Cisco D9094 and D9093 HD/SD AVC Low Delay Contribution Codecs

Product Overview

The Cisco® D9094 and D9093 HD/SD AVC Low Delay Contribution Codecs utilize advanced MPEG-4 AVC encoding to perform real-time transmission of TV at low bit rates over DVB and broadband IP networks. With an optional built-in DVB-S/S2 modulator, the Cisco D9094 and D9093 provide a very dense solution for DVB satellite applications. The Cisco D9094 supports transmission of HDTV as well as SDTV, and the Cisco D9093 is dedicated to SDTV transmission. Powerful error-correction functions help ensure high-quality of service over IP networks seeking to prevent the distortion of decoded images, even when network packet losses occur. With its compact size and rugged construction, the Cisco D9094 helps reduce the cost of transmission from remote locations that demand HDTV image quality.

Figure 1. Cisco D9094 HD/SD AVC Low Delay Contribution Codec

The Cisco D9093 as well as the D9094 supports transmission of SDTV and HDTV with 4:2:2 chroma resolution. This is achieved very elegantly by a concept called 4:2:2 Chroma Scalable Coding (422CSC), which enables standard AVC decoders to decode the 4:2:0 part of the stream, while the Cisco D9894 HD/SD AVC Contribution Decoder is capable of decoding the full 4:2:2 chroma resolution.

Applications

Applying the H.264 High Profile at Level 4 image processing algorithms, the Cisco D9094 and D9093 provide high video quality for use in Electronic News Gathering (ENG) as well as broadcast contribution networks. By utilizing sophisticated H.264 compression algorithms, the streaming bit rate may be reduced by more than half compared to MPEG-2 encoding, while still achieving the same video quality. Encoder delay is selectable between standard and low-delay modes, allowing the Cisco codec to be used in delay-sensitive ENG applications.

With 4:2:2CSC, the Cisco D9093 & D9094 and D9894 also provide high video quality for use in high-end event transmission and studio-to-studio links where 4:2:2 chroma resolution is

occasionally required. 4:2:2CSC enables an easy transition from 4:2:0 to 4:2:2, as existing 4:2:0 AVC decoders can be used to decode the 4:2:0 part of the signal.

The 4:2:2CSC is now supported for Standard Definition as well as High Definition.

The D9094 and D9093 codecs utilize auto-sensing 10BT/100BT/1G Ethernet for IP connectivity as well as optional DVB-S/S2 modulation or ASI I/O ports for connecting to DVB networks. The units also provide industry standard HD/SD-SDI and HDMI I/Os for connecting to HDTV camcorders and displays. Bidirectional voice intercom capability is provided across broadband networks for interactive communication between remote and studio locations.

Features – Software Version 4.3 (Version 2.3 for D9093)

- 4:2:0 High Definition MPEG-4 AVC encoding and decoding[1]
  - HP @ L4 and MP @ L4, 1080i, 720p (59.94/50 Hz) & 60Hz[2]

    Regular GOP based low-delay mode

    Low-delay mode: 300 ms @ ASI, 450 ms @ IP, with D9093 or D9094 Encoder
- 4:2:0 Standard MPEG-4 AVC encoding and decoding
  - HP @ L3 and MP @ L3, 720 x 480i, 720 x 576i (59.94/50 Hz)

    Regular GOP based low-delay mode

    Low-delay mode: 300 ms @ ASI, 450 ms @ IP, with D9093 or D9094 Encoder
- 4:2:2CSC Standard Definition and High Definition MPEG-4 AVC encoding

  4:2:2CSC is decoded by the D9894 HD/SD AVC Contribution Decoder

  4:2:2CSC compression is a unique compression scheme that enables standard 4:2:0 decoders to decode the 4:2:0 part of the compressed video.

  Low-delay mode: 360 ms @ ASI, 510 ms @ IP, with D9093 or D9094 Encoder
- Secondary channel video encoder with up to SD resolution
- Can down-convert HD to Full or less than D1[1]
- Codec: User configurable as encoder or decoder
- Four AES pairs embedded in SDI, 1 HDMI stereo pair, 1 analog pair
  - MPEG-1 Layer II audio
  - MPEG-2 AAC audio
  - SMPTE-302M uncompressed audio and Dolby E pass-through
  - Dolby Digital (AC-3) pass-through
- VANC Support
- Advanced error correction functions help to ensure high quality of service
  - Pro-MPEG FEC
  - FEC and ARQ

    For video transmission over an IP network, Forward Error Correction (FEC) and Automatic Repeat Request (ARQ) are provided for network error correction. The combined use of FEC and ARQ provides high quality of service.

