load impedance	9				
	Resistive value		-	40	-	□
	Capacitive value		-	9	-	□
V <sub>Left(FM)</sub>	FM Left output DC voltage	10	-	1.0	-	V
Z <sub>SIF</sub>	2'nd IF Sound output load impedance DC/AC	11		1.0		□
Z <sub>Left(FM)</sub>	FM Left output load impedance	10				
	Resistive value		-	40	-	□
	Capacitive value		-	9	-	□
Z <sub>V</sub>	Video base-band signal load impedance	12				
	DC/AC		-	75	-	Ω
T <sub>L</sub>	Load time constant		-	-	100	□
V <sub>cc(B<sub>IF</sub>)</sub>	IF supply voltage		4.75	5.0	5.25	V
V <sub>cc(B<sub>IF</sub>)</sub> [ripple]	Peak-to-peak ripple voltage	13				
	susceptibility (at 5V ±5%); note 1		-	-	5	□
	20 Hz to 100 kHz		-	-	10	
	> 100 kHz to 500 kHz		-	-	10	
I <sub>IF</sub>	IF supply current		-	130	180	□
Z <sub>A</sub>	AF sound output load impedance:	14				
	DC		100.0	-	-	□
	AC		10.0	-	-	

Notes :

1. Sinusoidal ripple voltage superimposed on the 5 V supply voltage in the frequency range of 20 Hz to 500 kHz . Criteria for TV interference □57 □

2. For detailed information about the address coding, refer to chapter application information.

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**Environmental conditions**

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Non-operational conditions</b>						
T <sub>Amb</sub>	Ambient temperature		-25	-	+85	□
RH	Relative humidity		-	-	100	%
G <sub>B</sub>	Bump acceleration	25g	-	-	245	□
G <sub>S</sub>	Shock acceleration	50g	-	-	490	□
	Vibration amplitude	10 to 55Hz	-	-	0.35	mm
<b>Operational conditions</b>						
T <sub>Amb</sub>	Ambient temperature		0	-	+60	□
RH	Relative humidity		-	-	95	%

**OVERALL PERFORMANCE**

**Conditional data**

Unless otherwise specified, all electrical values for Chapter overall performance apply at the following conditions.

SYMBOL	PARAMETER	VALUE	UNIT
T <sub>Amb</sub>	Ambient temperature	25±5	□
RH	Relative humidity	60±15	%
V <sub>cc</sub> (B <sub>TU</sub> ) V <sub>cc</sub> (B <sub>IF</sub> )	Supply voltage (Tuner and IF section)	5±0.125	V
Z <sub>V</sub>	Video output load impedance (DC)	>75	Ω
Z <sub>IF</sub>	Sound IF output load impedance (DC)	>500	Ω
Z <sub>S(AE)</sub>	Aerial source impedance (unbalanced)	75	Ω
Z <sub>A</sub>	AF Sound output load impedance (DC)	100	□

**Electrical characteristics**

For detailed information about the PLL programming, refer to Chapter application information. The multimedia tuner guaranteed to function properly within the specified operational condition, but a certain deterioration of performance parameters may occur at limits of the operational condition.

**Test equipment**

EQUIPMENT	PARAMETER	VALUE	UNIT
DC voltmeter	Input impedance	□1	MΩ
Oscilloscope	Input impedance Resistance Capacitance	□1 □15	MΩ □
Spectrum analyzer	Input impedance	75	Ω

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**Definitions of test signals (see test circuit, Fig3)**

Signal name.	Modulation		FREQ (MHz)	Level
	Signal	Condition		
<b>V0</b>	Video	EBU color bar pattern, Modulation depth: 87.5%.	199.25	70 □□
<b>V1</b>	Video	100%White pattern, Modulation depth: 87.5%.	199.29	70 □□
<b>V2</b>	Video	Full sweep (Based on 0.5□), Modulation depth: 87.5%.	199.25	70 □□
<b>V3</b>	Video	Sin <sup>2</sup> 2T pulse□bar pattern, Modulation depth: 87.5%.	199.25	70 □□
<b>V4</b>	Video	5 Stair-steps pattern, Modulation depth: 87.5%, Set modulation at the peak of 5'th chroma signal	199.25	70 □□
<b>S0</b>	Audio	Main Sound carrier, [unmodulated]	203.75	-13 □
<b>S1</b>	Audio	1kHz Sine wave, Pre-emphasis : 75 □ Modulation : FM , deviation : ±25kHz.	203.75	-13 □
<b>S2</b>	Audio	20Hz ~ 12 kHz Pre-emphasis : 75 □, (Based on 1kHz) Modulation : FM , deviation : ±7.5kHz .	203.75	-13 □
<b>S3</b>	Audio	1kHz Sine wave, Modulation : FM , deviation : ±22.5kHz [mono]	98.00	70 □□
<b>S4</b>	Audio	1kHz Sine wave, Modulation : FM, deviation : ±75kHz [mono]	98.00	70 □□
<b>S5</b>	Audio	1kHz Sine wave, Modulation : FM, deviation : ±75kHz 10% pilot carrier (L=R) [stereo]	98.00	70 □□
<b>S6</b>	Audio	20Hz ~ 12 kHz Sine wave , Pre-emphasis : 75 □ Modulation : FM, deviation : ±75kHz 10% pilot carrier (L=R) [stereo]	98.00	70 □□

Notes :

1. The line 17 and 330 shall always contain a composite video signal. (VITS lines)

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**Aerial input characteristics**

Symbol	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>PSM</sub>	Surge protection voltage		5	-	KV
V <sub>ANT</sub>	Antenna connection Disturbance Voltage	<950 □ 950~1,750 □	-	46 54	□ □

**General characteristics [Tuner section]**

PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Frequency range	Low band	55.25	-	157.25	MHz
	Mid band	163.25	-	439.25	
	High band	445.25	-	801.25	
	FM band	88.00	-	108.00	
Margin Frequency	Low band	1.0	-	-	MHz
	Mid/High band	2	-	-	
	FM band	2	-	-	
Image rejection	Low band	50	-	-	□
	Mid band	50	-	-	
	All band cable	40	-	-	
	High band	40	-	-	
	FM band	45	-	-	
Usable maximum input	Ant input	-	-	95	□ □
IF rejection (picture)		55	-	-	□
Cross modulation					
	In-channel	60	-	-	□ □
	In-band Low band(n±2)	78	-	-	
	Mid band(n±3)	78	-	-	
	High band(n±5)	84	-	-	
	Out of band	-	100	-	

