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DS3181/DS3182/DS3183/DS3184

Single/Dual/Triple/Quad

ATM/Packet PHYs with Built-In LIU

www.maxim-ic.com

GENERAL DESCRIPTION

The DS3181, DS3182, DS3183, and DS3184 (DS318x) integrate ATM cell/HDLC packet processor(s) with a DS3/E3 framer(s) and LIU(s) to map/demap ATM cells or packets into as many as four DS3/E3 physical copper lines with DS3-framed, E3-framed, or clear-channel data streams on per-port basis.

APPLICATIONS

Access Concentrators	Multiservice Access Platform (MSAP)
SONET/SDH ADM	
SONET/SDH Muxes	Multiservice Protocol Platform (MSPP)
PBXs	
Digital Cross Connect	ATM and Frame Relay Equipment
Test Equipment	
Routers and Switches	PDH Multiplexer/ Demultiplexer
Integrated Access Device (IAD)	

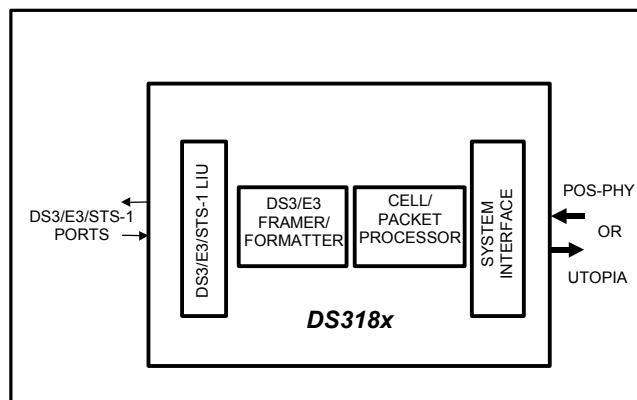
ORDERING INFORMATION

PART	TEMP RANGE	PIN-PACKAGE
DS3181	0°C to +70°C	400 TE-PBGA (27mm x 27mm, 1.27mm pitch)
DS3181N	-40°C to +85°C	400 TE-PBGA (27mm x 27mm, 1.27mm pitch)
DS3182	0°C to +70°C	400 TE-PBGA (27mm x 27mm, 1.27mm pitch)
DS3182N	-40°C to +85°C	400 TE-PBGA (27mm x 27mm, 1.27mm pitch)
DS3183	0°C to +70°C	400 TE-PBGA (27mm x 27mm, 1.27mm pitch)
DS3183N	-40°C to +85°C	400 TE-PBGA (27mm x 27mm, 1.27mm pitch)
DS3184	0°C to +70°C	400 TE-PBGA (27mm x 27mm, 1.27mm pitch)
DS3184N	-40°C to +85°C	400 TE-PBGA (27mm x 27mm, 1.27mm pitch)

Note: Add the "+" suffix for the lead-free package option.

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FUNCTIONAL DIAGRAM



FEATURES

- Single (DS3181), Dual (DS3182), Triple (DS3183), or Quad (DS3184) with Integrated LIU ATM/Packet PHYs for DS3, E3, and Clear-Channel 52Mbps (CC52)
- Pin Compatible for Ease of Port Density Migration in the Same PC Board Platform
- Each Port Independently Configurable
- Perform Receive Clock/Data Recovery and Transmit Waveshaping
- Jitter Attenuator can be Placed Either in the Receive or Transmit Paths
- Interfaces to 75Ω Coaxial Cable at Lengths Up to 380 Meters or 1246 Feet (DS3) or 440 Meters or 1443 Feet (E3)
- Uses 1:2 Transformers on Both Tx and Rx
- Universal PHYs Map ATM Cells and/or HDLC Packets into DS3 or E3 Data Streams
- UTOPIA L2/L3 or POS-PHY™ L2/L3 or SPI-3 Interface with 8-, 16-, or 32-Bit Bus Width
- 66MHz UTOPIA L3 and POS-PHY L3 Clock
- 52MHz UTOPIA L2 and POS-PHY L2 Clock
- Ports Independently Configurable for Cell or Packet Traffic in POS-PHY Bus Modes
- Direct, PLCP, DSS, and Clear-Channel Cell Mapping

Note: Some revisions of this device may incorporate deviations from published specifications known as errata. Multiple revisions of any device may be simultaneously available through various sales channels. For information about device errata, click here: www.maxim-ic.com/errata.

FEATURES (continued)

- Direct and Clear-Channel Packet Mapping
- On-Chip DS3 (M23 or C-Bit) and E3 (G.751 or G.832) Framers(s)
- Ports Independently Configurable for DS3, E3 (Full or Subrate) or Arbitrary Framing Protocols Up to 52Mbps
- Programmable (Externally Controlled or Internally Finite State Machine Controlled) Subrate DS3/E3
- Full-Featured DS3/E3/PLCP Alarm Generation and Detection
- Built-In HDLC Controllers with 256-Byte FIFOs for Insertion/Extraction of DS3 PMDL, G.751 Sn Bit, and G.832 NR/GC Bytes and PLCP NR/GC Bytes
- On-Chip BERTs for PRBS and Repetitive Pattern Generation, Detection, and Analysis
- Large Performance-Monitoring Counters for Accumulation Intervals of at Least 1 Second
- Flexible Overhead Insertion/Extraction Ports for DS3, E3, and PLCP Framers
- Loopbacks Include Line, Diagnostic, Framers, Payload, Analog, and System Interface with Capabilities to Insert AIS in the Directions Away from Loopback Directions
- Ports can be Disabled to Reduce Power
- Integrated Clock Rate Adapter to Generate the Remaining Internally Required 44.736MHz (DS3), 34.368MHz (E3), and 52MHz (Arbitrary Framing at Up to 52Mbps) from a Single Clock Reference Source at One of Those Three Frequencies
- Pin Compatible with the DS3171/2/3/4 Family and the DS3161/2/3/4 Family
- 8/16-Bit Generic Microprocessor Interface
- Low-Power (2.7W typ) 3.3V Operation (5V-Tolerant I/O)
- Small, High-Density, Thermally Enhanced, BGA Packaging (TE-PBGA) with 1.27mm Pin Pitch
- Industrial Temperature Operation: -40°C to +85°C
- IEEE1149.1 JTAG Test Port

DETAILED DESCRIPTION

The DS3181 (single), DS3182 (dual), DS3183 (triple), and DS3184 (quad) PHYs perform all the functions necessary for mapping/demapping ATM cells and/or packets into as many as four DS3 (44.736Mbps) framed, E3 (34.368Mbps) framed, or 52Mbps clear-channel data streams on DS3, E3, or STS-1 physical copper lines. Each line interface unit (LIU) has independent receive and transmit paths. The receiver LIU block performs clock and data recovery from a B3ZS- or HDB3-coded AMI signal and monitors for loss of the incoming signal or can be bypassed for direct clock and data inputs. The receiver LIU block optionally performs B3ZS/HDB3 decoding. The transmitter LIU drives standard pulse-shape waveforms onto 75Ω coaxial cable or can be bypassed for direct clock and data outputs. The jitter attenuator can be placed in either transmit or receive data path when the LIU is enabled. Dedicated cell processor and packet processor blocks prepare outgoing cells or packets for transmission and check incoming cells or packets upon arrival. Built-in DS3/E3 framers transmit and receive cell/packet data in properly formatted M23 DS3, C-bit DS3, G.751 E3, or G.832 E3 data streams. PLCP framers provide legacy ATM transmission-convergence support. DSS scrambling is performed for clear-channel ATM cell support. With integrated hardware support for both cells and packets, the DS318x DS3/E3 ATM/Packet PHYs provide system on-chip solutions (from DS3/E3/STS-1 physical copper lines to ATM/Packet UTOPIA/POS-PHY Level 2/3 system switch) for universal high-density line cards in the unchannelized DS3/E3/clear-channel DS3 ATM/Packet applications. Unused functions can be powered down to reduce device power. The DS318x ATM/Packet PHYs with embedded LIU conform to the telecommunications standards listed in Section [4](#).

TABLE OF CONTENTS

1	BLOCK DIAGRAMS	14
2	APPLICATIONS	15
3	FEATURE DETAILS	17
3.1	GLOBAL FEATURES	17
3.2	RECEIVE DS3/E3/STS-1 LIU FEATURES	17
3.3	RECEIVE DS3/E3 FRAMER FEATURES	17
3.4	RECEIVE PLCP FRAMER FEATURES	18
3.5	RECEIVE CELL PROCESSOR FEATURES	18
3.6	RECEIVE PACKET PROCESSOR FEATURES	18
3.7	RECEIVE FIFO FEATURES	19
3.8	RECEIVE SYSTEM INTERFACE FEATURES	19
3.9	TRANSMIT SYSTEM INTERFACE FEATURES	19
3.10	TRANSMIT FIFO FEATURES	19
3.11	TRANSMIT CELL PROCESSOR FEATURES	19
3.12	TRANSMIT PACKET PROCESSOR FEATURES	19
3.13	TRANSMIT PLCP FORMATTER FEATURES	20
3.14	TRANSMIT DS3/E3 FORMATTER FEATURES	20
3.15	TRANSMIT DS3/E3/STS-1 LIU FEATURES	20
3.16	JITTER ATTENUATOR FEATURES	20
3.17	CLOCK RATE ADAPTER FEATURES.....	20
3.18	HDLC OVERHEAD CONTROLLER FEATURES	20
3.19	FEAC CONTROLLER FEATURES	21
3.20	TRAIL TRACE BUFFER FEATURES.....	21
3.21	BIT ERROR RATE TESTER (BERT) FEATURES.....	21
3.22	LOOPBACK FEATURES	21
3.23	MICROPROCESSOR INTERFACE FEATURES.....	21
3.24	SUBRATE FEATURES (FRACTIONAL DS3/E3).....	21
3.25	TEST FEATURES.....	22
4	STANDARDS COMPLIANCE	23
5	ACRONYMS AND GLOSSARY	25
6	MAJOR OPERATIONAL MODES	26
6.1	DS3/E3 ATM/PACKET MODE	26
6.2	DS3/E3 ATM/PACKET—OHM MODE	27
6.3	DS3/E3 INTERNAL FRACTIONAL (SUBRATE) ATM/PACKET MODE	28
6.4	DS3/E3 EXTERNAL FRACTIONAL (SUBRATE) ATM/PACKET MODE.....	29
6.5	DS3/E3 FLEXIBLE EXTERNAL FRACTIONAL (SUBRATE) MODE CONFIGURATION MODE	30
6.6	DS3/E3 G.751 PLCP ATM MODE	31
6.7	DS3/E3 G.751 PLCP ATM—OHM MODE	32
6.8	CLEAR-CHANNEL ATM/PACKET MODE.....	34
6.9	CLEAR-CHANNEL ATM/PACKET—OHM MODE	35
6.10	CLEAR-CHANNEL OCTET ALIGNED ATM/PACKET—OHM MODE	36
7	MAJOR LINE INTERFACE OPERATING MODES	37
7.1	DS3HDB3/B3ZS/AMI LIU MODE	37
7.2	HDB3/B3ZS/AMI NON-LIU LINE INTERFACE MODE	39
7.3	UNI LINE INTERFACE MODE	40
7.4	UNI LINE INTERFACE—OHM MODE	41
8	PIN DESCRIPTIONS	42

