



from THAT Corporation

**Consumer Multi-Standard
TV-Audio Decoder**

Verilog® Decoder Code for Integrated Circuits

FEATURES

- Verilog all-digital audio decoder from Sound IF input to Audio outputs
- All legacy audio TV- standards
 - BTSC, NICAM, A2, EIA-J, FM-Stereo
- Full feature set
 - Aural carrier demodulator
 - Automatic system detection
 - Automatic output selection
 - Choice of five output sample rates
~ 31.25, 32.0, 44.1, 46.875, & 48 kHz
- FPGA-based evaluation board
 - Baseband or SIF input
 - Audio outputs
 - Control interface
- **Available immediately**

APPLICATIONS

- ASIC TV-audio decoders
 - DTV/ATSC with legacy systems
 - Individual regions
 - Worldwide coverage
 - System on-a-chip
- Consumer multimedia products
 - LCD TVs
 - Digital TVs
 - PVRs/DVRs
 - PC TV tuner cards
 - Cable/satellite set-top boxes
 - DVD recorders

Description

THAT's dbx-TV Consumer Multi-Standard TV-Audio Decoder is a complete and robust decoder solution covering all the world's legacy TV-audio standards in one compact Verilog-based design. Available under license exclusively from THAT Corporation, this set of intellectual property integrates into ICs for audio decoding in TVs, set-top boxes, DVD recorders, PVRs, DVRs, and other TV-centric consumer products.

THAT offers licensees a choice of decoders handling any one or more legacy audio standard, including BTSC, NICAM, A2, EIAJ, and FM Stereo. For multi-standard systems, the core code offers automatic system detection, automatic audio output selection, automatic volume correction, and a choice of up to five output sample rates. For IF inputs, the code provides a readout of SIF signal level which may be used to drive analog IF AGC. Customers may select all, or only a few of these features

to suit their individual needs.

As a result of our careful attention to integrating all these standards within one cohesive piece of code, the complete worldwide decoder system requires ~300k gates (Xilinx-equivalent) to implement all features. Gate count will drop when features are dropped from the complete set. The decoder comes with an extensive set of deliverables including well commented source code, an FPGA-based evaluation board, and complete engineering support including customization and evaluation services.

The system is offered for a license issue fee plus per-instance royalties. Code meeting the specifications shown in this data sheet is available immediately. Our engineers are implementing additional features and performance improvements, so please check our web site for the latest updates.

Applications Assistance

THAT provides a comprehensive set of deliverables and support for its dbx-TV multi-standard TV-audio decoder code. These include the following:

Deliverables

- Well-commented RTL source code (Verilog)
- Design documentation
- FPGA-based evaluation board
 - SIF Input
 - L/R audio outputs
 - Serial configuration interface
- Test bench (to verify final netlist against RTL)

Support

- Training on decoder design
- Training on test equipment and procedures
- Code customization as required
- Code updates and bug fixes (if necessary)
- Comprehensive performance evaluation in THAT's specialized lab

SPECIFICATIONS¹

Complete System and I/O		
Parameter	Conditions	Typical
Aural Carrier	Depends on system	4.0 to 7.0 MHz as appropriate
System Clock Input	44.1 kHz output 32 or 48 kHz output 31.25 or 46.875 kHz output	33.8688 MHz 36.864 MHz 36.0 MHz
SIF Input Signal Resolution	Specified performance	10 bits
SIF Input Sample Rate		½ system clock
Mode Configuration		Manual system selection Mono (Analog or digital, as appropriate) Stereo Second language/SAP Automatic system selection Output sample rate Various threshold settings Test modes System reset
Audio Output Signal	D/A	Interface to support clock and data
Output Clock Rates		31.25, 32, 44.1, 46.875, 48.0 kHz
Audio Output Resolution	Specified performance	16 bits
Audio Output Signals	L, R, or mono/2nd language as appropriate	Two simultaneous channels
Indicators	Depends on system	Mode of operation Quality of various signals Bit error rate IF input level (for AGC applications) Various signal indicators

BTSC Performance				
Parameter	Conditions	USA	Units	
Stereo Frequency Response	50 - 12 kHz	± 0.25	dB	
Stereo THD+N	1 kHz, 100% 75-µs EIM ² , NR on, 12 kHz BW	0.13	%	
Stereo S/N	No input signal, NR on, 15 kHz BW	-75	dB	
Stereo Separation (Static)	50 - 10 kHz, NR on			
	1% 75-µs EIM	21	dB	
	10% 75-µs EIM	25	dB	
	66% 75-µs EIM	25	dB	
Dynamic Separation	10% 75-µs EIM, NR on			
	300 Hz	20	dB	
	3 kHz	24	dB	
Mono Frequency Response	50 - 12 kHz	± 0.25	dB	
Mono THD+N	1 kHz, 100%, 75-µs EIM, 12 kHz BW	0.13	%	
Mono S/N	No input signal, 15kHz BW	-79	dB	
SAP Frequency Response	50 - 9 kHz	± 0.5	dB	
SAP THD+N	1 kHz, 100% 75-µs EIM, NR on, 9 kHz BW	0.14	%	
SAP S/N	No input signal, NR on, 10 kHz BW	-87	dB	
SAP Deviation Threshold		User defined		

¹ All specifications are typical and subject to change.