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**Video characteristics [IF section: Video Trap Bypass Off]**

PARAMETER	Test signal & Test Condition	Test point	MIN.	TYP.	MAX	UNIT
Video output level	V0	TP V	1.5	2.0	2.3	V <sub>p-p</sub>
SYNC Ratio	V0 T1	TP V	27	30	33	%
Video S/N	V1+S1 T2	TP V	43	49	-	□
Video Noise limiting Sensitivity	V1+S1 T2 + T3	TP V	-	45	52	□□
Video frequency characteristics 1.00□ 2.00□ 3.00□ 3.58□	V2	TP V	-2.5 -3.5 -4.0 -6.0	0 0 0 -1.5	+2.5 +3.0 +4.0 +3.0	□
Sin <sup>2</sup> 2T pulse response	V3	TP V	70	90	-	%
Differential gain	V4	TP V	-10	5	+10	%
Differential Phase	V4	TP V	-10	5	+10	deg

Notes :

1. T1 : Test signal Sync. Level: 30% Sync ratio.
2. T2 : Test instrument condition : Sub-carrier trap : on , HPF : 100 □, LPF : 4.2MHz.
3. T3 : Video Noise S/N reference: 30 dB.

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**Audio characteristics [IF section: Audio Gain 0 ]**

Mode	PARAMETER	Test signal & Test Condition	Test point	MIN.	TYP.	MAX	UNIT
TV	Audio output level	S1 + V0	TP A1	350	450	550	mVrms
	Audio distortion [THD]	S1 + V0 (Note 1)	TP A1	-	1	3	%
	Audio frequency Characteristics	S2 + V0 (Note 2)	TP A1	20□	0	+3	□
	1□			-3	0	+3	
	12□			-4	0	+4	
	Audio S/N	S1 + V0 (Note 1)	TP A1	42	50	-	□
	SIF output level (2'nd sound IF out)	S0 + V0 (Note 3)	TP S	80	-	-	□□
SYNC Buzz	V0 + S1	TP A1	-	50	100	mVp-p	
FM	Limiting sensitivity	S3 (Note 4) S5	TP FM	- -	20 30	40 40	□□
	Audio S/N	S3 (Note 1) S4 S5	TP FM	43 55 24	48 59 30	- - -	□
	Audio frequency Characteristics	(Note 2) Lower -3dB point, S6 Upper -3dB point, S6	TP FM	- 14	20 18	40 -	Hz kHz
	AM suppression	S3	TP FM	38	-	-	dB
	Audio output level	S3 S5 C7=1	TP FM	75 142	100 190	125 237	mVrms
	Stereo separation	S5	TP FM	15	20	-	dB
	Audio distortion [THD] (Note 1)	S5 C7=1	TP FM	-	0.7	3.0	%

Notes :

1. Audio characteristics:

- 1) AF output level measured via LP 20kHz filter, RMS detector, 75□ de-emphasis,
- 2) THD Measured via LP 20kHz filter, RMS detector, 75 □ de-emphasis, CCITT weighting,
- 3) S/N measured via CCIR filter, peak CCIR detector, 75 □ de-emphasis.

3. Variation from standard de-emphasis curve.

4. Measured with spectrum analyzer.

5. Audio S/N reference : 30□, 75□ de-emphasis.

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**APPLICATION INFORMATION**

**TUNER Part Programming**

A detailed description of the I<sup>2</sup>C-bus specification, with applications, is given in data sheet of the TUA6030 [Infineon semiconductor].

**I2C Bus Control format [ WRITE mode(R/W=0) ]**

BYTE	BITS								
	7(MSB)	6	5	4	3	2	1	0(LSB)	A <sup>(1)</sup>
Address byte	1	1	0	0	0	MA1	M01	R/W=0	A
Program divider byte 1	0	N14	N13	N12	N11	N10	N9	N8	A
Program divider byte 2	N7	N6	N5	N4	N3	N2	N1	N0	A
Control byte	1	CP	T2	T1	T0	RSA	RSB	OS	A
Band switch byte	P7	P6	P5	P4	P3	P2	P1	P0	A
Auxiliary byte <sup>(2)</sup>	ATC	AL2	AL1	AL0	0	0	0	0	A

Notes :

- (1) A = Acknowledge.
- (2) By default it is set to AL2=0 , AL1=1 , AL0=0. This sets the tuner TOP to 112dBuV upon Power-on reset.

**Address Byte**

V<sub>cc</sub>(B<sub>TU</sub>) = +5 V (Tuner section supply voltage)

MA1	M01	Address	Voltage applied on CE input
0	0	C0	0 V <sub>cc</sub> (B <sub>TU</sub> ) to 0.1 V <sub>cc</sub> (B <sub>TU</sub> )
0	1	C2	Open-circuit or 0.2 to 0.3 V <sub>cc</sub> (B <sub>TU</sub> )
1	0	C4	0.4 to 0.6 V <sub>cc</sub> (B <sub>TU</sub> )
1	1	C6	0.9 V <sub>cc</sub> (B <sub>TU</sub> ) to V <sub>cc</sub> (B <sub>TU</sub> )

**Programmable Divider Byte settings (Program divider byte 1 and 2)**

Divider ratio:  $N = f_{OSC} * N_{ref}$

$$f_{OSC} = N / N_{ref} = \{f_{RF(pc)} + f_{IF(pc)}\}, \text{ where (pc) is picture carrier and } f_{RF} \text{ are}$$

Expressed in MHz

$$N_{ref} = 1\text{MHz} / f_{ref}, \quad f_{ref} = \text{Step size, refer to Ratio select bits (RSA, RSB)}$$

If Step size = 62.5 kHz → N<sub>ref</sub> = 16

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**Control Byte**

▪ **Charge pump settings**

CP	T2	T1	T0	Mode	Charge pump current
0	0	0	X	Normal	50uA
1			X		250uA (default)
0	1	1	0	Extended	50uA
0			1		125uA
1			0		250uA
1			1		650uA