8.1	SHORT PIN DESCRIPTIONS	42
8.2	DETAILED PIN DESCRIPTIONS	48
8.3	PIN FUNCTIONAL TIMING.....	66
8.3.1	Line IO.....	66
8.3.2	DS3/E3 Framing and PLCP Overhead Functional Timing.....	69
8.3.3	Internal (IFRAC) and External (XFRAC) Fractional DS3/E3 Overhead Functional Timing.....	72
8.3.4	Flexible Fractional (FFRAC) DS3/E3 Overhead Interface Functional Timing.....	73
8.3.5	UTOPIA/POS-PHY/SPI-3 System Interface Functional Timing.....	75
8.3.6	Microprocessor Interface Functional Timing.....	87
8.3.7	JTAG Functional Timing.....	91
9	INITIALIZATION AND CONFIGURATION	92
9.1	MONITORING AND DEBUGGING	94
9.1.1	Cell/Packet FIFO.....	94
9.1.2	Cell Processor.....	94
9.1.3	Packet Processor.....	95
10	FUNCTIONAL DESCRIPTION	96
10.1	PROCESSOR BUS INTERFACE	96
10.1.1	8/16-Bit Bus Widths.....	96
10.1.2	Ready Signal (\overline{RDY}).....	96
10.1.3	Byte Swap Modes.....	96
10.1.4	Read-Write/Data Strobe Modes.....	96
10.1.5	Clear on Read/Clear on Write Modes.....	96
10.1.6	Global Write Method.....	97
10.1.7	Interrupt and Pin Modes.....	97
10.1.8	Interrupt Structure.....	97
10.2	CLOCKS.....	99
10.2.1	Line Clock Modes.....	99
10.2.2	Sources of Clock Output Pin Signals.....	100
10.2.3	Line IO Pin Timing Source Selection.....	103
10.2.4	Clock Structures On Signal IO Pins.....	105
10.2.5	Gapped Clocks.....	106
10.3	RESET AND POWER-DOWN.....	107
10.4	GLOBAL RESOURCES	109
10.4.1	Clock Rate Adapter (CLAD).....	109
10.4.2	8 kHz Reference Generation.....	111
10.4.3	One-Second Reference Generation.....	113
10.4.4	General-Purpose IO Pins.....	113
10.4.5	Performance Monitor Counter Update Details.....	114
10.4.6	Transmit Manual Error Insertion.....	115
10.5	PER-PORT RESOURCES	116
10.5.1	Loopbacks.....	116
10.5.2	Loss Of Signal Propagation.....	118
10.5.3	AIS Logic.....	118
10.5.4	Loop Timing Mode.....	121
10.5.5	HDLC Overhead Controller.....	121
10.5.6	Trail Trace.....	121
10.5.7	BERT.....	121
10.5.8	Fractional Payload Controller.....	122
10.5.9	PLCP/Fractional port pins.....	122
10.5.10	Framing Modes.....	127
10.5.11	Mapping Modes.....	128
10.5.12	Line Interface Modes.....	132
10.6	UTOPIA/POS-PHY/SPI-3 SYSTEM INTERFACE.....	134
10.6.1	General Description.....	134
10.6.2	Features.....	134
10.6.6	System Interface Bus Controller.....	135

10.7	ATM CELL/HDLC PACKET PROCESSING	139
10.7.1	General Description	139
10.7.2	Features	139
10.7.3	Transmit Cell/Packet Processor.....	140
10.7.4	Receive Cell/Packet Processor.....	141
10.7.5	Cell Processor.....	141
10.7.6	Packet Processor.....	146
10.7.7	FIFO.....	148
10.7.8	System Loopback.....	149
10.8	DS3/E3 PLCP FRAMER.....	150
10.8.1	General Description	150
10.8.2	Features	150
10.8.3	Transmit PLCP Frame Processor.....	151
10.8.4	Receive PLCP Frame Processor.....	151
10.8.5	Transmit DS3 PLCP Frame Processor.....	151
10.8.6	Receive DS3 PLCP Frame Processor.....	154
10.8.7	Transmit E3 PLCP Frame Processor.....	155
10.8.8	Receive E3 PLCP Frame Processor.....	158
10.9	FRACTIONAL PAYLOAD CONTROLLER.....	160
10.9.1	General Description	160
10.9.2	Features	160
10.9.3	Transmit Fractional Interface	161
10.9.4	Transmit Fractional Controller.....	161
10.9.5	Receive Fractional Interface	161
10.9.6	Receive Fractional Controller.....	161
10.10	DS3/E3 FRAMER/FORMATTER	163
10.10.1	General Description	163
10.10.2	Features	163
10.10.3	Transmit Formatter.....	164
10.10.4	Receive Framer.....	164
10.10.5	C-bit DS3 Framer/Formatter	168
10.10.6	M23 DS3 Framer/Formatter.....	171
10.10.7	G.751 E3 Framer/Formatter.....	174
10.10.8	G.832 E3 Framer/Formatter.....	176
10.10.9	Clear-Channel Frame Processor	181
10.11	HDLC OVERHEAD CONTROLLER	181
10.11.1	General Description	181
10.11.2	Features	182
10.11.3	Transmit FIFO.....	182
10.11.4	Transmit HDLC Overhead Processor	182
10.11.5	Receive HDLC Overhead Processor	183
10.11.6	Receive FIFO.....	184
10.12	TRAIL TRACE CONTROLLER	184
10.12.1	General Description	184
10.12.2	Features	185
10.12.3	Functional Description.....	185
10.12.4	Transmit Data Storage.....	186
10.12.5	Transmit Trace ID Processor.....	186
10.12.6	Transmit Trail Trace Processing.....	186
10.12.7	Receive Trace ID Processor.....	186
10.12.8	Receive Trail Trace Processing.....	186
10.12.9	Receive Data Storage.....	187
10.13	FEAC CONTROLLER	188
10.13.1	General Description	188
10.13.2	Features	188
10.13.3	Functional Description.....	188
10.14	LINE ENCODER/DECODER	190
10.14.1	General Description	190

10.14.2 Features	190
10.14.3 B3ZS/HDB3 Encoder	190
10.14.4 Transmit Line Interface	191
10.14.5 Receive Line Interface	191
10.14.6 B3ZS/HDB3 Decoder	191
10.15 BERT	193
10.15.1 General Description	193
10.15.2 Features	193
10.15.3 Configuration and Monitoring	193
10.15.4 Receive Pattern Detection	194
10.15.5 Transmit Pattern Generation	196
10.16 LINE INTERFACE UNIT (LIU)	197
10.16.1 General Description	197
10.16.2 Features	197
10.16.3 Detailed Description	198
10.16.4 Transmitter	198
10.16.5 Receiver	199
11 OVERALL REGISTER MAP	202
12 REGISTER MAPS AND DESCRIPTIONS	204
12.1 REGISTERS BIT MAPS	204
12.1.1 Global Register Bit Map	204
12.1.2 HDLC Register Bit Map	207
12.1.3 T3 Register Bit Map	209
12.1.4 E3 G.751 Register Bit Map	210
12.1.5 E3 G.832 Register Bit Map	211
12.1.6 Clear-Channel Register Bit Map	212
12.1.7 Fractional Register Bit Map	212
12.1.8 Transmit Cell Processor Bit Map	215
12.1.9 Transmit Packet Processor Bit Map	216
12.2 GLOBAL REGISTERS	219
12.2.1 Register Bit Descriptions	219
12.3 UTOPIA/POS-PHY SYSTEM INTERFACE	227
12.3.1 Transmit System Interface	227
12.3.2 Receive System Interface Register Map	229
12.4 PER-PORT COMMON	231
12.4.1 Per-Port Common Register Map	231
12.4.2 Per-Port Common Register Bit Descriptions	231
12.5 BERT	242
12.5.1 BERT Register Map	242
12.5.2 BERT Register Bit Descriptions	242
12.6 B3ZS/HDB3 LINE ENCODER/DECODER	251
12.6.1 Transmit Side Line Encoder/Decoder Register Map	251
12.6.2 Receive Side Line Encoder/Decoder Register Map	252
12.7 HDLC	256
12.7.1 HDLC Transmit Side Register Map	256
12.7.2 HDLC Receive Side Register Map	260
12.8 FEAC CONTROLLER	264
12.8.1 FEAC Transmit Side Register Map	264
12.8.2 FEAC Receive Side Register Map	267
12.9 TRAIL TRACE	270
12.9.1 Trail Trace Transmit Side	270
12.9.2 Trail Trace Receive Side Register Map	272
12.10 DS3/E3 FRAMER	276
12.10.1 Transmit DS3	276
12.10.2 Receive DS3 Register Map	279
12.10.3 Transmit G.751 E3	289