[1] D9094 AVC Codec only

[2] By converting the signal to 59.94 Hz before encoding to H.264

ARQ enables retransmission of packets lost in the network, and the user may adjust the retransmission buffer size to optimize the end-to-end delay.

- ToS bit control enables usage of Diffserv IP QoS mechanisms in the network
- Encryption - BISS 1/E
- Bidirectional Voice Intercom over IP
- SNMPv2 control and traps, ROSA® Driver

Optional Features

- DVB-ASI Single Input / Dual Output module
- DVB-S/S2 Modulator for IF or L-band

Product Specifications

Table 1. Product Specifications – Software Version 4.3 (2.3 for D9093)

Parameter		Value			
Video					
Input		1 x HD-SDI[1] or SD-SDI 1 x HDMI			
Genlock Input		1 x NTSC/PAL Black Burst or HD Tri-level Sync[1]			
Output		1 x HD-SDI[1] or SD-SDI 1 x HDMI 1 x NTSC/PAL			
Video Format					
Input/Output		HD[1]: 1920/1440/960 x 1080i (59.94 / 50 Hz) and 60Hz[2] HD[1]: 1280/960/640 x 720p (59.94 / 50 Hz) and 60Hz[2] SD: 720 x 480i (59.94 Hz), 720 x 576i (50 Hz)			
Video Coding					
HD[1]		4:2:0 - H.264 MP and HP @ L4, 3 to 27 Mbps 4:2:2CSC - 12 to 33 Mbps			
SD		4:2:0 H.264 MP and HP @ L3, 1.3 to 10 Mbps 4:2:2CSC - 6 to 14 Mbps			
Delay (nominal) Encode & Decode – D9094 @ HD, at 12 Mbit/s					
GOP mode		1080i		720p	
	Field/Frame frequency	59.94 Hz	50 Hz	59.94 Hz	50 Hz
Ultra Low	IP @ 4:2:0	0.43s	0.45s	0.41s	0.44s
	IP @ 4:2:2CSC	0.46s	0.48s	0.43s	0.45s
	DVB-ASI @ 4:2:0	0.28s	0.30s	0.26s	0.29s
	DVB-ASI @ 4:2:2CSC	0.31s	0.33s	0.28s	0.30s
Low	IP @ 4:2:0	0.69s	0.70s	0.65s	0.67s
	IP @ 4:2:2CSC	0.71s	0.74s	0.67s	0.70s
	DVB-ASI @ 4:2:0	0.54s	0.55s	0.50s	0.52s
	DVB-ASI @ 4:2:2CSC	0.56s	0.59s	0.52s	0.55s
Standard	IP @ 4:2:0	1.19s	1.28s	1.03s	1.10s
	IP @ 4:2:2CSC	1.23s	1.34s	1.08s	1.14s
	DVB-ASI @ 4:2:0 &	1.04s	1.13s	0.88s	0.95s
	DVB-ASI @ 4:2:2CSC	1.08s	1.19s	0.93s	0.99s
Delay (nominal) Encode & Decode – D9093/D9094 @ SD, at 6 Mbit/s					
GOP mode	Field frequency	59.94 Hz		50 Hz	
Ultra Low	IP @ 4:2:0	0.41s		0.44s	
	IP @ 4:2:2CSC	0.44s		0.46s	
	DVB-ASI @ 4:2:0	0.26s		0.29s	
	DVB-ASI @ 4:2:2CSC	0.29s		0.31s	
Low	IP @ 4:2:0	0.55s		0.58s	
	IP @ 4:2:2CSC	0.58s		0.61s	
	DVB-ASI @ 4:2:0	0.40s		0.43s	
	DVB-ASI @ 4:2:2CSC	0.43s		0.46s	
Standard	IP @ 4:2:0	1.05s		1.12s	
	IP @ 4:2:2CSC	1.12s		1.20s	
	DVB-ASI @ 4:2:0 &	0.90s		0.97s	
	DVB-ASI @ 4:2:2CSC	0.97s		1.05s	