▪ **Test mode settings**

T2	T1	T0	Mode
0	0	0	Normal mode, charge pump currents 50 and 250uA selectable
0	0	1	Normal mode, charge pump currents 50 and 250uA selectable (default)
0	1	0	CP is in high-impedance state
0	1	1	Byte AB will follow (otherwise byte BB will follow)
1	0	0	P0 = $f_{div}$ output, P1 = $f_{ref}$ output
1	0	1	Not in use
1	1	0	Extended mode, charge pump currents 50 and 250uA selectable
1	1	1	Extended mode, charge pump currents 50 and 650uA selectable

▪ **PLL disabling (tuning amplifier control bit)**

OS = 0, for normal operation; tuning voltage is ON

OS = 1, for switching the charge pump to the high impedance state; tuning voltage is OFF

▪ **Ratio select bit**

T2	T1	RSA	RSB	Mode	Fref <sup>1)</sup>	Reference divider ratio
0	0	0	0	Normal	50KHz	80
0	0	0	1	Normal	31.25 KHz	128
X	X	1	0	X	166.67 KHz	24
X	X	1	1	X	62.5 KHz	64
1	1	0	0	Extended	125 KHz	32
1	1	0	1	Extended	142.86 KHz	28

Note: 1) With a 4MHz quartz.

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▪ **Band Switch Byte**

Band	Band switch byte							
	P7	P6	P5	P4	P3	P2	P1	P0
Low band	X	X	X	0	0	0	0	1
Mid band	X	X	X	0	0	0	1	0
High band	X	X	X	0	0	1	0	0
FM band stereo	X	0	X	1	1	0	0	1
FM band mono	X	1	X	1	1	0	0	1

▪ **Auxiliary Byte**

ATC = AGC time constant bit

In M/N mode, ATC = 1,  $I_{AGC} = 9\mu A$ ,  $\Delta t = 50mS$  with  $C = 160nF$

ATC = 0,  $I_{AGC} = 220nA$ ,  $\Delta t = 2S$  with  $C = 160nF$  (default)

**AGC take-over point**

AL2	AL1	AL0	Remark	IF output level, symmetrical mode
0	0	0		115 dBuV
0	0	1		115 dBuV
0	1	0	Default mode at POR	112 dBuV
0	1	1	Recommended for negative Modulation	109 dBuV
1	0	0	Recommended for Modulation	106 dBuV
1	0	1		103 dBuV
1	1	0	External AGC <sup>1)</sup>	$I_{AGC} = 0$
1	1	1	Disable <sup>2)</sup>	3.5V

Notes : 1) The AGC detector is disabled. Both the sinking and sourcing current from the IC is disabled.

The AGC output goes into a high impedance state and an external AGC source can be connected in parallel and will not be influenced.

2) The AGC detector is disabled and  $I_{AGC} = 9 \square$ .

3) It is recommend to set the TOP at 109  $\square \square$  NTSC M/N system. For FM radio, it is also recommend to set the TOP at 109  $\square \square$ .

**Telegram examples (write mode)**

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb - Ack - Pb - Ack - Stop

Start - Adb - Ack - Cb - Ack - Pb - Ack - Db1 - Ack - Db2 - Ack - Stop

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb - Ack - Stop

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Stop

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Where: Start = start condition    Adb = address byte    Ack = acknowledge  
 Db1 = divider byte1    Db2 = divider byte2    Cb = control byte  
 Pb = ports byte    Stop = stop condition

**Remark**

for channel selection involving band switching, and to ensure smooth tuning to the desired channel without causing unnecessary charge pump action, it is recommended to consider the difference between wanted channel frequency ( $f_w$ ) and the current channel frequency ( $f_c$ )

. If  $f_w > f_c$ , use telegram as:

Start - Adb - Ack - Db1 - Ack - Db2 - Ack - Cb - Ack - Pb - Ack - Stop

. If  $f_w < f_c$ , use telegram as:

Start - Adb - Ack - Cb - Ack - Pb - Ack - Db1 - Ack - Db2 - Ack - Stop

Unnecessary charge pump action will result in very low tuning voltage ( $V_T \square 0V$ ) which may drive the oscillator to extreme conditions.

**I2C Bus Control format [ READ mode(R/W=1) ]**

The in lock can be read by setting the R/W bit to 1.

BYTE	BITS								
	7(MSB)	6	5	4	3	2	1	0(LSB)	A(5)
Address byte	1	1	0	0	0	MA1	MA0	R/W=1	A
Status byte	POR(1)	FL(2)	1	1	AGC(3)	A2(4)	A1(4)	A0(4)	A

Notes :

- (1) POR = Power on reset.(POR = 1 at power on)
- (2) FL = 0 In-lock flag. (FL=1: loop is phase-locked)
- (3) AGC =0 Internal AGC flag. AGC = 1 when internal AGC is active (level below 3V)
- (4) Digital AFC status = digital output of the 5-level ADC(Optional)

**Digital AFC status (Optional)**

Digital read out			Voltage applied on ADC input	Frequency [kHz]
A2	A1	A0		
1	0	0	$0.60 * V_{cc}(B_{TU})$ to $1.00 * V_{cc}(B_{TU})$	+125
0	1	1	$0.45 * V_{cc}(B_{TU})$ to $0.60 * V_{cc}(B_{TU})$	+62.5
0	1	0	$0.30 * V_{cc}(B_{TU})$ to $0.45 * V_{cc}(B_{TU})$	0
0	0	1	$0.15 * V_{cc}(B_{TU})$ to $0.30 * V_{cc}(B_{TU})$	-62.5
0	0	0	$0 V_{cc}(B_{TU})$ to $0.15 * V_{cc}(B_{TU})$	-125

**TELEGRAM EXAMPLES (READ MODE)**

Start - Adb - Ack - STB - Ack - STB - Stop (no Ack from processor = End of data).

Start - Adv - Ack - STB - Stop (no Ack from processor = End of data).

Where:                    STB - Status byte.

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**IF Part Programming**

A detailed description of the I<sup>2</sup>C-bus specification, with applications, is given in data sheet of the TDA9887TS [Philips semiconductor].