12.10.4 Receive G.751 E3 Register Map	291
12.10.5 Transmit G.832 E3 Register Map	297
12.10.6 Receive G.832 E3 Register Map	300
12.10.7 Transmit Clear Channel	309
12.10.8 Receive Clear Channel	310
12.11 FRACTIONAL DS3/E3	312
12.11.1 Fractional Transmit Side Register Map	312
12.11.2 Fractional Receive Side Register Map	314
12.12 DS3/E3 PLCP	316
12.12.1 Transmit Side PLCP	316
12.12.2 Receive Side PLCP Register Map	320
12.13 FIFO REGISTERS	331
12.13.1 Transmit FIFO Register Map	331
12.13.2 Receive FIFO Register Map	335
12.14 CELL/PACKET PROCESSOR	338
12.14.1 Transmit Cell Processor Register Map	338
12.14.2 Receive Cell Processor	345
12.14.3 Transmit Packet Processor Register Map	357
12.14.4 Receive Packet Processor Register Map	362
13 JTAG INFORMATION	372
13.1 JTAG DESCRIPTION	372
13.2 JTAG TAP CONTROLLER STATE MACHINE DESCRIPTION	373
13.3 JTAG INSTRUCTION REGISTER AND INSTRUCTIONS	375
13.4 JTAG ID CODES	376
13.5 JTAG FUNCTIONAL TIMING	376
13.6 IO PINS	376
14 PIN ASSIGNMENT	377
15 PACKAGE INFORMATION	380
15.1 400-LEAD TE-PBGA (27MM X 27MM, 1.27MM PITCH) (56-G6003-003)	380
16 PACKAGE THERMAL INFORMATION	381
17 DC ELECTRICAL CHARACTERISTICS	382
18 AC TIMING CHARACTERISTICS	384
18.1 FRACTIONAL PORT CHARACTERISTICS	386
18.2 LINE INTERFACE AC CHARACTERISTICS	386
18.3 MISCELLANEOUS PIN AC CHARACTERISTICS	387
18.4 OVERHEAD PORT AC CHARACTERISTICS	387
18.5 SYSTEM INTERFACE AC CHARACTERISTICS	388
18.6 MICRO INTERFACE AC CHARACTERISTICS	390
18.7 CLAD JITTER CHARACTERISTICS	393
18.8 LIU INTERFACE AC CHARACTERISTICS	393
18.8.1 Waveform Templates	393
18.8.2 LIU Input/Output Characteristics	397
18.9 JTAG INTERFACE AC CHARACTERISTICS	399
19 REVISION HISTORY	400

LIST OF FIGURES

Figure 1-1. LIU External Connections for a DS3/E3/STS-1 Port of a DS318x Device.....	14
Figure 1-2. DS318x Functional Block Diagram	14
Figure 2-1. Four-Port Unchannelized ATM over DS3/E3/CC52 Line Card	15
Figure 2-2. Four-Port Unchannelized HDLC over DS3/E3/CC52 Line Card	16
Figure 6-1. DS3/E3 ATM/Packet Mode	26
Figure 6-2. DS3/E3 ATM/Packet—OHM Mode	27
Figure 6-3. DS3/E3 Internal Fractional ATM/Packet Mode	28
Figure 6-4. DS3/E3 External Fractional ATM/Packet Mode	29
Figure 6-5. DS3/E3 Flexible External Fractional Mode	30
Figure 6-6. DS3/E3 G.751 PLCP ATM Mode	31
Figure 6-7. DS3/E3 G.751 PLCP ATM—OHM Mode	33
Figure 6-8. Clear-Channel ATM/Packet Modes.....	34
Figure 6-9. Clear-Channel ATM/Packet—OHM Mode	35
Figure 6-10. Clear-Channel Octet Aligned ATM/Packet—OHM Mode.....	36
Figure 7-1. HDB3/B3ZS/AMI LIU Mode.....	38
Figure 7-2. HDB3/B3ZS/AMI Non-LIU Line Interface Mode.....	39
Figure 7-3. UNI Line Interface Mode	40
Figure 7-4. UNI Line Interface—OHM Mode	41
Figure 8-1. TX Line IO B3ZS Functional Timing Diagram	66
Figure 8-2. TX Line IO HDB3 Functional Timing Diagram	67
Figure 8-3. RX Line IO B3ZS Functional Timing Diagram.....	67
Figure 8-4. RX Line IO HDB3 Functional Timing Diagram	68
Figure 8-5. TX Line IO UNI OHM Functional Timing Diagram	68
Figure 8-6. TX Line IO UNI Octet Aligned OHM Functional Timing Diagram.....	68
Figure 8-7. RX Line IO OHM UNI Functional Timing Diagram.....	69
Figure 8-8. RX Line IO UNI Octet Aligned OHM Functional Timing Diagram	69
Figure 8-9. DS3 Framing Receive Overhead Port Timing.....	69
Figure 8-10. E3 G.751 Framing Receive Overhead Port Timing	70
Figure 8-11. E3 G.832 Framing Receive Overhead Port Timing	70
Figure 8-12. DS3 Framing Transmit Overhead Port Timing.....	70
Figure 8-13. E3 G.751 Framing Transmit Overhead Port Timing	70
Figure 8-14. E3 G.832 Framing Transmit Overhead Port Timing	71
Figure 8-15. DS3 PLCP Receive Overhead Port Timing.....	71
Figure 8-16. E3 G.751 PLCP Receive Overhead Port Timing	71
Figure 8-17. DS3 PLCP Transmit Overhead Port Timing.....	71
Figure 8-18. E3 G.751 PLCP Transmit Overhead Port Timing	72
Figure 8-19. External (XFRAC) Transmit Fractional Timing.....	72
Figure 8-20. External (XFRAC) Receive Fractional Timing.....	72
Figure 8-21. Internal (IFRAC) Transmit Fractional Timing	73
Figure 8-22. Internal (IFRAC) Receive Fractional Timing	73
Figure 8-23. Transmit Flexible Fractional (FFRAC) Timing.....	74
Figure 8-24. Receive Flexible Fractional (FFRAC) Timing.....	74
Figure 8-25. UTOPIA Level 2 Transmit Cell Transfer Direct Mode	75
Figure 8-26. UTOPIA Level 2 Receive Cell Transfer Direct Mode	76
Figure 8-27. UTOPIA Level 2 Transmit Multiple Cell Transfer Polled Mode.....	77
Figure 8-28. UTOPIA Level 2 Receive Multiple Cell Transfer Polled Mode.....	77
Figure 8-29. UTOPIA Level 2 Receive Unexpected Multiple Cell Transfer.....	78
Figure 8-30. UTOPIA Level 3 Transmit Multiple Cell Transfer Direct Mode.....	78
Figure 8-31. UTOPIA Level 3 Transmit Multiple Cell Transfer Polled Mode.....	79
Figure 8-32. UTOPIA Level 3 Receive Multiple Cell Transfer Direct Mode.....	80
Figure 8-33. UTOPIA Level 3 Receive Multiple Cell Transfer Polled Mode.....	80
Figure 8-34. Transmit Multiple Packet Transfer to Different PHY ports (direct status mode)	81
Figure 8-35. POS-PHY Level 2 Receive Multiple Packet Transfer from Different PHY Ports/Devices(direct status mode).....	82
Figure 8-36. POS-PHY Level 2 Transmit Multiple Packet Transfer to Different PHY Ports (polled status mode)....	83
Figure 8-37. POS-PHY Level 2 Receive Multiple Packet Transfer (polled status mode).....	84
Figure 8-38. POS-PHY Level 3 Transmit Multiple Packet Transfer In-Band Addressing.....	85

Figure 8-39. POS-PHY Level 3 Receive Multiple Packet Transfer In-Band Addressing.....	86
Figure 8-40. 16-Bit Mode Write.....	87
Figure 8-41. 16-Bit Mode Read.....	87
Figure 8-42. 8-Bit Mode Write.....	88
Figure 8-43. 8-Bit Mode Read.....	88
Figure 8-44. 16-Bit Mode without Byte Swap.....	89
Figure 8-45. 16-Bit Mode with Byte Swap.....	89
Figure 8-46. Clear Status Latched Register on Read.....	90
Figure 8-47. Clear Status Latched Register on Write.....	90
Figure 8-48. RDY Signal Functional Timing Writes.....	90
Figure 8-49. RDY Signal Functional Timing Read.....	91
Figure 10-1. Interrupt Structure.....	98
Figure 10-2. Internal TX Clock.....	101
Figure 10-3. Internal RX Clock.....	102
Figure 10-4. Example IO Pin Clock Muxing.....	106
Figure 10-5. Reset Sources.....	107
Figure 10-6. CLAD Block.....	110
Figure 10-7. 8KREF Logic.....	112
Figure 10-8. Performance Monitor Update Logic.....	115
Figure 10-9. Transmit Error Insert Logic.....	116
Figure 10-10. Loopback Modes.....	117
Figure 10-11. ALB Mux.....	117
Figure 10-12. AIS Signal Flow.....	120
Figure 10-13. DS3 C-Bit or DS3 M23 (with C-Bit Generation) Frame.....	128
Figure 10-14. DS3 PLCP Frame.....	129
Figure 10-15. DS3 M23 (with C-Bits Used as Payload) Frame.....	130
Figure 10-16. E3 G.751 Frame.....	130
Figure 10-17. E3 PLCP Frame.....	131
Figure 10-18. Example E3 G.751 Internal Fractional Frame.....	131
Figure 10-19. E3 G.832 Frame.....	132
Figure 10-20. System Interface Functional Diagram.....	134
Figure 10-21. Normal Packet Format in 32-Bit Mode.....	135
Figure 10-22. Normal Packet Format in 16-Bit Mode.....	135
Figure 10-23. Byte Reordered Packet Format in 32-Bit Mode.....	135
Figure 10-24. Byte Reordered Packet Format in 16-Bit Mode.....	136
Figure 10-25. ATM Cell/HDLC Packet Functional Diagram.....	139
Figure 10-26. Receive DSS Scrambler Synchronization State Diagram.....	143
Figure 10-27. Cell Delineation State Diagram.....	144
Figure 10-28. HEC Error Monitoring State Diagram.....	145
Figure 10-29. Cell Format for 53-Byte Cell With 32-Bit Data Bus.....	145
Figure 10-30. Cell Format for 52-Byte Cell With 32-Bit Data Bus.....	146
Figure 10-31. PLCP Framing Functional Diagram.....	150
Figure 10-32. DS3 PLCP Frame Format.....	152
Figure 10-33. DS3 PLCP G1 Byte Format.....	152
Figure 10-34. E3 PLCP Frame Format.....	156
Figure 10-35. E3 PLCP G1 Byte Format.....	156
Figure 10-36. Fractional Payload Controller Detailed Block Diagram.....	160
Figure 10-37. Data Group Format.....	162
Figure 10-38. Frame Format.....	162
Figure 10-39. Framing Detailed Block Diagram.....	163
Figure 10-40. DS3 Frame Format.....	165
Figure 10-41. DS3 Sub-Frame Framing State Diagram.....	166
Figure 10-42. DS3 Multiframe Framing State Diagram.....	167
Figure 10-43. G.751 E3 Frame Format.....	174
Figure 10-44. G.832 E3 Frame Format.....	176
Figure 10-45. MA Byte Format.....	177
Figure 10-46. HDLC Controller Block Diagram.....	182
Figure 10-47. Trail Trace Controller Block Diagram.....	185
Figure 10-48. Trail Trace Byte (DT = Trail Trace Data).....	187

