Preliminary Data Sheet Supplement

Subject:	MAS 3529H
Data Sheet Concerned:	MAS 3528E 6251-509-1PD, Edition Dec. 10, 2001
Supplement:	No. 1/ 6251-598-1PDS
Edition:	July 3, 2002

MAS 3529H Dolby Digital, ProLogic II, MPEG1L2 decoder

1. Overview

The MAS 3529H is based on the MAS 3528E Dolby Digital decoder with two additional main features:

– Dolby Pro Logic II

– Virtual Dolby Digital

The same package and pinning is used as for MAS 3528E (PLCC44K). The user interface remains almost the same as in MAS 3528E, the new features are added without rearranging functions/addresses (see section 2. on page 2).

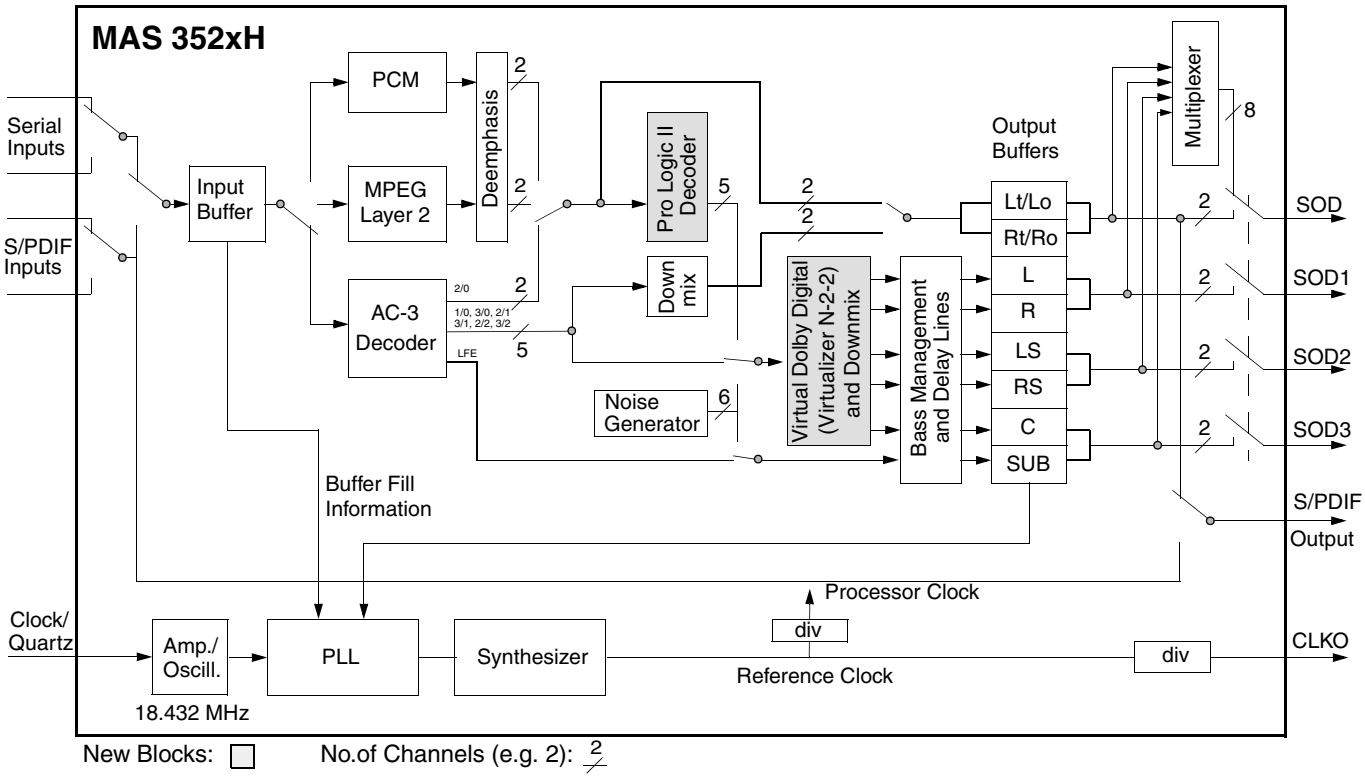

Fig. 1–1: Block diagram of the MAS 3529H

2. User Interface for Additional or Changed Features and Functions

Note: All bits not mentioned within the description of a memory cell must be set to 0.