**I2C Bus Control Format [ WRITE Mode (slave receives data) ]**

<b>S</b>	<b>SLAVE ADDRESS</b>	<b>R/W=0</b>	<b>A</b>	<b>SAD</b>	<b>A</b>	<b>DATA</b>	<b>A</b>	<b>P</b>
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<b>BIT</b>	<b>FUNCTION</b>
S	START Condition
Standard SLAVE ADDRESS	100 0011X, where X is the value of R/W
R/W=0	WRITE mode
A	Acknowledge, generated by slave
SUB ADDRESS (SAD)	See table below
DATA	Byte B, C and E (Described below)
P	STOP Condition

**- SUB ADDRESS BYTE (SAD, Second byte after slave address)**

<b>Data Byte following SAD</b>	<b>MSB</b>							<b>LSB</b>
	<b>D7<sup>(1)</sup></b>	<b>D6</b>	<b>D5</b>	<b>D4</b>	<b>D3</b>	<b>D2</b>	<b>D1</b>	<b>D0</b>
SWITCHING (B Data)	0	0	X <sup>(2)</sup>	X <sup>(2)</sup>	X <sup>(2)</sup>	X <sup>(2)</sup>	0	0
ADJUST(C Data)	0	0	0	0	0	0	0	1
DATA (E Data)	0	0	0	0	0	0	1	0

Notes :

1. D7=1 is not allowed.
2. X =don't care.

**DESCRIPTION OF THE BITS OF VARIOUS DATA BYTES**

<b>DATA BYTE</b>	<b>BIT</b>	<b>SUB ADDRESS</b>	<b>FUNCTION</b>
<b>B DATA</b>	B0	SWITCHING	Video Mode (Sound trap)
	B1	SWITCHING	Auto Mute FM
	B2	SWITCHING	Carrier Mode (QSS or Inter-carrier)
	B3	SWITCHING	TV Mode(PAL/SCAM)/FM Radio Mode
	B4	SWITCHING	TV Mode(PAL/SECAM)/FM Radio Mode
	B5	SWITCHING	Forced Mute Audio
	B6	SWITCHING	FM Sensitivity
<b>C DATA</b>	B7	SWITCHING	L/L' Sound
	C0	ADJUST	TOP Adjustment
	C1	ADJUST	TOP Adjustment
	C2	ADJUST	TOP Adjustment

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C DATA	C3	ADJUST	TOP Adjustment
	C4	ADJUST	TOP Adjustment
	C5	ADJUST	De-emphasis
	C6	ADJUST	De-emphasis
	C7	ADJUST	Audio gain
E DATA	E0	DATA	Standard Sound Carrier
	E1	DATA	Standard Sound Carrier
	E2	DATA	Standard Video IF
	E3	DATA	Standard Video IF
	E4	DATA	Standard Video IF
	E5	DATA	VIF, SIF and Tuner Minimum gain
	E6	DATA	L Standard PLL gating HIGH
	E7	DATA	VIF-AGC

**TV Sound / FM Radio Mode Switching**

FUNCTION	BIT	
	B3	B4
TV Sound / FM Radio	B3	B4
Positive AM TV <sup>(1)</sup>	0	0
Negative FM TV	0	1
FM Radio	1	0
FM Radio	1	1

Note :

1. For positive AM TV choose 6.5MHz for second SIF.

**• TV Mode function (TV Mode: B3 =0)**

VIDEO IF SELECT BITS			VIF Frequency (MHz)
E4	E3	E2	
0	0	0	58.75
0	0	1	45.75
0	1	0	38.9
0	1	1	38.0
1	0	0	33.9
1	0	1	33.4
1	1	0	45.75+FM external input via pin13 ; Notes (1) and (2)
1	1	1	38.9+FM external input via pin13 ; Notes (1) and (2)

Notes :

1. Video sound traps are locked on the FM VCO.
2. Second SIF should be selected in accordance to the selected video standard.

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• **FM Radio Mode function (FM Radio Mode: B3=1)**

VIDEO IF SELECT BITS			RIF Frequency (MHz)	PIN 21 OUTPUT	
E4	E3	E2		E7=0	E7=1
0	0	0	44	FM Radio Carrier related AFC	SIF-AGC Radio output
0	0	1	52		
1	1	0	52		FM-AGC Radio output
1	1	1	44		

• **For detail programming information (TV Mode)**

Description	Bits	TV Systems				FM Modes				TV FM
		M/N				St	Mo	H.S	N.S	F.A.M
Video Trap Bypass	B0	0				X	X	X	X	X
Auto Mute FM	B1	1				1	1	1	1	X
Carrier Mode	B2	1				X	X	X	X	X
FM Mode	B3	0				1	1	1	1	X
TV Modulation	B4	1				X	X	X	X	X
Forced Mute Audio	B5	0				0	0	0	0	1
FM Sensitivity (OP1)	B6	0				X	X	1	0	X
L/L' Sound(OP2)	B7	0				X	X	X	X	X
TOP Adjustment	C0	0				0	0	0	0	X
	C1	0				0	0	0	0	X
	C2	0				0	0	0	0	X
	C3	0				0	0	0	0	X
	C4	1				1	1	1	1	X
De-emphasis	C5	1				0	1	1	1	X
De-emphasis Time	C6	1				X	0	0	0	X
Audio gain	C7	0				1	0	0	0	X
Sound Inter-carrier	E0	1				X	X	X	X	X
	E1	0				X	X	X	X	X
Video IF	E2	1				X	X	X	X	X
	E3	0				X	X	X	X	X
	E4	0				X	X	X	X	X
IF Gain	E5	0				1	1	1	1	X
L/L' PLL Gating	E6	1				X	X	X	X	X
VIF AGC Output	E7	0				0	0	0	0	0

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Note :

- 1. St : Stereo. 2. Mo : Mono 3. H.S : High Sensitivity 4. N.S : Normal Sensitivity
- 5. F.A.M : Force Audio Mute.

**I2C Bus Control Format [READ Mode (slave transmits data)]**

<b>S</b>	<b>SLAVE ADDRESS</b>	<b>R/W=1</b>	<b>A</b>	<b>DATA</b>	<b>AN</b>	<b>P</b>
----------	----------------------	--------------	----------	-------------	-----------	----------

<b>BIT</b>	<b>FUNCTION</b>
S	START Condition
Standard SLAVE ADDRESS	100 0011X, where X is the value of R/W
R/W=11	READ Mode
A	Acknowledge, Generated by slave
DATA	Byte D (Described below)
AN	Acknowledge not, Generated by the master
P	STOP Condition, Generated by the master

The master generates an acknowledge when it has received the data-word READ. The master next generates an acknowledge, then slave begins transmitting the data-word READ, and so on until the master generates no acknowledge and transmits a STOP condition.