Figure 10-49. FEAC Controller Block Diagram.....	188
Figure 10-50. FEAC Codeword Format.....	189
Figure 10-51. Line Encoder/Decoder Block Diagram.....	190
Figure 10-52. B3ZS Signatures.....	192
Figure 10-53. HDB3 Signatures.....	192
Figure 10-54. BERT Block Diagram.....	193
Figure 10-55. PRBS Synchronization State Diagram.....	195
Figure 10-56. Repetitive Pattern Synchronization State Diagram.....	196
Figure 10-57. LIU Functional Diagram.....	197
Figure 10-58. DS3/E3/STS-1 LIU Block Diagram.....	198
Figure 10-59. Receiver Jitter Tolerance.....	201
Figure 13-1. JTAG Block Diagram.....	372
Figure 13-2. JTAG TAP Controller State Machine.....	373
Figure 13-3. JTAG Functional Timing.....	376
Figure 14-1. DS3184 Pin Assignments—400-Lead TE-PBGA.....	377
Figure 14-2. DS3183 Pin Assignments—400-Lead TE-PBGA.....	378
Figure 14-3. DS3182 Pin Assignments—400-Lead TE-PBGA.....	378
Figure 14-4. DS3181 Pin Assignments—400-Lead TE-PBGA.....	379
Figure 18-1. Clock Period and Duty Cycle Definitions.....	384
Figure 18-2. Rise Time, Fall Time, and Jitter Definitions.....	384
Figure 18-3. Hold, Setup, and Delay Definitions (Rising Clock Edge).....	384
Figure 18-4. Hold, Setup, and Delay Definitions (Falling Clock Edge).....	385
Figure 18-5. To/From High-Z Delay Definitions (Rising Clock Edge).....	385
Figure 18-6. To/From High-Z Delay Definitions (Falling Clock Edge).....	385
Figure 18-7. Micro Interface Nonmultiplexed Read/Write Cycle.....	391
Figure 18-8. Micro Interface Multiplexed Read Cycle.....	392
Figure 18-9. E3 Waveform Template.....	395
Figure 18-10. STS-1 Pulse Mask Template.....	396
Figure 18-11. DS3 Pulse Mask Template.....	397

LIST OF TABLES

Table 4-1. Standards Compliance	23
Table 6-1. DS3/E3 ATM/Packet Mode Configuration Registers.....	26
Table 6-2. DS3/E3 ATM/Packet—OHM Mode Configuration Registers.....	27
Table 6-3. DS3/E3 Internal Fractional (IFRAC) ATM/Packet Mode Configuration Registers	28
Table 6-4. DS3/E3 External Fractional (XFRAC) ATM/Packet Mode Configuration Registers.....	29
Table 6-5. DS3/E3 Flexible External Fractional (Subrate) Mode Configuration Registers.....	30
Table 6-6. DS3/E3 G.751 PLCP ATM Mode Configuration Registers	31
Table 6-7. DS3/E3 G.751 PLCP ATM—OHM Mode Configuration Registers	32
Table 6-8. Clear-Channel ATM/Packet Mode Configuration Modes	34
Table 6-9. Clear-Channel ATM/Packet—OHM Mode Configuration Registers.....	35
Table 6-10. Clear-Channel Octet Aligned ATM/Packet—OHM Mode Configuration Registers.....	36
Table 7-1. HDB3/B3ZS/AMI LIU Mode Configuration Registers	37
Table 7-2. HDB3/B3ZS/AMI Non-LIU Mode Configuration Registers	39
Table 7-3. UNI Line Interface Mode Configuration Registers.....	40
Table 7-4. UNI Line Interface—OHM Mode Configuration Registers.....	41
Table 8-1. DS3184 Short Pin Descriptions.....	42
Table 8-2. Detailed Pin Descriptions	48
Table 9-1. Configuration of Global Register Settings	93
Table 9-2. Configuration of Port Register Settings	93
Table 10-1. LIU Enable Table.....	100
Table 10-2. All Possible Clock Sources Based on Mode and Loopback.....	100
Table 10-3. Source Selection of TLCLK Clock Signal.....	101
Table 10-4. Source Selection of TCLKOn (internal TX clock).....	102
Table 10-5. Source Selection of RCLKO Clock Signal (internal RX clock).....	102
Table 10-6. Transmit Line Interface Signal Pin Valid Timing Source Select.....	103
Table 10-7. Transmit Framer Pin Signal Timing Source Select	104
Table 10-8. Receive Line Interface Pin Signal Timing Source Select.....	104
Table 10-9. Receive Framer Pin Signal Timing Source Select	105
Table 10-10. Reset and Power-Down Sources	108
Table 10-11. CLAD IO Pin Decode.....	111
Table 10-12. Global 8 kHz Reference Source Table.....	112
Table 10-13. Port 8 kHz Reference Source Table.....	112
Table 10-14. GPIO Global Signals	113
Table 10-15. GPIO Pin Global Mode Select Bits.....	113
Table 10-16. GPIO Port Alarm Monitor Select	114
Table 10-17. Loopback Mode Selections	116
Table 10-18. Line AIS Enable Modes.....	120
Table 10-19. Payload (Downstream) AIS Enable Modes	121
Table 10-20. TSOFIn/TOHMIn Input Pin Functions	122
Table 10-21. TSERn/TPOHn/TFOHn Input Pin Functions	122
Table 10-22. TPDENIn/TPOHENn/TFOHENIn Input Pin Functions	123
Table 10-23. TSOFOn/TDENn/TPOHSOFn/TFOHENOn Output Pin Functions	123
Table 10-24. TCLKOn/TGCLKn/TPOHCLKn Output Pin Functions.....	124
Table 10-25. TPDATn Input Pin Functions.....	124
Table 10-26. TPDENOn Output Pin Functions.....	124
Table 10-27. RSERn/RPOHn Output Pin Functions	125
Table 10-28. RPDENIn/RFOHENIn Input Pin Functions.....	125
Table 10-29. RPDATn Input Pin Functions	125
Table 10-30. RSOFOOn/RDENn/RPOHSOFn/RFOHENOn Output Pin Functions.....	126
Table 10-31. RCLKOn/RGCLKn/RPOHCLKn Output Pin Functions	126
Table 10-32. Framing Mode Select Bits FM[5:0].....	127
Table 10-33. Line Mode Select Bits LM[2:0].....	133
Table 10-34. C-Bit DS3 Frame Overhead Bit Definitions	169
Table 10-35. M23 DS3 Frame Overhead Bit Definitions	171
Table 10-36. G.832 E3 Frame Overhead Bit Definitions	177
Table 10-37. Payload Label Match Status.....	180
Table 10-38. Pseudorandom Pattern Generation.....	194

Table 10-39. Repetitive Pattern Generation	194
Table 10-40. Transformer Characteristics	199
Table 10-41. Recommended Transformers	200
Table 11-1. Global and Test Register Address Map	203
Table 11-2. Per-Port Register Address Map	203
Table 12-1. Global Register Bit Map	204
Table 12-2. System Interface Bit Map	205
Table 12-3. Port Register Bit Map	205
Table 12-4. BERT Register Bit Map	206
Table 12-5. LINE Register Bit Map	206
Table 12-6. HDLC Register Bit Map	207
Table 12-7. FEAC Register Bit Map	208
Table 12-8. Trail Trace Register Bit Map	208
Table 12-9. T3 Register Bit Map	209
Table 12-10. E3 G.751 Register Bit Map	210
Table 12-11. E3 G.832 Register Bit Map	211
Table 12-12. Clear-Channel Register Bit Map	212
Table 12-13. Fractional Register Bit Map	212
Table 12-14. PLCP Register Bit Map	213
Table 12-15. FIFO Register Bit Map	214
Table 12-16. Transmit Cell Processor Register Bit Map	215
Table 12-17. Transmit Packet Processor Register Bit Map	216
Table 12-18. Receive Cell Processor Register Bit Map	216
Table 12-19. Receive Packet Processor Register Bit Map	217
Table 12-20. Global Register Map	219
Table 12-21. Transmit System Interface Register Map	227
Table 12-22. Receive System Interface Register Map	229
Table 12-23. Per-Port Common Register Map	231
Table 12-24. BERT Register Map	242
Table 12-25. Transmit Side B3ZS/HDB3 Line Encoder/Decoder Register Map	251
Table 12-26. Receive Side B3ZS/HDB3 Line Encoder/Decoder Register Map	252
Table 12-27. Transmit Side HDLC Register Map	256
Table 12-28. Receive Side HDLC Register Map	260
Table 12-29. FEAC Transmit Side Register Map	264
Table 12-30. FEAC Receive Side Register Map	267
Table 12-31. Transmit Side Trail Trace Register Map	270
Table 12-32. Trail Trace Receive Side Register Map	272
Table 12-33. Transmit DS3 Framer Register Map	276
Table 12-34. Receive DS3 Framer Register Map	279
Table 12-35. Transmit G.751 E3 Framer Register Map	289
Table 12-36. Receive G.751 E3 Framer Register Map	291
Table 12-37. Transmit G.832 E3 Framer Register Map	297
Table 12-38. Receive G.832 E3 Framer Register Map	300
Table 12-39. Transmit Clear-Channel Register Map	309
Table 12-40. Receive Clear-Channel Register Map	310
Table 12-41. Fractional Transmit Side Register Map	312
Table 12-42. Receive Side Register Map	314
Table 12-43. Transmit Side PLCP Register Map	316
Table 12-44. Receive Side PLCP Register Map	320
Table 12-45. Transmit FIFO Register Map	331
Table 12-46. Receive FIFO Register Map	335
Table 12-47. Transmit Cell Processor Register Map	338
Table 12-48. HEC Error Mask	341
Table 12-49. Receive Cell Processor Register Map	345
Table 12-50. Transmit Packet Processor Register Map	357
Table 12-51. Receive Packet Processor Register Map	362
Table 13-1. JTAG Instruction Codes	375
Table 13-2. JTAG ID Codes	376
Table 14-1. Pin Assignment Breakdown	377