Table 2–1: Command register table

Register Address (hex)	R/W	Function	Default (hex)	Name
2E		**Loop-through and Sync Pin Control S/PDIF Input**	00000	OUTPUT_CONF
	W	bit[12] 0: automatic active loop-through if DTS is recognized or the input format at S/PDIF_IN cannot be determined 1: bit[1] controls loop-through		
		bit[11..2] reserved: do not change!		
	R W	bit[1] 0: normal operation 1: connect SPDI_IN to SPDIF_OUT (loop- through)		
	R	bit[0] sync bit in case of AC-3 and MPEG signals, this bit will be automatically detected and set by internal software, it will not be set by PCM signals.		

Table 2–2: S/PDIF status

Memory Address (hex)	Function Mode	Name
D0:13C7	**S/PDIF Status S/PDIF Input** bit[15] S/PDIF Input synchronized while processing I^2S D0:13D0 [9] = 0 S/PDIF Input selected 0 bit is always 0 (to be compatible with MAS3528E) D0:13D0 [9] = 1 I^2S Input selected 0 S/PDIF Input not synchronized; no valid bit stream 1 S/PDIF Input in sync; valid bit stream. Further information about the signal can be obtained from UIS_DSI and UIS_PC<i>; i=0..7. bit[3:2] Parity Error (only valid when processing S/PDIF Input) 0 no error >0 parity error bit[1] Data Mode 0 PCM 1 compressed audio data bit[0] S/PDIF Copy Active 0 inactive 1 active	UIS_SP_STATUS

Table 2–3: Version readout

Memory Address (hex)	Function	Mode	Name
D0:13FC	**MAS 352xH Type** bit[15:0] 29_{dez} MAS **3529**H 27_{dez} MAS **3527**H	**All**	UIS_MASH_TYPE
D0:1FF7	**MAS 352xH Version** bit[15:0] 0104_{hex} MAS 3529H **A2**	**All**	UIS_MASH_ VERSION

Table 2–4: User interface for Dolby Pro Logic II

Memory Address (hex)	Function	Mode	Reset Value (hex)	Name
D0:13D3	**Left Surround Channel Delay** (Sec. 4.10.1 of Dolby Digital LIM Issue 3 and Sec. 2.1.4 of Pro Logic II LIM Issue 1) Dolby Digital: all Modes Pro Logic II: Music Mode / Matrix Mode; Movie Mode / PL Emulation bit[3:0] 0000: 0 ms / 10 ms ... 1111: 15 ms / 25 ms For Dolby Pro Logic II in Movie and in Pro Logic Emulation Mode, the delay is automatically extended by 10 ms.	**Dolby Digital** **Dolby Pro Logic II**	00000	UIC_SL_DELAY
D0:13D4	**Right Surround Channel Delay** (Sec. 4.10.1 of Dolby Digital LIM Issue 3 and Sec. 2.1.4 of Pro Logic II LIM Issue 1) Dolby Digital: all Modes Pro Logic II: Music Mode / Matrix Mode; Movie Mode / PL Emulation bit[3:0] 0000: 0 ms / 10 ms ... 1111: 15 ms / 25 ms For Dolby Pro Logic II in Movie and in Pro Logic Emulation Mode, the delay is automatically extended by 10 ms.	**Dolby Digital** **Dolby Pro Logic II**	00000	UIC_SR_DELAY

Table 2–4: User interface for Dolby Pro Logic II

Memory Address (hex)	Function	Mode	Reset Value (hex)	Name
D0:13EE	**Operational Modes** (Sec. 2.2 of Pro Logic II LIM Issue 1)	**Dolby Pro Logic II**	00000	UIC_DPL_ STANDARD
	Pro Logic II Standard Modes			
	bit[2:0] 000	**Movie Mode**		
		Autobalance	enabled	
		Surround Filter	No	
		Surround Coherence (RS Inv.)	enabled	
		Panorama Mode	disabled	
		Center Width Control	disabled	
		Dimension Control	neutral (3)	
	001	**Music Mode**		
		Autobalance	disabled	
		Surround Filter	Shelf	
		Surround Coherence (RS Inv.)	disabled	
		Panorama Mode	User defined	
		Center Width Control	User defined	
		Dimension Control	User defined	
	010	**Virtual compatible Mode**		
		Autobalance	enabled	
		Surround Filter	No	
		Surround Coherence (RS Inv.)	disabled	
		Panorama Mode	disabled	
		Center Width Control	disabled	
		Dimension Control	neutral (3)	
	011	**Pro Logic Emulation**		
		Autobalance	enabled	
		Surround Filter	7-kHz LP	
		Surround Coherence (RS Inv.)	disabled	
		Panorama Mode	disabled	
		Center Width Control	disabled	
		Dimension Control	neutral (3)	
	100	**Matrix Mode**		
		Autobalance	disabled	
		Surround Filter	Shelf	
		Surround Coherence (RS Inv.)	disabled	
		Panorama Mode	disabled	
		Center Width Control	disabled	
		Dimension Control	neutral (3)	
	101	– **(do not use!)**		
	110	**Custom Mode**		
		Surround Filter	User defined	
		Surround Coherence (RS Inv.)	User defined	
		Autobalance	User defined	
		Panorama Mode	User defined	
		Center Width Control	User defined	
		Dimension Control	User defined	
	111	**Off (Bypass Mode)**		