² 75-µs equivalent-input modulation (EIM): The audio signal level prior to encoding that results in a stated percentage modulation when the encoding process is replaced by 75 µs pre-emphasis.

FM Stereo Radio Performance					
Parameter	Conditions	USA	Europe	Units	
Stereo Frequency Response	20 Hz ~ 15 kHz	± 0.4	± 0.4	dB	
Stereo THD+N	1 kHz, 100% modulation	0.03	0.04	%	
Stereo S/N	No input signal, 12 kHz BW	75	70	dB	
Stereo Separation	50 Hz ~ 12 kHz, 10% modulation	33	34	dB	
Mono Frequency Response	20 Hz ~ 15 kHz	± 0.4	± 0.4	dB	
Mono THD+N	1 kHz, 100% modulation	0.04	0.02	%	
Mono S/N	No input signal, 12 kHz BW	75	75	dB	

EIA-J Performance			
Parameter	Conditions	Japan	Units
Stereo Frequency Response	50 Hz ~ 12 kHz (-3dB@15kHz)	± 0.4	dB
Stereo THD+N	1 kHz, 100% modulation	0.09	%
Stereo S/N	No input signal, 15 kHz BW	68	dB
Stereo Separation	50 Hz ~ 10 kHz, 10% modulation	23	dB
Mono Frequency Response	50 Hz ~ 12 kHz (-3dB@15kHz)	± 0.4	dB
Mono THD+N	1 kHz, 100% modulation	0.04	%
Mono S/N	No input signal, 15 kHz BW	70	dB
Bilingual-A Frequency Response	50 Hz ~ 12 kHz (-3dB@15kHz)	± 0.4	dB
Bilingual-A THD+N	1 kHz, 100% modulation	0.04	%
Bilingual-A S/N	No input signal, 15 kHz BW	70	dB
Bilingual-B Frequency Response	50 Hz ~ 12 kHz (-3dB@15kHz)	± 0.4	dB
Bilingual-B THD+N	1 kHz, 100% modulation	0.44	%
Bilingual-B S/N	No input signal, 15 kHz BW	70	dB

A2 Performance							
Parameter	Conditions	B/G	M/N	D/K1	D/K2	D/K3	Units
Stereo Frequency Response	20 Hz ~ 15 kHz	±0.25	±0.25	±0.25	±0.25	±0.25	dB
Stereo THD+N	1kHz, 100% modulation	0.07	0.10	0.06	0.06	0.06	%
Stereo S/N	No input signal, 15 kHz BW	73	67	72	72	72	dB
Stereo Separation	50 Hz - 12 kHz, 66% modulation	23	27	26	28	28	dB
Mono Frequency Response	20 Hz ~ 15kHz	±0.25	±0.25	±0.25	±0.25	±0.25	dB
Mono THD+N	1kHz, 100% modulation	0.02	0.03	0.02	0.02	0.02	%
Mono S/N	No input signal, 15 kHz BW	76	73	78	78	78	dB
Bilingual-A Frequency Response	20 Hz ~ 15 kHz	±0.25	±0.25	±0.25	±0.25	±0.25	dB
Bilingual-A THD+N	1 kHz, 100% modulation	0.03	0.03	0.02	0.02	0.02	%

A2 Performance (continued)							
Parameter	Conditions	B/G	M/N	D/K1	D/K2	D/K3	Units
Bilingual-A S/N	No input signal, 15 kHz BW	78	74	77	77	78	dB
Bilingual-B Frequency Response	20 Hz ~ 15 kHz	±0.25	±0.25	±0.25	±0.25	±0.25	dB
Bilingual-B THD+N	1 kHz, 100% modulation	0.07	0.01	0.04	0.07	0.04	%
Bilingual-B S/N	No input signal, 15 kHz BW	75	69	74	74	74	dB

NICAM Performance						
Parameter	Conditions	B/G	D/K	I	L	Units
Stereo Frequency Response	20 Hz ~ 15 kHz	±0.7	±0.7	±0.7	±0.7	dB
Stereo THD+N	1 kHz, 100% modulation	0.05	0.06	0.05	0.08	%
Stereo S/N	No input signal, 15 kHz BW	80	80	81	80	dB
Stereo Separation	Depends on (analog) layout of IC					
Mono Frequency Response	20 kHz ~ 15 kHz	±0.3	±0.3	±0.3	±0.3	dB
Mono THD+N	1 kHz, 100% modulation	0.02	0.24	0.05	0.55	%
Mono S/N	No input signal, 15 kHz BW	72	71	77	62	dB
Bilingual-A Frequency Response	20 Hz ~ 15 kHz	±0.7	±0.7	±0.7	±0.7	dB
Bilingual-A THD+N	1 kHz, 100% modulation	0.06	0.05	0.05	0.06	%
Bilingual-A S/N	No input signal, 15 kHz BW	80	80	80	79	dB
Bilingual-B Frequency Response	20 Hz ~ 15 kHz	±0.7	±0.7	±0.7	±0.7	dB
Bilingual-B THD+N	1 kHz, 100% modulation	0.05	0.06	0.04	0.07	%
Bilingual-B S/N	No input signal, 15 kHz BW	79	81	80	80	dB

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 This product is covered by one or more of the following U.S. patents and applications, as well as corresponding filings worldwide:
 6,037,993 6,192,086 6,259,482, 60/370,064, 60/555,853, 60/602,169. Other patents pending.