Table 17-1. Recommended DC Operating Conditions	382
Table 17-2. DC Electrical Characteristics	382
Table 17-3. Output Pin Drive	383
Table 18-1. Fractional Port Timing	386
Table 18-2. Line Interface Timing	386
Table 18-3. Miscellaneous Pin Timing	387
Table 18-4. Overhead Port Timing	387
Table 18-5. System Interface L2 Timing	388
Table 18-6. System Interface L3 Timing	389
Table 18-7. Micro Interface Timing	390
Table 18-8. DS3 Waveform Template	393
Table 18-9. DS3 Waveform Test Parameters and Limits	393
Table 18-10. STS-1 Waveform Template	394
Table 18-11. STS-1 Waveform Test Parameters and Limits	394
Table 18-12. E3 Waveform Test Parameters and Limits	395
Table 18-13. Receiver Input Characteristics—DS3 and STS-1 Modes	397
Table 18-14. Receiver Input Characteristics—E3 Mode	398
Table 18-15. Transmitter Output Characteristics—DS3 and STS-1 Modes	398
Table 18-16. Transmitter Output Characteristics—E3 Mode	398
Table 18-17. JTAG Interface Timing	399

1 BLOCK DIAGRAMS

Figure 1-1 shows the external components required at each LIU interface for proper operation. Figure 1-2 shows the functional block diagram of one channel ATM/Packet PHY.

Figure 1-1. LIU External Connections for a DS3/E3/STS-1 Port of a DS318x Device

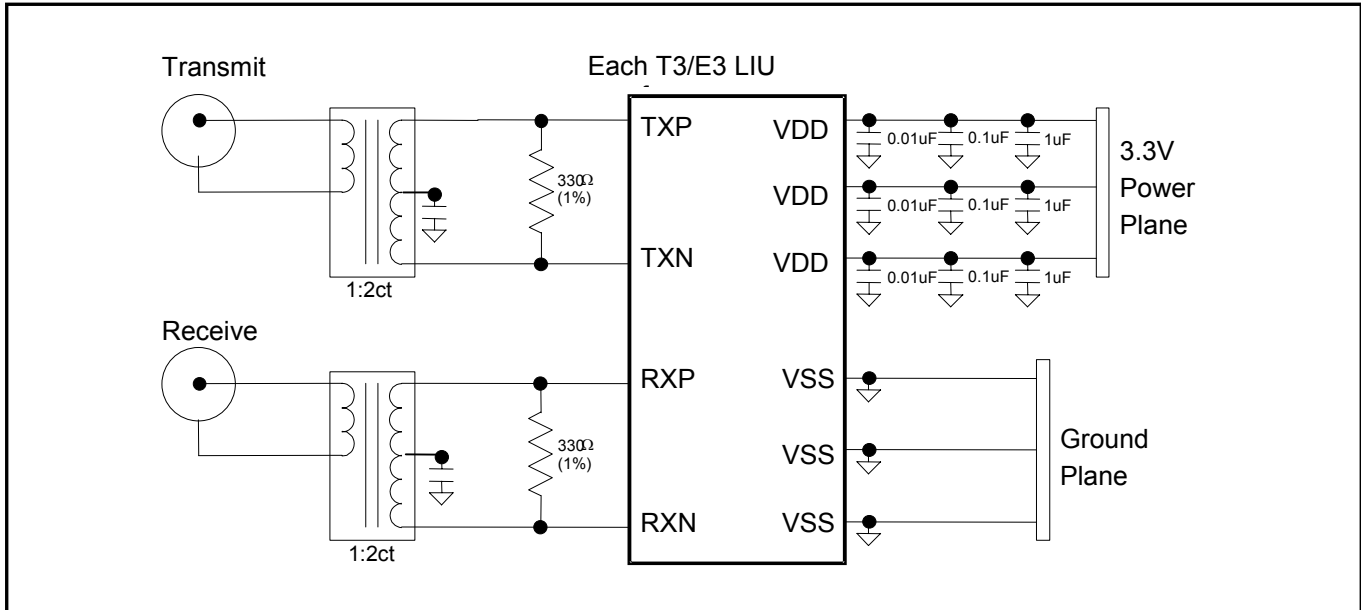
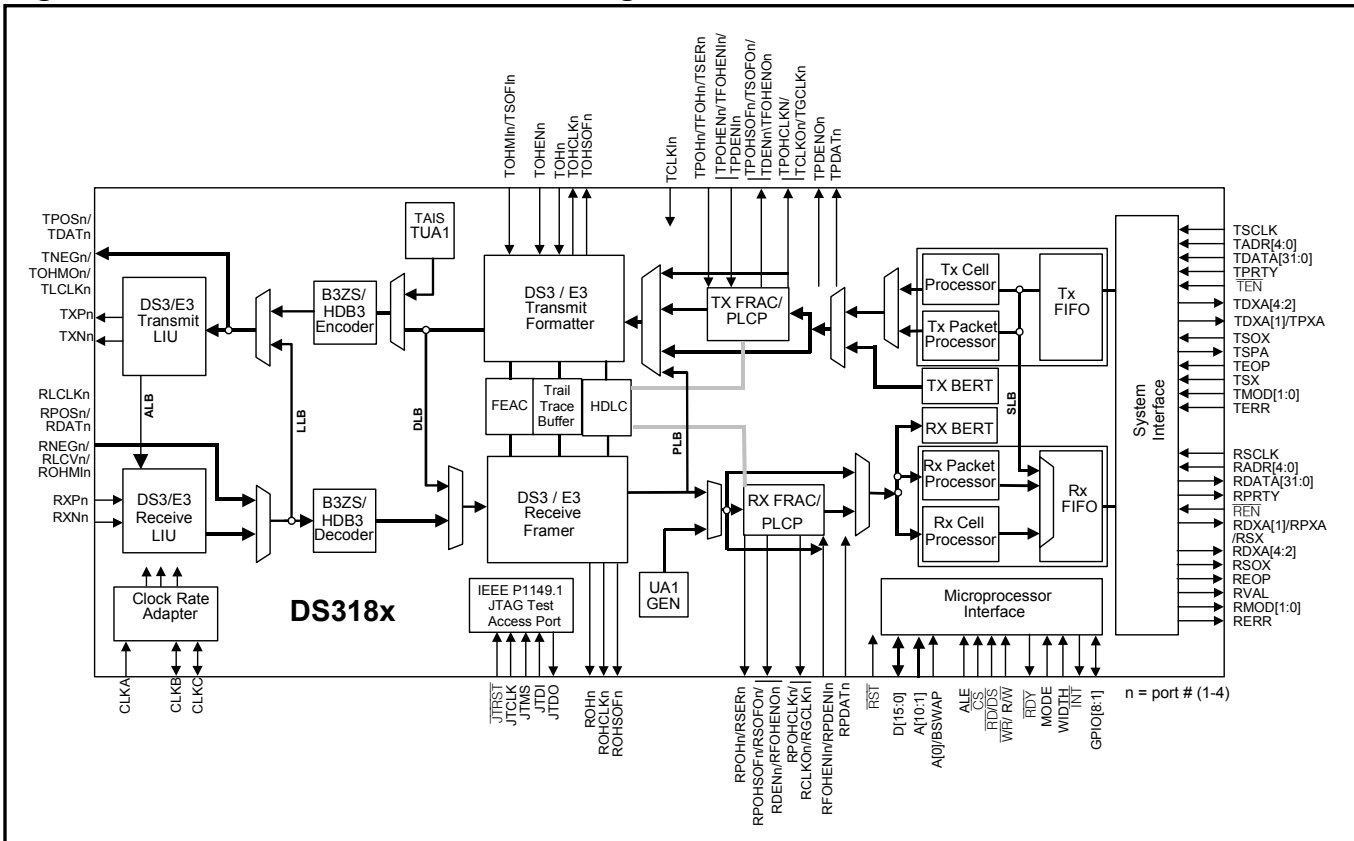


Figure 1-2. DS318x Functional Block Diagram



2 APPLICATIONS

- Access Concentrators
- Multiservice Access Platforms
- ATM and Frame Relay Equipment
- Routers and Switches
- SONET/SDH ADM
- SONET/SDH Muxes
- PBXs
- Digital Cross Connect
- PDH Multiplexer/Demultiplexer
- Test Equipment
- Integrated Access Device (IAD)

Figure 2-1 and Figure 2-2 show applications for the DS3184 as four-port unchannelized ATM and packet DS3/E3 line cards, respectively.