Table 2–4: User interface for Dolby Pro Logic II

Memory Address (hex)	Function Mode	Reset Value (hex)	Name
D0:13EE ..continued	**Operational Modes** **Dolby Pro Logic II** **Movie Mode** The Movie mode in Pro Logic II is very similar to that of the original Pro Logic decoder. The main difference is that it has stereo surround channels and no surround filter, unlike Pro Logic which has a mono surround channel and a 7-kHz surround filter. Movie mode is the standard required for all A/V systems. When an autosound unit has a video screen, it is also considered as an A/V system. It can be called simply “Pro Logic II.” **Music Mode** The Music mode offers users some flexibility to control the end results according to their own taste. Music mode should not be used with a THX audio processing mode. Music mode is recommended as the standard mode for autosound music systems (without video) and is optional for A/V systems. It is recommended that Music mode be identified as the “Music” version of Pro Logic II, to distinguish it from the Movie mode. **Virtual Mode** The Virtual mode is usually used when Pro Logic II is connected to a virtual process for speaker use. However, there might be some virtualizers for which this mode does not produce the intended result. For those virtualizers, Movie mode may give the best surround effect. Virtual mode is designed to be used with the virtual process developed by Dolby Laboratories. The Pro Logic II mode should be called only “Pro Logic II” so the Virtual name can be reserved to describe the speaker virtualization process itself. **Pro Logic Emulation Mode** The Pro Logic Emulation mode offers users the same robust surround processing as original Pro Logic, in case the source content is not of optimum quality, or if there is a desire to hear the program more “as it used to be.” When this mode is used, it is called Pro Logic, as before. There is no “Pro Logic I” mode. The Pro Logic emulation mode is optional. Dolby does not require PLII products to use the original Pro Logic decoding algorithm. However, if the DSP contains the original Pro Logic code, and if the product maker would like to use it, this is quite acceptable and even encouraged. A product must not offer both original Pro Logic and the Pro Logic emulation mode. **Matrix Mode** The Matrix mode is the same as the Music mode except that the directional enhancement logic is turned off. It may be used to enhance mono signals by making them seem “larger.” The Matrix mode may also find use in auto systems, where the fluctuations from poor FM stereo reception can otherwise cause disturbing surround signals from a logic decoder. The ultimate “cure” for poor FM stereo reception may be simply to force the audio to mono. **Custom Mode** All settings are user defined **Off (Bypass Mode)** Pro Logic Decoding is switched off. Lt to L; Rt to R; Sl,Sr and C muted.	00000	