**• Byte D (Transmitted byte after read condition Status Register)**

<b>FUNCTION</b>	<b>MSB</b>							<b>LSB</b>
	<b>D7</b>	<b>D6</b>	<b>D5</b>	<b>D4</b>	<b>D3</b>	<b>D2</b>	<b>D1</b>	<b>D0</b>
READ	AFCWIN	VIFL	FMIFL	AFC4	AFC3	AFC2	AFC1	PONR

AFCWIN = 1  $F_{VIF}$  inside AFC Window

AFCWIN = 0  $F_{VIF}$  outside AFC Window

PONR = 1 After Power On Reset or After Supply Breakdown

PONR = 0 After a successful reading of the status register

FMIFL = Not used

VIFL = 1 Video IF level HIGH

VIFL = 0 Video IF level LOW

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**AFC STATUS**

FUNCTION	BITS			
	D4	D3	D2	D1
AFC $F_{VIF}$ vs. $F_0^{(1)}$				
$F_{VIF} \leq F_0 - 187.5\text{kHz}$	0	1	1	1
$F_{VIF} = F_0 - 162.5\text{kHz}$	0	1	1	0
$F_{VIF} = F_0 - 137.5\text{kHz}$	0	1	0	1
$F_{VIF} = F_0 - 112.5\text{kHz}$	0	1	0	0
$F_{VIF} = F_0 - 87.5\text{kHz}$	0	0	1	1
$F_{VIF} = F_0 - 62.5\text{kHz}$	0	0	1	0
$F_{VIF} = F_0 - 37.5\text{kHz}$	0	0	0	1
$F_{VIF} = F_0 - 12.5\text{kHz}$	0	0	0	0
$F_{VIF} = F_0 + 12.5\text{kHz}$	1	1	1	1
$F_{VIF} = F_0 + 37.5\text{kHz}$	1	1	1	0
$F_{VIF} = F_0 + 62.5\text{kHz}$	1	1	0	1
$F_{VIF} = F_0 + 87.5\text{kHz}$	1	1	0	0
$F_{VIF} = F_0 + 112.5\text{kHz}$	1	0	1	1
$F_{VIF} = F_0 + 137.5\text{kHz}$	1	0	1	0
$F_{VIF} = F_0 + 162.5\text{kHz}$	1	0	0	1
$F_{VIF} \geq F_0 + 187.5\text{kHz}$	1	0	0	0

Note :

- $F_0$  = Standard VIF Frequency.

**Programmable divider settings (Program Tuner divider byte 1 and 2)**

Divider ratio:  $N = f_{OSC} * N_{ref}$

TV mode  $f_{OSC} = N / N_{ref} = \{f_{RF(pc)} + f_{IF(pc)}\}$ , where (pc) is picture carrier and  $f_{RF}$  are  
Expressed in MHz

$N_{ref} = 1\text{MHz} / f_{ref}$ ,  $f_{ref}$  = Step size, refer to Ratio select bits (RSA, RSB)

If Step size = 62.5 kHz  $\rightarrow N_{ref} = 16$

< Examples >

• TV Mode

$f_{OSC} [TV] = f_{RF(pc)} + 45.75$  ;  $f_{OSC} [TV]$  is VCO frequency of TV mode  
45.75MHz is picture intermediate frequency of NTSC system

$N_{ref} = 16$  ;  $f_{ref} = \text{Step size} = 62.5 \text{ kHz} [RSA=RSB=1]$

$f_{RF(pc)} = 471.25 \text{ MHz}$ ,

$f_{IF(pc)} = 45.75\text{MHz}$

$f_{OSC}[TV] = 471.25 \text{ MHz} + 45.75\text{MHz} = 517 \square$

$N = \text{INT}(517 * 16) = 8,272$

$N[H] = 2050[H]$

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• **FM Radio Mode**

**1. Case. B3=0**

$$f_{OSC} [FM] = f_{RF(fm)} + 10.70 \quad ; \quad f_{OSC} [FM] \text{ is VCO frequency of FM mode}$$

10.7MHz is FM Radio intermediate frequency

$$N_{ref} = 20 \quad ; \quad f_{ref} = \text{Step size} = 31.25 \text{ kHz}[RSA=0,RSB=1]$$

$$f_{RF(FM)} = 98.00 \text{ MHz}$$

$$f_{RIF} = 10.7 \text{ MHz}$$

$$f_{OSC[FM]} = 98.00 \text{ MHz} + 10.7 \text{ MHz} = 108.7\text{MHz}$$

$$N = (108.70 * 1000) / 31.25 = 3423.6$$

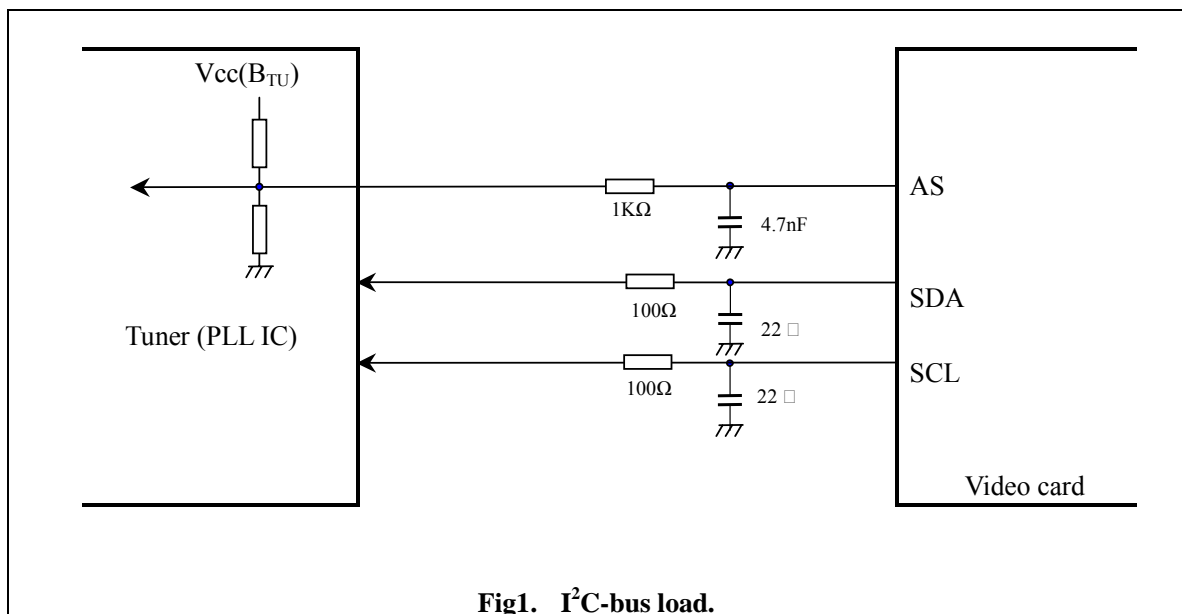
$$N[H] = 0DAC[H]$$

**Video Buffer**

The Multi media tuner contains a video buffer.