Figure 2-1. Four-Port Unchannelized ATM over DS3/E3/CC52 Line Card

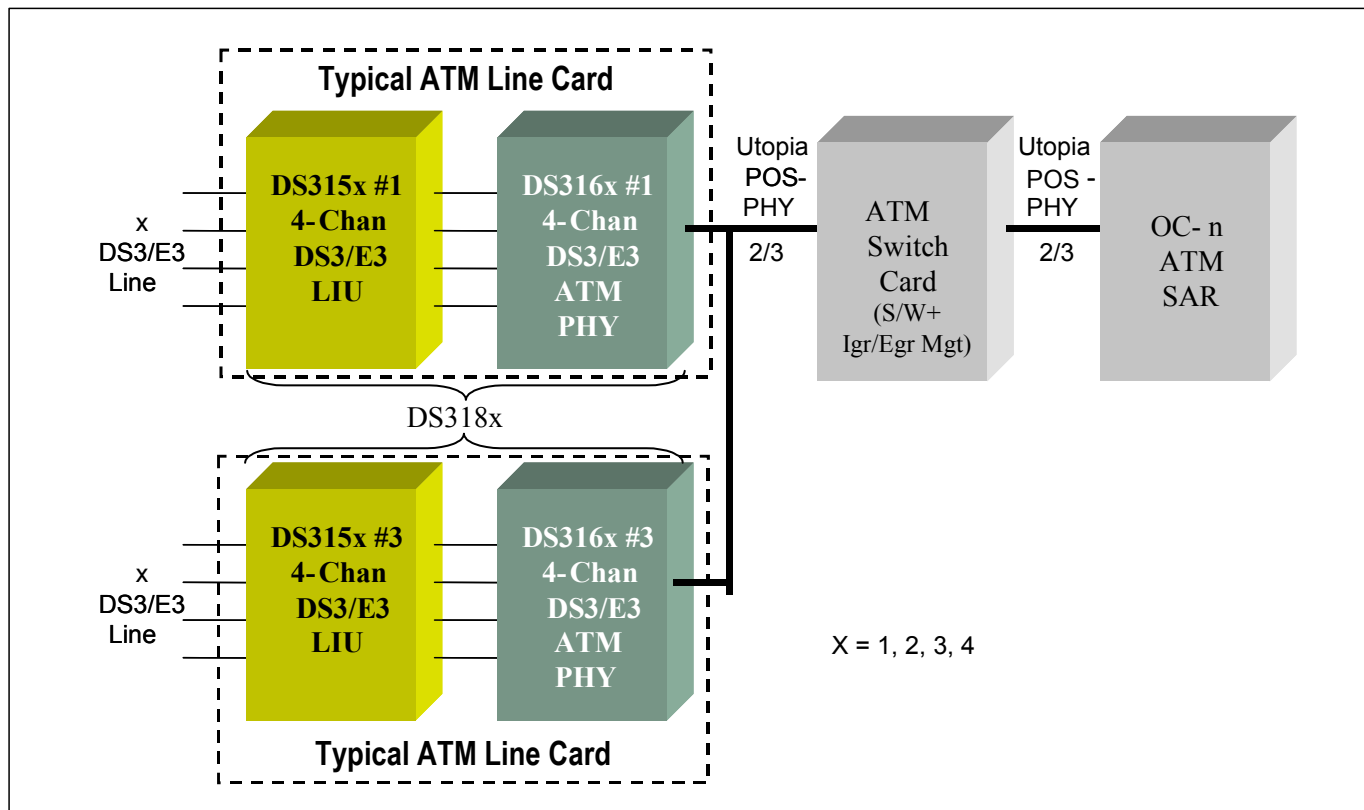
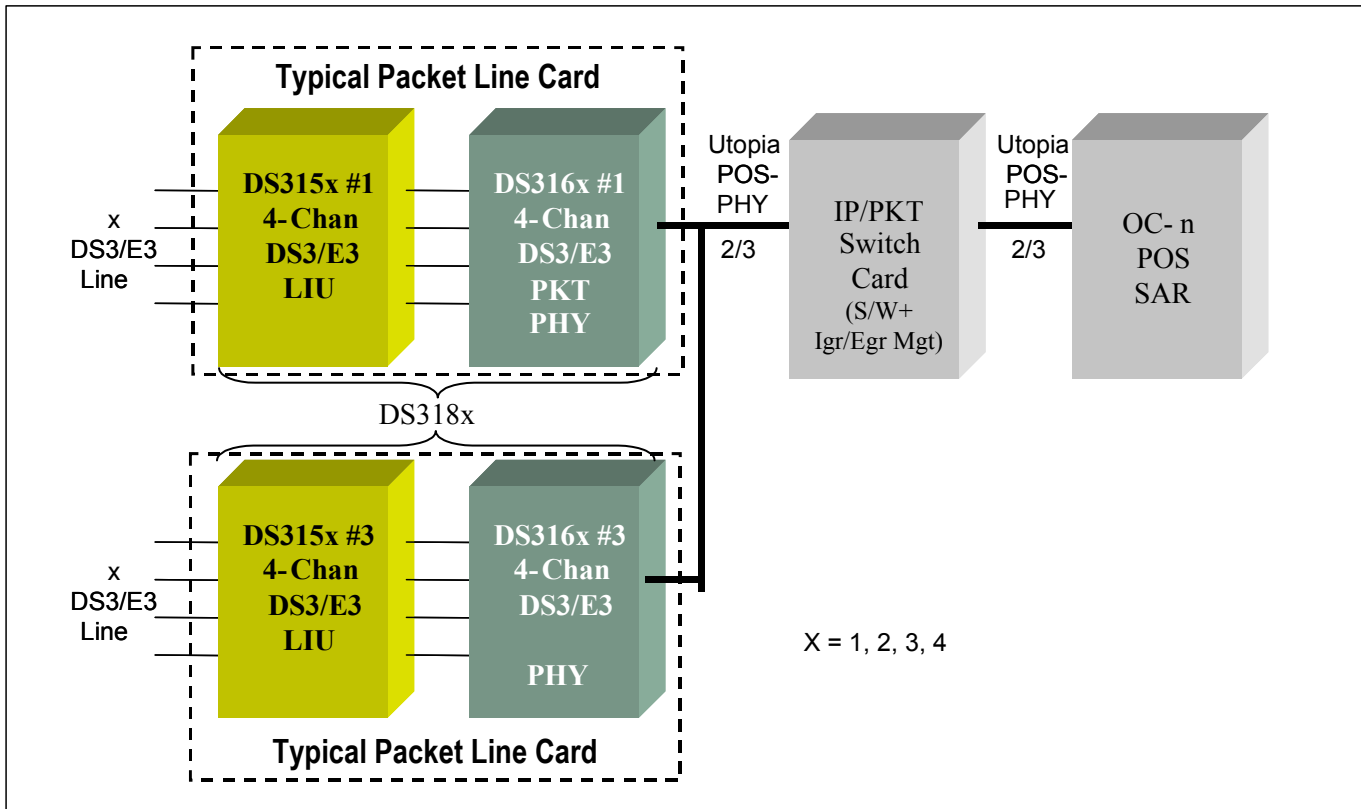


Figure 2-2. Four-Port Unchannelized HDLC over DS3/E3/CC52 Line Card



3 FEATURE DETAILS

The following sections describe the features provided by the DS3181 (single), DS3182 (dual), DS3183 (triple), and DS3184 (quad) PHYs.

3.1 Global Features

- System interface configurable for UTOPIA L2/UTOPIA L3 for ATM cell traffic or POS-PHY L2/POS-PHY L3 or SPI-3 for HDLC packets or mixed packet/cell traffic
- Supports the following transmission protocols:
 - Direct-mapped ATM over DS3 or sub-rate DS3
 - PLCP-mapped ATM over DS3
 - Direct-mapped ATM over G.751 E3 or sub-rate G.751 E3
 - PLCP-mapped ATM over G.751 E3
 - Direct-mapped ATM over G.832 E3 or sub-rate G.832 E3
 - Bit or byte synchronous (octet aligned) direct-mapped ATM over externally-defined frame formats up to 52 Mbps
 - Clear-channel ATM (cell-based physical layer) at line rates up to 52 Mbps
 - Clear-channel ATM DSS at line rates up to 52 Mbps
 - Direct-mapped HDLC over DS3 or sub-rate DS3
 - Direct-mapped HDLC over G.751 E3 or sub-rate G.751 E3
 - Direct-mapped HDLC over G.832 E3 or sub-rate G.832 E3
 - Bit or byte synchronous (octet aligned) direct-mapped HDLC over externally-defined frame formats up to 52 Mbps
 - Clear-channel HDLC at line rates up to 52 Mbps
- In UTOPIA bus mode, ports are independently configurable for any ATM protocol
- In POS-PHY bus mode, ports are independently configurable for any ATM or HDLC protocol
- Programmable to support internally or externally controlled sub-rate DS3 or E3 on any ports
- Supports gapped 52 MHz clock rates for signals embedded in SONET/SDH
- Optional transmit loop timed clock(s) mode using the associated port's receive clock(s)
- Optional transmit clock mode using references generated by the internal Clock Rate Adapter (CLAD)
- Requires only a single reference clock for all three LIU data rates using internal CLAD
- The LIU can be powered down and bypassed for direct logic IO to/from line circuits.
- Jitter attenuator can be placed in either transmit or receive path when the LIU is enabled.
- Clock, data and control signals can be inverted for a direct interface to many other devices
- Detection of loss of transmit clock and loss of receive clock
- Automatic one-second, external or manual update of performance monitoring counters
- Each port can be placed into a low-power standby mode when not being used
- Framing and line code error insertion available

3.2 Receive DS3/E3/STS-1 LIU Features

- AGC/Equalizer block handles from 0 dB to 15 dB of cable loss
- Loss-of-lock PLL status indication
- Interfaces directly to a DSX monitor signal (20 dB flat loss) using built-in pre-amp
- Digital and analog Loss of Signal (LOS) detectors (ANSI T1.231 and ITU G.775)
- Per-channel power-down control