Parameter	Value
Ancillary Data	
HD	Private PES • 59.94 Hz: SMPTE RDD 11-2007 • 50 Hz: Proprietary (SMPTE RDD 11-2007 base)
	ATSC Closed Caption (at encoder) • 59.94 Hz: ATSC Closed Caption (ATSC CS/TSG-659r4(A/72)) • 50 Hz: Proprietary (ATSC CS/TSG-659r4(A/72) equivalent)
SD	Private PES • 59.94 Hz: SMPTE RDD 11-2007 • 50 Hz: Proprietary (SMPTE RDD 11-2007 base)
	ATSC Closed Caption (at encoder) • 59.94 Hz: ATSC Closed Caption (ATSC CS/TSG-659r4(A/72)) • 50 Hz: Proprietary (ATSC CS/TSG-659r4(A/72) equivalent)
Sub Encoder	Private PES • 59.94 Hz: SMPTE RDD 11-2007 • 50 Hz: Proprietary (SMPTE RDD 11-2007)
Bandwidth Optimization	DID filtering, Bit rate limiter
VBI	
Input/Output	NTSC Closed Caption Line 21 and Line 261 (decodable with a Cisco D9894 or D9094 decoder)
Audio	
Input/Output	4 x AES pairs embedded in SDI (48 kHz) 1 x HDMI 1 x Analog stereo pair (balanced)
Audio Coding	
Program	MPEG-1 Layer II MPEG-2 AAC SMPTE-302M uncompressed audio or Dolby E pass-through Dolby Digital (AC-3) pass-through (ATSC/DVB)
Audio Encoding Bit Rates	MPEG-1 Layer II: 128, 256, 384 kb/s MPEG-2 AAC: 64, 128, 256, 384 kb/s Uncompressed audio or Dolby E pass-through: 2304 kb/s Dolby Digital (AC-3) pass-through (ATSC/DVB): 56-640 kb/s
Voice Intercom	G.711
Transport Interface	
Interface Type	10BASE-T/100BASE-TX /1000BASE-T DVB-ASI (optional) DVB-S/S2 Modulator (optional)
Error Correction	Pro-MPEG FEC and ARQ
Encryption on ASI & DVB-S/S2	BISS 1/E
DVB-S/S2 Modulator – Option	
Modulator Type, Frequency	Option: L-Band Modulator, 950.000 to 1,750.000 MHz Option: IF-Band Modulator, 50.000 to 90.000 MHz, 100.000 to 180.000 MHz
Transmission System	CCM
Modulation & FEC	DVB-S (DSNG): QPSK: 1/2, 2/3, 3/4, 5/6, 7/8 8PSK: 2/3, 5/6, 8/9 DVB-S2: QPSK: 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 16APSK: 2/3, 3/4, 4/5, 5/6, 8/9, 9/10

Parameter	Value
Environmental Specifications	
Operating Temperature	-10 to 55°C (14 to 131°F)
Chassis Mechanical Specifications	
Height	4.2 cm (1.65 in.)
Width	42.5 cm (16.73 in.)
Depth	35.0 cm (13.8 in.)
Weight	6 kg (13.2 lb)
Power	
Voltage Range	100 to 240 VAC
Line Frequency	50/60 Hz
Power Consumption	60 W maximum at 100 VAC With option: 90 W maximum at 100 VAC

Figure 2. D9094 AVC HD/SD Codec Rear Panel (Base unit – No Option Card installed)

Ordering Information

Table 2. Ordering Information

Cisco D9094/D9093 HD/SD AVC Codec	Part Number
D9093 AVC SD Codec, IP In/Out, Enc/Dec switchable	40297660
D9093 AVC SD Codec, IP and ASI In/Out, Enc/Dec switchable	40297662
D9093 AVC HD/SD Codec, IP and ASI Dual-Out/1-In,Enc/Dec switch	40297663
D9093 AVC SD Codec, IP and DVB-S/S2, L-Band, Enc/Dec switchable	40297664
D9094 AVC HD/SD Codec, IP In/Out, Enc/Dec switchable	40297670
D9094 AVC HD/SD Codec, IP and ASI Dual-Out/1-In,Enc/Dec switch	40297672
D9094 AVC HD/SD Codec, IP and DVB-S/S2,IF, Enc/Dec switchable	40297673
D9094 AVC HD/SD Codec, IP and DVB-S/S2, L-Band, Enc/Dec switchable	40297674
Power Cords	
Power Cord (Argentina)	207340
Power Cord (China)	745415
Power Cord (Australia)	1000897
Power Cord (Europe)	3989835
Power Cord (UK)	3989836
Power Cord (US)	3989838
Power Cord (Italy)	3993130
Power Cord (Japan)	3993133
ROSA Drivers	
ROSA Driver for Cisco D9093	7018618
ROSA Driver for Cisco D9094	7018619

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