**I<sup>2</sup>C Bus Load**

The Multi media tuner contains a series resistor ( R=100Ω) in the SCL and SDA lines. Both lines also have a capacitive load of typical 22 pF.(see Fig1)



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**ENVIRONMENTAL TESTS**

ITEMS	TEST CONDITION	TUNER	DEMODULATOR
Heat load Test	Initial value measure at standard test condition. Leave samples in 70° ±2° for 96±5 hours, and in standard test condition for 30 minutes, then take measurements within 1 hour. Supply voltage : standard ± 5% Supply voltage cycle: 1.5h on, 0.5h off	OSC frequency PLL On: ±100°	Video S/N ±6dB Video output level : ±0.4V <sub>PP</sub> Noise limiting Sensitivity : ±6dB Audio output : ±30% Max.
Humidity load test	Leave samples in 40±5° for 24±2 hours, and in standard test condition for 30 minutes, Then take measurements. Leave samples in 40±5° 90±95% rh, for 96±5 hours, and in standard test condition for 30 minutes, then take measurements within 1 hour. Supply voltage: standard+5% Supply voltage cycle: 1.5h on, 0.5h off	OSC frequency PLL ON: ±100°	Video S/N ±6dB Video output level : ±0.4V <sub>PP</sub> Noise limiting Sensitivity : ±6dB Audio output : ±30% Max.
Cold Test	Initial value measure at standard test condition. Leave samples in -20° ± 2° for 96±5 hours, and in standard test condition for 2 hours then take measurements within 1 hour.	OSC frequency PLL On: ±100°	Video S/N ±6dB Video output level : ±0.4V <sub>PP</sub> Noise limiting Sensitivity : ±6dB Audio output : ±30% Max.
Operating life test	Take measurements in standard test condition. Leave samples for 1000 hours, then take measurements Supply voltage: standard.	OSC frequency PLL On: ±100°	Video S/N ±6dB Video output level : ±0.4V <sub>PP</sub> Noise limiting Sensitivity : ±6dB Audio output : ±30% Max.
Impact Test	Impact acceleration: 50m/sec <sup>2</sup> Impact time: 11msec Impact time and direction: 3 times each in 6 directions.	OSC frequency PLL On: ±100°	Video S/N ±6dB Video output level : ±0.4V <sub>PP</sub> Noise limiting Sensitivity : ±6dB Audio output : ±30% Max.

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**TV CHANNEL FREQUENCIES (MHz)**

**NTSC US Cable**

Vision IF = 45.75 MHz; sound IF 41.25 MHz

Channel	Picture carrier frequency	Sound carrier frequency
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
04A	73.25	77.25
5	77.25	81.75
6	83.25	87.75
A-5	91.25	95.75
A-4	97.25	101.75
A-3	103.25	107.75
A-2	109.25	113.75
A-1	115.25	119.75
A	121.25	125.75
B	127.25	131.75
C	133.25	137.75
D	139.25	143.75
E	145.25	149.75
F	151.25	155.75
G	157.25	161.75
H	163.25	167.75
I	169.25	173.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75
J	217.25	221.75
K	223.25	227.75
L	229.25	233.75
M	235.25	239.75
N	241.25	245.75

Channel	Picture carrier frequency	Sound carrier frequency
O	247.25	251.75
P	253.25	257.75
Q	259.25	263.75
R	265.25	269.75
S	271.25	275.75
T	277.25	281.75
U	283.25	287.75
V	289.25	293.75
W	295.25	299.75
W+1	301.25	305.75
W+2	307.25	311.75
W+3	313.25	317.75
W+4	319.25	323.75
W+5	325.25	329.75
W+6	331.25	335.75
W+7	337.25	341.75
W+8	343.25	347.75
W+9	349.25	353.75
W+10	355.25	359.75
W+11	361.25	365.75
W+12	367.25	371.75
W+13	373.25	377.75
W+14	379.25	383.75
W+15	385.25	389.75
W+16	391.25	395.75
W+17	397.25	401.75
W+18	403.25	407.75
W+19	409.25	413.75
W+20	415.25	419.75
W+21	421.25	425.75
W+22	427.25	431.75
W+23	433.25	437.75

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Channel	Picture carrier frequency	Sound carrier frequency	Channel	Picture carrier frequency	Sound carrier frequency
W+24	439.25	1E50	39	621.25	625.75
W+25	445.25	1EB0	40	627.25	631.75
W+26	451.25	1F10	41	633.25	637.75
W+27	457.25	1F70	42	639.25	643.75
W+28	463.25	1FD0	43	645.25	649.75
W+29	469.25	2030	44	651.25	655.75
14	471.25	475.75	45	657.25	661.75
15	477.25	481.75	46	663.25	667.75
16	483.25	487.75	47	669.25	673.75
17	489.25	493.75	48	675.25	679.75
18	495.25	499.75	49	681.25	685.75
19	501.25	505.75	50	687.25	691.75
20	507.25	511.75	51	693.25	697.75
21	513.25	517.75	52	699.25	703.75
22	519.25	523.75	53	705.25	709.75
23	525.25	529.75	54	711.25	715.75
24	531.25	535.75	55	717.25	721.75
25	537.25	541.75	56	723.25	727.75
26	543.25	547.75	57	729.25	733.75
27	549.25	553.75	58	735.25	739.75
28	555.25	550.75	59	741.25	745.75
29	561.25	565.75	60	747.25	751.75
30	567.25	571.75	61	753.25	757.75
31	573.25	577.75	62	759.25	763.75
32	579.25	583.75	63	765.25	769.75
33	585.25	589.75	64	771.25	775.75
34	591.25	595.75	65	777.25	781.75
35	597.25	601.75	66	783.25	787.75
36	603.25	607.75	67	789.25	793.75
37	609.25	613.75	68	795.25	799.75
38	615.25	619.75	69	801.25	805.75

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NTSC M/N(Air CH.)