Table 2–4: User interface for Dolby Pro Logic II

Memory Address (hex)	Function Mode	Reset Value (hex)	Name
D0:13EE ..continued	**Operational Modes** **Dolby Pro Logic II** (Sec. 2.2 of Pro Logic II LIM Issue 1) **Surround Filter** bit[4:3] 00 No 01 Shelf 10 7kHz LPF There are two surround filters available in Pro Logic II. One is the 7-kHz lowpass filter for use with Pro Logic emulation mode; the other is the shelf filter for use with Music and Matrix modes. This latter filter is a mild shelving filter that improves the naturalness of the sound in Music mode. **Surround Coherence** bit[5] 0 RS Polarity Inversion disabled 1 RS Polarity Inversion enabled In the Movie mode, it is important that the surround speakers be in phase, so that movie sound effects panned to or across the surrounds will have optimal localization and imaging. This is achieved with the surround coherence function (Right Surround Channel Polarity can be inverted or not). Stereo music content, however, does not contain panned surround effects, so it benefits from a more spacious presentation of the ambient sounds by turning off the surround coherence function. **Auto-balance** bit[6] 0 enabled 1 disabled This operates in the same way as in all previous Pro Logic decoders to ensure that movie sound tracks decode optimally. Additional signal processing may be included if Pro Logic II is allowed to operate fully and without modification in name or function. In other words, any additional signal processing must include a bypass mode to defeat the processing. When any additional process works in conjunction with Pro Logic II, it must be clearly indicated that both processes are working together. **Panorama Mode** bit[7] 0 disabled 1 enabled In the Music Mode, this control extends the front stereo image to include the surround speakers for an exciting “wraparound” effect with side-wall imaging. It is particularly effective for recordings which have strong left- or right channel elements in the mix, as these are detected and accentuated by the Panorama process. According to the LIM for Pro Logic II, Panorama Mode must only be switched on in Music Mode.	00000	UIC_DPL_MODE_SURR_FILT UIC_DPL_MODE_RS_POL UIC_DPL_MODE_AUTO_BAL UIC_DPL_MUSIC_PANORAMA

Table 2–4: User interface for Dolby Pro Logic II

Memory Address (hex)	Function Mode	Reset Value (hex)	Name
D0:13EE ..continued	**Operational Modes** **Dolby Pro Logic II** **Input Matrix** bit[9:8] 00 Stereo or AB 01 Sound A 10 Sound B All Pro Logic II processed signals must pass this matrix. Normal operation is “Stereo or A/B” for 2 channel inputs.		UIC_DPL_MATRIX
D0:13ED	**Music Mode Controls** **Dolby Pro Logic II** (Sec. 2.1 of Pro Logic II LIM Issue 1) **Center Width Control** see also “Table 2-2 Center Width Control Levels” of LIM Dolby Pro Logic II bit[7:5] Control / Angle / C Lev.(dB) / L/R Lev.(dB) 000 0 00.0° 0.0 off 001 1 20.8° -0.6 -12 010 2 28.0° -1.1 -9.6 011 3 (default) 36.0° -1.8 -7.6 100 4 54.0° -4.6 -4.8 101 5 62.0° -6.6 -4.1 110 6 69.2° -9.0 -3.6 111 7 90.0° off -3.0 This control allows center-channel sounds to be positioned between the center speaker and the left/right speakers over a range of eight steps. Step “3” uses a combination of all three front speakers to give the best vocal imaging and most seamless soundstage presentation, and is recommended for most recordings. Step “0” places all center sound in the center speaker. Step “7” places all center sound equally in the left/right speakers, just as in conventional stereo. **Dimension Control** bit[15:13] 000 0 Most Center 001 1 010 2 011 3 (default) Neutral 100 4 101 5 110 6 Most Surround This control allows the user to gradually adjust the sound field either towards the front or the rear. This can be useful to help achieving the desired balance from all the speakers with certain recordings that may contain either too much or too little spatial effect. Step “3” is the recommended setting, which has no effect on the sound. Steps 2, 1, and 0 gradually move the sound forward, and steps 4, 5, and 6 move the sound towards the surrounds. **Note:** Center Width Control and Dimension Control with higher resolution may be implemented in firmware in a later version of the MAS 3529H. Therefore, bits[4:0] and bits[12:8] must be set to 0.	06060	UIC_DPL_MUSIC_CENTER_WIDTH UIC_DPL_MUSIC_DIMENSION

Table 2–5: User interface for Bass Management

Memory Address (hex)	Function	Mode	Reset Value (hex)	Name
D0:13DA	**Bass Management** (see chapter 2.9.10.3.;Sec. 4.7 of Dolby Digital Licensee Information Manual Issue 3) bit [4:0] 00000 Direct loop-through of all six channels without channel mixing 01000 Dolby Configuration 0 01001 Dolby Configuration 1 01010 Dolby Configuration 2 01011 Dolby Alternative Configuration 2 01100 Dolby Configuration 3 (No SubwooferOut) 01101 Dolby Configuration 3 (Subwoofer Out) 01110 DVD Configuration (Bass to L/R) 01111 DVD Configuration (Bass to Subwoofer) 11000 B2C (Bass to Center) **Note:** If Bass Management is enabled, high processor clock must be selected (D0:13DF; bit16=1) The LFE-content can be disabled in D0:13D5. The output configurations can be used for all input formats. However, for MPEG and PCM-data, only the L and R input channels will carry information.	**All**	00000	UIC_POST_PROCESSING
	Cross-Over Frequency (LP and complementary HP) bit[15:8] 0_{dez} 100 Hz (compatible with MAS 3528E) 5_{dez} 50 Hz min. cross-over frequency. 10_{dez} 100 Hz 15_{dez} 150 Hz 20_{dez} 200 Hz 25_{dez} 250 Hz 30_{dez} 300 Hz 35_{dez} 350 Hz 40_{dez} 400 Hz max. cross-over frequency	**All**		UIC_CROSSOVER_FREQ