3.3 Receive DS3/E3 Framer Features

- Frame synchronization for M23 or C-bit Parity DS3, or G.751 E3 or G.832 E3
- B3ZS/HDB3/AMI decoding
- Detection and accumulation of bipolar violations (BPV), code violations (CV), excessive zeroes occurrences (EXZ), F-bit errors, M-bit errors, FAS errors, LOF occurrences, P-bit parity errors, CP-bit parity errors, BIP-8 errors, and far end block errors (FEBE)

- Detection of RDI, AIS, DS3 idle signal, loss of signal (LOS), severely errored framing event (SEFE), change of frame alignment (COFA), receipt of B3ZS/HDB3 code words, DS3 application ID bit, DS3 M23/C-bit format mismatch, G.751 national bit, and G.832 RDI (FERF), payload type, and timing marker bits
- HDLC port for DS3 path maintenance data link (PMDL), G.751 national bit or G.832 NR or GC channels
- FEAC port for DS3 FEAC channel
- 16-byte Trail Trace Buffer port for G.832 trail access point identifier
- DS3 M23 C bits and stuff bits configurable as payload or overhead, stored in registers for software inspection
- Most framing overhead fields presented on the receive overhead port
- Support for internal and external subrate DS3/E3 control (Fractional DS3/E3)

3.4 Receive PLCP Framing Features

- PLCP frame synchronization
- C1 cycle/stuff counter interpretation
- Detection of out of frame (OOF), BIP-8 errors, FEFE and RAI (Yellow Signal)
- Frame timing can be presented on the GPIO2 output pin or used as the transmit PLCP reference
- All path overhead fields presented on the PLCP receive overhead port
- HDLC port for data link messages on F1, M1 or M2 bytes
- Trail Trace port for trace messages on F1 byte

3.5 Receive Cell Processor Features

- HEC-based cell delineation within the DS3/E3 frame, the PLCP frame, an externally defined frame, or the entire line bandwidth
- Cell descrambling using the self-synchronizing scrambler ($x^{43}+1$) for ATM over DS3/E3
- Distributed Sample Scrambler (DSS) for clear-channel ATM (cell-based physical layer)
- HEC error detection and correction; HEC discard
- Filtering of idle, unassigned and/or invalid cells (provisionable)
- Header pattern comparison vs. 32-bit header pattern and mask registers; counting of matching or non-matching cells; discard of matching or non-matching cells
- Four-cell Receive FIFO
- Controls include enables/disables/settings for: cell processing, coset polynomial addition, error correction, errored cell extraction, cell descrambling, idle/unassigned/invalid cell filtering, header pattern match counting/discarding, LCD integration time
- Status fields include: out of cell delineation (OCD), loss of cell delineation (LCD) and receipt of idle, unassigned, invalid, errored, corrected or header-pattern-match cells
- Performance monitoring counters for forwarded cells, corrected cells, uncorrectable cells, header pattern match/no-match cells, and filtered idle/unassigned/invalid cells
- Octet alignment option for externally defined frame formats

3.6 Receive Packet Processor Features

- Packet descrambling using the self-synchronizing scrambler ($x^{43}+1$)
- Flag detection, packet delineation, and inter-frame fill discard (flags and all-ones)
- Packet abort detection and accumulation
- Bit or octet destuffing
- FCS checking (16-bit or 32-bit), error accumulation, and FCS discard
- Packet size checking vs. programmable minimum and maximum size registers
- Abort declaration for packets with non-integral number of bytes
- Controls include enables/disables/settings for: packet processing, descrambling, 16/32-bit FCS, filtering of FCS errored packets, FCS discard, minimum/maximum packet size
- Status fields include: receipt of FCS errored packet, aborted packet, size violation packet, non-integer-length packets
- Performance monitoring counters for forwarded packets, forwarded bytes, aborted bytes, FCS errored packets, aborted packets, size violation packets (min, max, non-integer-length)
- Octet alignment with octet destuffing option for externally defined frame formats

3.7 Receive FIFO Features

- Storage capacity for four cells or 256 bytes of packet data per port
- Programmable port address
- Programmable fill level thresholds
- Underflow and overflow status indications

3.8 Receive System Interface Features

- UTOPIA L2 / UTOPIA L3 interface in cell mode, POS-PHY L2 / POS-PHY L3 or SPI-3 interface in packet or mixed traffic modes
- 8, 16, or 32-bit data bus at clock rates from 10 MHz to 66 MHz (52 MHz in L2 modes)
- Polled and direct cell available outputs
- Controls include enables/disables/settings for: HEC transfer, signal inversions, parity enable/polarity, cell available deassertion time

3.9 Transmit System Interface Features

- UTOPIA L2 / UTOPIA L3 interface in cell mode, POS-PHY L2 / POS-PHY L3 or SPI-3 interface in packet or mixed traffic modes
- 8, 16, or 32-bit data bus at clock rates from 10 MHz to 66 MHz (52 MHz in L2 modes)
- Polled and direct cell available outputs
- Controls include enables/disables/settings for: HEC transfer, signal inversions, parity enable/polarity, cell available deassertion time

3.10 Transmit FIFO Features

- Storage capacity for four cells or 256 bytes of packet data per port
- Programmable port address
- Programmable fill level thresholds
- Underflow and overflow status indications

3.11 Transmit Cell Processor Features

- Programmable fill cell type
- HEC calculation and insertion/overwrite, including coset addition
- Cell scrambling using the self-synchronizing scrambler ($x^{43}+1$) for ATM over DS3/E3
- Distributed Sample Scrambler (DSS) for clear-channel ATM (cell-based physical layer)
- Single-bit and multiple-bit header error insertion for diagnostics
- Controls include enables/disables/settings for: cell processing, HEC insertion, coset polynomial addition, cell scrambling, fill cell type, error insertion type/rate/count, HEC bit corruption
- Counter for number of cells read from the transmit FIFO
- Cell mapping into the DS3/E3 frame, the PLCP frame, an externally defined frame, or the entire line bandwidth
- Octet alignment option for externally defined frame formats

3.12 Transmit Packet Processor Features

- FCS calculation (16-bit or 32-bit) and insertion/overwrite
- Programmable FCS error insertion for diagnostics
- Bit or octet stuffing
- Programmable inter-frame fill insertion (flags or all-ones)
- Automatic packet abort insertion
- Packet scrambling using the self-synchronizing scrambler ($x^{43}+1$)
- Controls include enables/disables/settings for: packet processing, FCS insertion or overwrite, 16/32-bit FCS, inter-frame fill type/length, scrambling, FCS error insertion type/rate/count
- Counters for number of packets and bytes read from the transmit FIFO
- Octet alignment with octet stuffing option for externally defined frame formats

3.13 Transmit PLCP Formatter Features

- Insertion of FAS bytes (A1, A2), path overhead identification (POI) bytes, and path overhead bytes
- Generation of BIP-8 (B1), FEBE and RAI (G1)
- C1 cycle/stuff counter generation referenced to GPIO4 input pin, referenced to the received PLCP timing, or based on an 8 kHz division of one of the clock sources
- Automatic or manual insertion of FAS errors, BIP-8 errors
- All path overhead fields can be sourced from the PLCP transmit overhead port
- HDLC port for data link messages on F1, M1 or M2 bytes
- Trail Trace port for trace messages on F1 byte

3.14 Transmit DS3/E3 Formatter Features

- Insertion of framing overhead for M23 or C-bit parity DS3, or G.751 E3 or G.832 E3
- B3ZS/HDB3 encoding
- Generation of RDI, AIS, and DS3 idle signal
- Automatic or manual insertion of bipolar violations (BPVs), excessive zeroes (EXZ) occurrences, F-bit errors, M-bit errors, FAS errors, P-bit parity errors, CP-bit parity errors, BIP-8 errors, and far end block errors (FEBE)
- HDLC port for DS3 path maintenance data link (PMDL), G.751 national bit or G.832 NR or GC channels
- FEAC port for DS3 FEAC channel can be configured to send one codeword, one codeword continuously, or two different code words back-to-back to send DS3 Line Loopback commands
- 16-byte Trail Trace Buffer port for the G.832 trail access point identifier
- Insertion of G.832 payload type, and timing marker bits from registers
- DS3 M23 C bits configurable as payload or overhead; as overhead they can be controlled from registers or the transmit overhead port
- Most framing overhead fields can be sourced from transmit overhead port
- Formatter bypass mode for clear-channel or externally defined format applications
- Support for subrate DS3/E3, internally or externally controlled (Fractional DS3/E3)

3.15 Transmit DS3/E3/STS-1 LIU Features

- Wide 50+20% transmit clock duty cycle
- Line Build-Out (LBO) control
- Tri-state line driver outputs support protection switching applications
- Per-channel power-down control
- Output driver monitor status indication

3.16 Jitter Attenuator Features

- Fully integrated and requiring no external components
- Can be placed in transmit or receive path
- FIFO depth of 16 bits
- Standard compliant transmission jitter and wander

3.17 Clock Rate Adapter Features

- Generation of the internally needed DS3 (44.736 MHz), E3 (34.368 MHz), and STS-1 (51.84 MHz) clocks a from single input reference clock
- Input reference clock can be 51.84 MHz, 44.736MHz or 34.368 MHz
- Internally derived clocks can be used as references for LIU and jitter attenuator
- Derived clocks can be transmitted off-chip for external system use
- Standards compliant jitter and wander requirements.