Channel	Picture carrier frequency	Sound carrier frequency
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75
14	471.25	475.75
15	477.25	481.75
16	483.25	487.75
17	489.25	493.75
18	495.25	499.75
19	501.25	505.75
20	507.25	511.75
21	513.25	517.75
22	519.25	523.75
23	525.25	529.75
24	531.25	535.75
25	537.25	541.75
26	543.25	547.75
27	549.25	553.75
28	555.25	559.75
29	561.25	565.75
30	567.25	571.75
31	573.25	577.75
32	579.25	583.75
33	585.25	589.75
34	591.25	595.75
35	597.25	601.75

Channel	Picture carrier frequency	Sound carrier frequency
36	603.25	607.75
37	609.25	613.75
38	615.25	619.75
39	621.25	625.75
40	627.25	631.75
41	633.25	637.75
42	639.25	643.75
43	645.25	649.75
44	651.25	655.75
45	657.25	661.75
46	663.25	667.75
47	669.25	673.75
48	675.25	679.75
49	681.25	685.75
50	687.25	691.75
51	693.25	697.75
52	699.25	703.75
53	705.25	709.75
54	711.25	715.75
55	717.25	721.75
56	723.25	727.75
57	729.25	733.75
58	735.25	739.75
59	741.25	745.75
60	747.25	751.75
62	759.25	757.75
63	765.25	763.75
64	771.25	769.75
65	777.25	775.75
61	753.25	781.75
66	783.25	787.75
67	789.25	793.75
68	795.25	799.75
69	801.25	805.75

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•Frequency table

FM Radio

No	FM Carrier	No	FM Carrier	No	FM Carrier	No	FM Carrier
1	88.0	41	92.0	81	96.0	121	100.0
2	88.1	42	92.1	82	96.1	122	100.1
3	88.2	43	92.2	83	96.2	123	100.2
4	88.3	44	92.3	84	96.3	124	100.3
5	88.4	45	92.4	85	96.4	125	100.4
6	88.5	46	92.5	86	96.5	126	100.5
7	88.6	47	92.6	87	96.6	127	100.6
8	88.7	48	92.7	88	96.7	128	100.7
9	88.8	49	92.8	89	96.8	129	100.8
10	88.9	50	92.9	90	96.9	130	100.9
11	89.0	51	93.0	91	97.0	131	101.0
12	89.1	52	93.1	92	97.1	132	101.1
13	89.2	53	93.2	93	97.2	133	101.2
14	89.3	54	93.3	94	97.3	134	101.3
15	89.4	55	93.4	95	97.4	135	101.4
16	89.5	56	93.5	96	97.5	136	101.5
17	89.6	57	93.6	97	97.6	137	101.6
18	89.7	58	93.7	98	97.7	138	101.7
19	89.8	59	93.8	99	97.8	139	101.8
20	89.9	60	93.9	100	97.9	140	101.9
21	90.0	61	94.0	101	98.0	141	102.0
22	90.1	62	94.1	102	98.1	142	102.1
23	90.2	63	94.2	103	98.2	143	102.2
24	90.3	64	94.3	104	98.3	144	102.3
25	90.4	65	94.4	105	98.4	145	102.4
26	90.5	66	94.5	106	98.5	146	102.5
27	90.6	67	94.6	107	98.6	147	102.6
28	90.7	68	94.7	108	98.7	148	102.7
29	90.8	69	94.8	109	98.8	149	102.8
30	90.9	70	94.9	110	98.9	150	102.9
31	91.0	71	95.0	111	99.0	151	103.0
32	91.1	72	95.1	112	99.1	152	103.1
33	91.2	73	95.2	113	99.2	153	103.2
34	91.3	74	95.3	114	99.3	154	103.3
35	91.4	75	95.4	115	99.4	155	103.4
36	91.5	76	95.5	116	99.5	156	103.5
37	91.6	77	95.6	117	99.6	157	103.6
38	91.7	78	95.7	118	99.7	158	103.7
39	91.8	79	95.8	119	99.8	159	103.8
40	91.9	80	95.9	120	99.9	160	103.9
No	FM	No	FM	No	FM	No	FM

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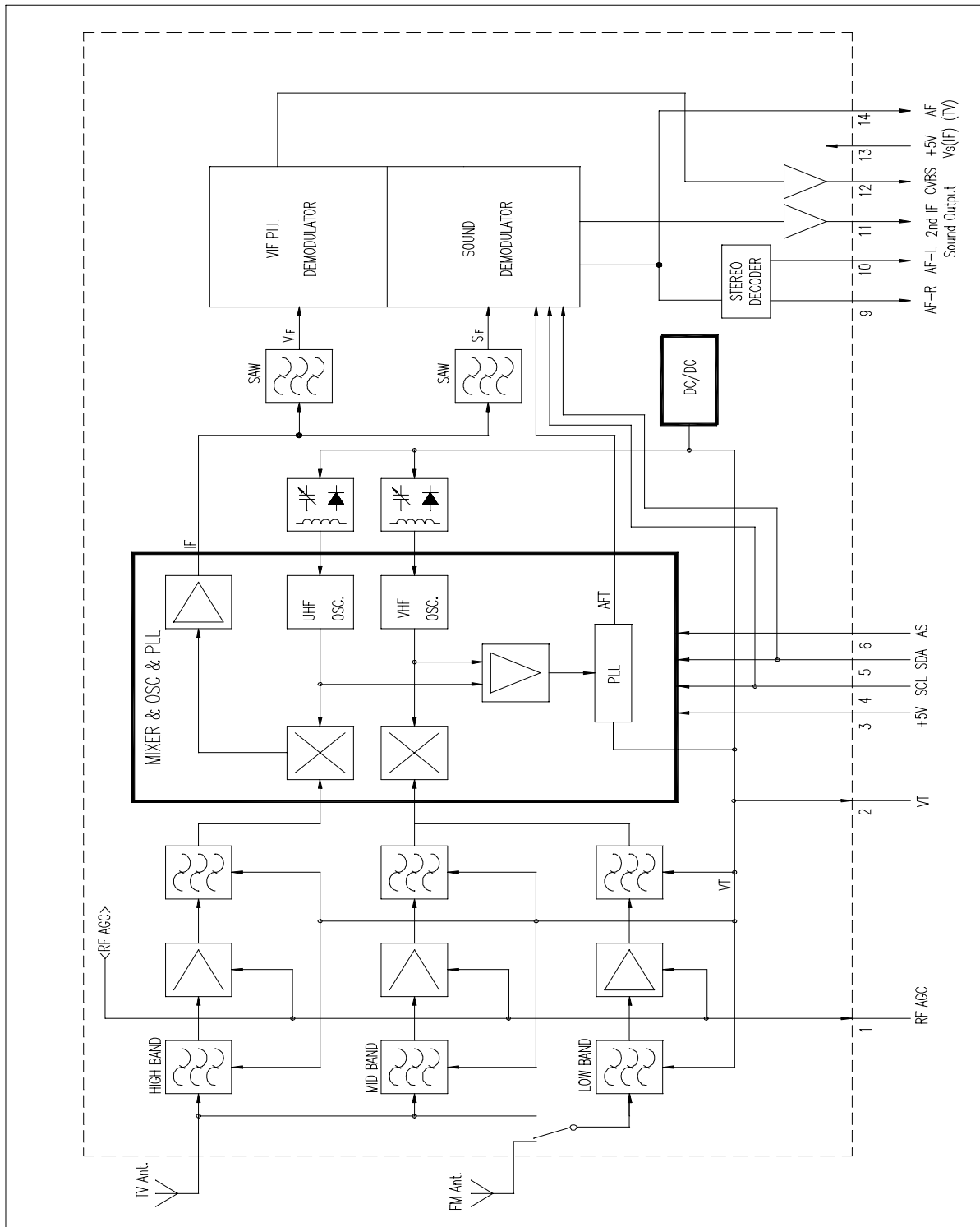
	Carrier		Carrier
161	104.0	172	105.1
162	104.1	173	105.2
163	104.2	174	105.3
164	104.3	175	105.4
165	104.4	176	105.5
166	104.5	177	105.6
167	104.6	178	105.7
168	104.7	179	105.8
169	104.8	180	105.9
170	104.9	181	106.0
171	105.0		