Table 2–6: User interface for I^2S output tristate

Memory Address (hex)	Function	Mode	Reset Value (hex)	Name
D0:13DF	**Output Clock Scaling** bit [19] 0 enable CLKO 1 disable CLKO bit [18:17] Division factor applied to the internal reference clock for the CLKO-output 0 divide reference clock by 1 1 divide by 2 2 divide by 4 3 divide by 8 bit [16] Low/high system clock for Dolby Digital 0 61/56/40 MHz for 48/44.1/32 kHz 1 73/67/49 MHz for 48/44.1/32 kHz bit [15:12] 0 reserved (set to 0) Sets the processor clock and the output clock at pin CLKO. The clock frequencies are coupled to the audio data sampling rate of the input signal by a PLL. The high clock frequencies have to be used if the internal Dolby Digital Bass Management is used.	**All**	80004	UIC_OUT_CLK_SCALE
	Auxiliary Interface Control bit [11] Tristate SO* (SOI, SOC, SOD, SOD1.3) 0 enable SO* output 1 tristate SO* output bit [10:7] 0 reserved (set to 0) bit [6] S/PDIF input select 0 select SPDI input 1 select SPDI2 input bit [5:3] 0 reserved (set to 0) bit [2] SOC Impedance 0 low impedance 1 high impedance bit [1] Serial input select 0 select SID, SII, SIC 1 select SID*, SII*, SIC* bit [0] 0 reserved Input/output interface selections.	**All**		UIC_AUX_INTERFACE_CTRL

Table 2–7: User interface for Virtual Dolby

Memory Address (hex)	Function	Mode	Reset Value (hex)	Name
D0:13D6	**Virtualizer Control (Test Implementation)** bit[5] Mode 0 Off — Virtualizer disabled 1 On — Virtualizer enabled bit[6] Output — valid if Virtualizer is enabled 0 2/0 Virt — Virtualizer with 2/0 Output (Mute C,LS,LR) 1 3/0 Virt — Virtualizer with 3/0 Output (Mute LS,LR) **Note:** To get correct virtualization of the surround channels, the Dolby Downmix Listening Mode Selector (bit[2:0]) must be defined as “3/2”. In this Test Implementation, the Bass Management is disabled while the Virtualizer is enabled.	**Dolby Digital** **Dolby Pro Logic II**	00007	UIC_VIRTUALIZER_CTRL
	Output Mode Control (Dolby Downmix) (Section 7.8 of ATSC Spec. A/52) bit[4:3] Dual mono setting of Dolby C decoder, applicable only if Audio Coding Mode is dual mono (acmod = 0). The actual mixing depends on the number of available output channels (speakers). 00 Stereo (straight output of both channels) 01 Left Mono (channel 1) 10 Right Mono (channel 2) 11 Mixed Mono (sum of both channels) bit[2:0] Listening Mode Selector Defines the number of available (desired) output channels (loudspeakers). 000 2/0 L, R Dolby Surround compatible 001 1/0 C 010 2/0 L, R 011 3/0 L, C, R 100 2/1 L, R, S 101 3/1 L, C, R, S 110 2/2 L, R, SL, SR 111 3/2 L, C, R, SL, SR These downmixing options are independent of the setting of the Extra Stereo Output (D0:13DE). Undesired channels can be muted by setting the volume to zero or by muting the outputs in the DPL 4519G or MSP 44x0G, respectively. Only listening modes 1/0, and 2/0 should be used if dual mono is transmitted. **Note:** other values or combinations of bits must not be written, bits not mentioned must be set to 0.	**Dolby Digital** **Dolby Pro Logic II**		UIC_OUT_MODE_CTRL