3.18 HDLC Overhead Controller Features

- Each port has a dedicated HDLC controller for DS3/E3 framer or PLCP link management
- 256-byte receive and transmit FIFOs
- Handles all of the normal Layer 2 tasks including zero stuffing/destuffing, FCS generation/checking, abort generation/checking, flag generation/detection, and byte alignment
- Programmable high and low water marks for the transmit and receive FIFOs

- Terminates the Path Maintenance Data Link in DS3 C-bit Parity mode and optionally the G.751 Sn bit or the G.832 NR or GC channels or PLCP F1, M1 or M2 bytes
- RX data is forced to all ones during LOS, LOF and AIS detection to eliminate false packets

3.19 FEAC Controller Features

- Each port has a dedicated FEAC controller for DS3/E3 link management
- Designed to handle multiple FEAC code words without Host intervention
- Receive FEAC automatically validates incoming code words and stores them in a 4-byte FIFO
- Transmit FEAC can be configured to send one codeword, one codeword continuously, or two different code words back-to-back to send DS3 Line Loopback commands
- Terminates the FEAC channel in DS3 C-Bit Parity mode and optionally the Sn bit in E3 mode

3.20 Trail Trace Buffer Features

- Each port has a dedicated Trail Trace Buffer for E3-G.832 or DS3/E3 PLCP link management
- Extraction and storage of the incoming G.832 or PLCP trail access point identifier in a 16-byte receive register
- Insertion of the outgoing trail access point identifier from a 16-byte transmit register
- Receive trace identifier unstable status indication

3.21 Bit Error Rate Tester (BERT) Features

- Each port has a dedicated BERT tester
- Generation and detection of pseudo-random patterns and repetitive patterns from 1 to 32 bits in length
- Pattern insertion/extraction in PLCP payload, DS3/E3 payload, DS3/E3 fractional payload or entire data stream to and from the line interface
- Large 24-bit error counter allows testing to proceed for long periods without host intervention
- Errors can be inserted in the generated BERT patterns for diagnostic purposes (single bit errors or specific bit-error rates)

3.22 Loopback Features

- Analog interface loopback – ALB (transmit to receive)
- Line facility loopback – LLB (receive to transmit) with optional transmission of unframed all-one AIS payload toward system/trunk interface
- Framer diagnostic loopback – DLB (transmit to receive) with automatic transmission of DS3 AIS or unframed all-one AIS signal toward line/tributary interface(s)
- DS3/E3 framer payload loopback – PLB (receive to transmit) with optional transmission of unframed all-one AIS payload toward system/trunk interface
- System interface loopback – SLB (transmit to receive)
- Simultaneous line facility loopback and framer diagnostic loopback

3.23 Microprocessor Interface Features

- Multiplexed or non-multiplexed address bus modes
- 8 or 16-bit data bus modes
- Byte swapping option in 16-bit data bus mode
- Read/Write and Data Strobe modes
- Ready handshake output signal
- Global reset input pin
- Global interrupt output pin
- Two programmable I/O pins per port

3.24 Subrate Features (Fractional DS3/E3)

- Independent per-port built-in support for subrate DS3 or E3
- Independent subrate operation for both RX and TX data paths
- Subrate operation for each channel is totally independent from the other channels' operation, i.e. all subrate functions within the device are mutually exclusive
- Three distinct subrate algorithms:

- (FFRAC) Externally controlled with DS3 or E3 payload manipulating capability
- (XFRAC) Externally controlled with flexible DS3 or E3 data rate reduction capability
- (IFRAC) Internally controlled with simple DS3 or E3 data rate reduction capability
- Subrate algorithm selection is on per-port basis
- Internal subrate mechanism allows down to bit-level granularity of the DS3 or E3 payload

3.25 Test Features

- Five pin JTAG port
- All functional pins are in/out pins in JTAG mode
- Standard JTAG instructions: SAMPLE/PRELOAD, BYPASS, EXTEST, CLAMP, HIGHZ, IDCODE
- RAM BIST on all internal RAM
- High-Z pin to force all digital output and in/out pins into HIZ
- TEST pin for manufacturing scan test modes

4 STANDARDS COMPLIANCE

Table 4-1. Standards Compliance

SPECIFICATION	SPECIFICATION TITLE
ANSI	
T1.102-1993	<i>Digital Hierarchy – Electrical Interfaces</i>
T1.107-1995	<i>Digital Hierarchy – Formats Specification</i>
T1.231-1997	<i>Digital Hierarchy – Layer 1 In-Service Digital Transmission Performance Monitoring</i>
T1.404-1994	<i>Network-to-Customer Installation – DS3 Metallic Interface Specification</i>
T1.646-1995	<i>Broadband ISDN – Physical Layer Specification for User-Network Interfaces Including DS1/ATM</i>
ATM FORUM	
af-phy-0034.000	<i>E3 Public UNI, August, 1995</i>
af-phy-0039.000	<i>UTOPIA Level 2, Version 1.0, June, 1995</i>
af-phy-0043.000	<i>A Cell-Based Transmission Convergence Sublayer for Clear-Channel Interfaces, November, 1995</i>
af-phy-0054.000	<i>DS3 Physical Layer Interface Specification, January, 1996</i>
af-phy-0136.000	<i>UTOPIA L3 Physical Layer Interface, November, 1999</i>
af-phy-0143.000	<i>Frame-based ATM Interface (Level 3), March, 2000</i>
af-bici-0013.003	<i>BISDN Inter Carrier Interface (B-ICI) Specification Version 2.0 (Integrated), December, 1995</i>
ETSI	
ETS 300 686	<i>Business TeleCommunications; 34Mbps and 140Mbps/s digital leased lines (D34U, D34S, D140U and D140S); Network interface presentation, 1996</i>
ETS 300 337	<i>Transmission and Multiplexing (TM); Generic frame structures for the transport of various signals (including Asynchronous Transfer Mode (ATM) cells and Synchronous Digital Hierarchy (SDH) elements) at the ITU-T Recommendation G.702 hierarchical rates of 2 048 kbit/s, 34 368 kbit/s and 139 264 kbit/s, Second Edition, June, 1997</i>
ETS EN 300 689	<i>Access and Terminals (AT); 34Mbps Digital Leased Lines (D34U and D34S); Terminal equipment interface, July 2001</i>
ETS 300 689	<i>Business TeleCommunications (BTC); 34 Mbps digital leased lines (D34U and D34S), Terminal equipment interface, V 1.2.1, 2001-07</i>
IETF	
RFC 1661	<i>The Point-to-Point Protocol (PPP), July, 1994</i>
RFC 1662	<i>PPP in HDLC-like Framing, July, 1994</i>
RFC 2496	<i>Definition of Managed Objects for the DS3/E3 Interface Type, January, 1999</i>
ISO	
ISO 3309:1993	<i>Information Technology – Telecommunications & information exchange between systems – High Level Data Link Control (HDLC) procedures – Frame structure, Fifth Edition, 1993</i>
ITU-T	
G.703	<i>Physical/Electrical Characteristics of Hierarchical Digital Interfaces, 1991</i>
G.704	<i>Synchronous Frame Structures Used at 1544, 6312, 2048, 8488 and 44 736 kbit/s Hierarchical Levels, July, 1995</i>
G.751	<i>Digital Multiplex Equipment Operating at the Third Order Bit Rate of 34,368 kbit/s and the Fourth Order bit Rate of 139,264 kbit/s and Using Positive Justification, 1993</i>
G.775	<i>Loss Of Signal (LOS) and Alarm Indication Signal (AIS) Defect Detection and Clearance Criteria, November, 1994</i>
G.804	<i>ATM Cell Mapping Into Plesiochronous Digital Hierarchy (PDH), November, 1993</i>
G.823	<i>The Control of Jitter and Wander Within Digital Networks Which are Based on the 2048 kbit/s Hierarchy, 1993</i>
G.824	<i>The Control of Jitter and Wander within Digital Networks that are Based on the 1544kbps</i>

SPECIFICATION	SPECIFICATION TITLE
	<i>Hierarchy, 1993</i>
G.832	<i>Transport of SDH Elements on PDH Networks – Frame and Multiplexing Structures, November, 1995</i>
I.432	<i>B-ISDN User-Network Interface – Physical Layer Specification, March, 1993</i>
O.151	<i>Error Performance Measuring Equipment Operating at the Primary Rate and Above, October, 1992</i>
Q.921	<i>ISDN User-Network Interface – Data Link Layer Specification, March 1993</i>
OIF	
OIF-SPI3-01.0	<i>System Packet Interface Level 3 (SPI-3): OC-48 System Interface for Physical and Link Layer Devices</i>
SATURN® GROUP	
POS-PHY L2	<i>POS-PHY Level 2 Packet Over SONET Interface Specification for Physical Layer Devices, December, 1998</i>
POS-PHY L3	<i>POS-PHY Level 3 Packet Over SONET Interface Specification for Physical and Link Layer Devices, June, 2000</i>
TELCORDIA	
GR-253-CORE	<i>SONET Transport Systems: Common Generic Criteria, Issue 2, December 1995</i>
GR-499-CORE	<i>Transport Systems Generic Requirements (TSGR): Common Requirements, Issue 2, December 1998</i>
GR-820-CORE	<i>Generic Digital Transmission Surveillance, Issue 1, November 1994</i>
IEEE	
IEEE Std 1149-1990	<i>IEEE Standard Test Access Port and Boundary-Scan Architecture, (Includes IEEE Std 1149-1993) October 21, 1993</i>

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5 ACRONYMS AND GLOSSARY

Definition of the terms used in this data sheet:

Acronyms

- ATM – Asynchronous Transfer Mode
- CC52 – Clear-Channel 52 Mbps (STS-1 Clock Rate)
- CLAD – Clock Rate Adapter
- CLR – Clear-Channel Mode
- DSS – Distributed Sample Scrambler
- FFRAC – Flexible Fractional Mode
- FRM – Frame Mode
- HDLC – High Level Data Link Control
- IFRAC – Internal Fractional Mode
- OHM – Overhead Mask mode (LIU disabled) for externally defined framing
- PLCP – Physical Layer Convergence Protocol
- SPI-3 – same as POS-PHY L3
- XFRAC – External Fractional Mode

Glossary

- Cell – ATM cell
- Clear-Channel – A datastream with no framing included
- Fractional – Uses only a portion of available payload for data, also known as subrate
- Octet Aligned – Byte aligned
- Packet – HDLC packet
- Subrate – See Fractional
- Unchannelized – See Clear-Channel