	Carrier		Carrier
182	106.1	192	107.1
183	106.2	193	107.2
184	106.3	194	107.3
185	106.4	195	107.4
186	106.5	196	107.5
187	106.6	197	107.6
188	106.7	198	107.7
189	106.8	199	107.8
190	106.9	200	107.9
191	107.0	201	108.0

**Multi Media Tuner**  
 NTSC M/N(JPN) & FM Radio

TAPE-H091F

**BLOCK DIAGRAM**

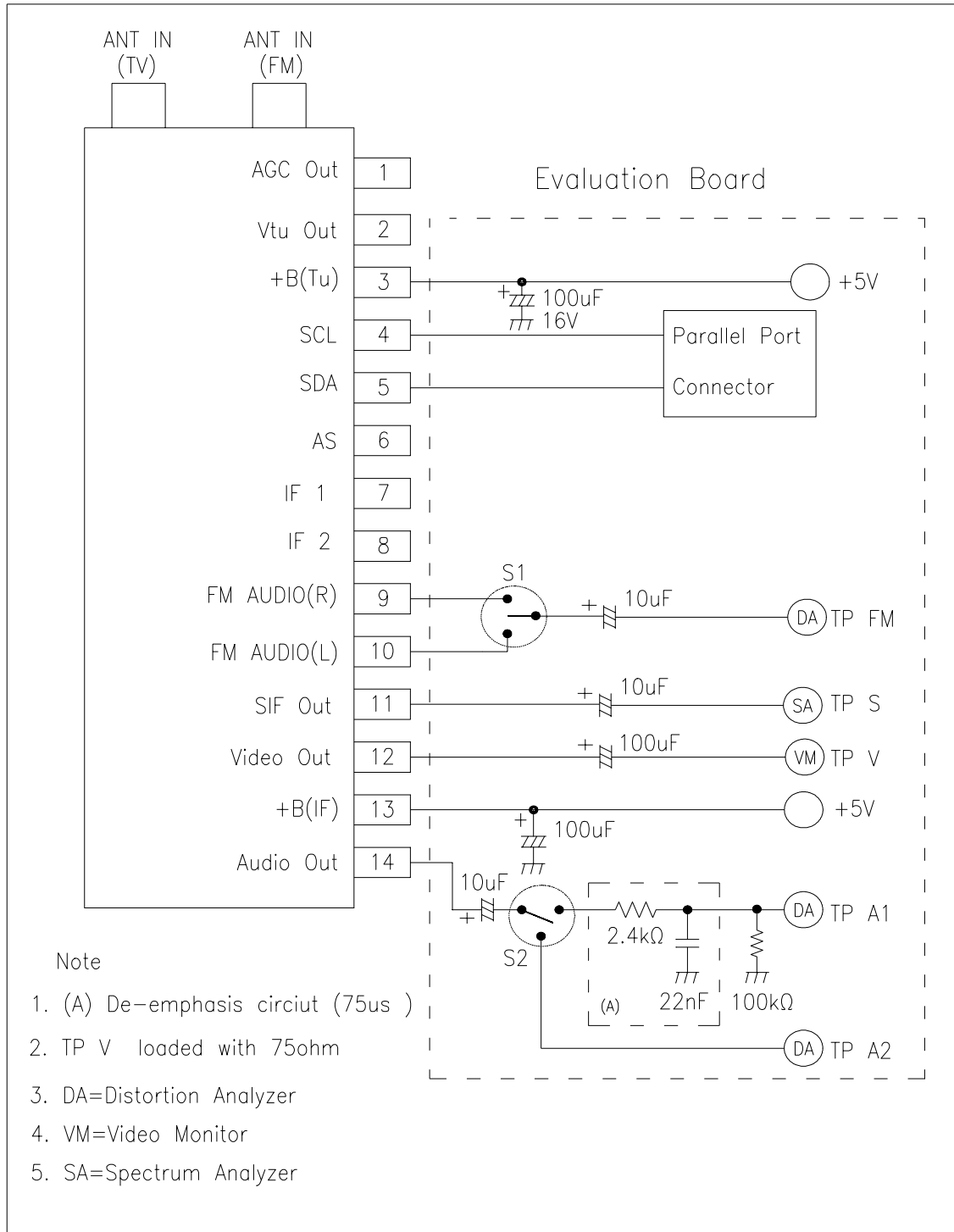


**Fig 2. Block diagram**

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• **TEST CIRCUIT**



**Fig 3. Typical Test Circuit**



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**MEMO:**