

Digital Wrapper with Forward Error Correction for 10Gbps Optical Transport Network

NLC0375APB

NTT Electronics Corporation

NLC0375APB < Features >



Compliant with ITU-T G.709 Recommendation

FEC algorithm: Reed-Solomon code RS8 (255,239), Coding gain: 6db

Supports Justification Control (JC) and Fixed Stuff (FS) insertion for STM-64/OC-192 signal

Bit rate

OTU-side: 10.71 Gbps/10.66 Gbps

Client-side: 9.95 Gbps/9.99 Gbps

Simultaneous processing of Encoding/Decoding is possible

Upgrading to 40 Gbps system

By combining four LSIs together, upgrading to 40 Gbps system is possible

Other features

Overhead insertion/extraction

Scrambling/Descrambling

BIP-8 insertion/checking

Alarm detection/sending

Internal loop connection

Host CPU interface: 8-bits address/data separated bus

I/O interface

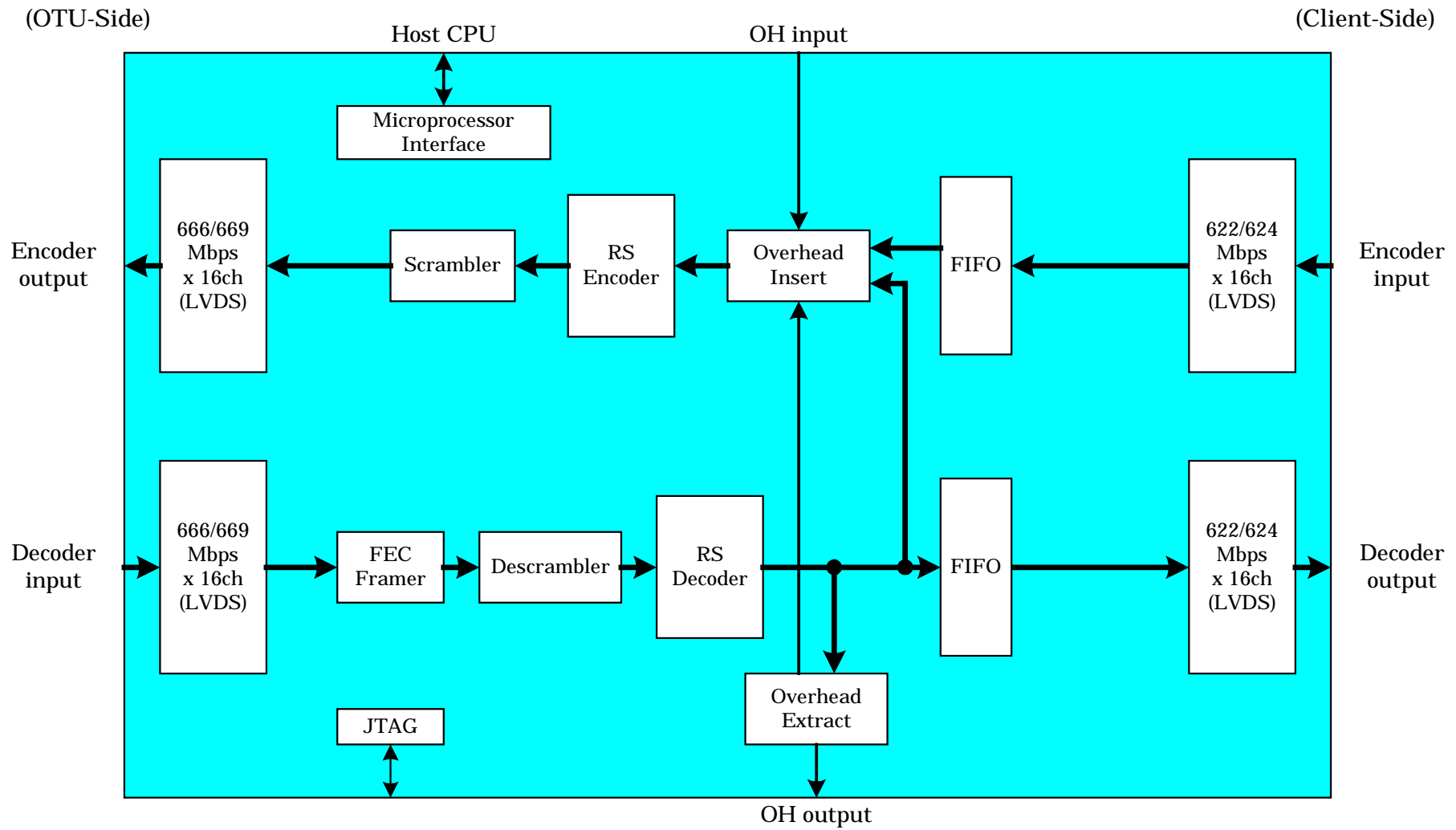
Main signal: LVDS, Others: LVTTL

600-pin BGA Package

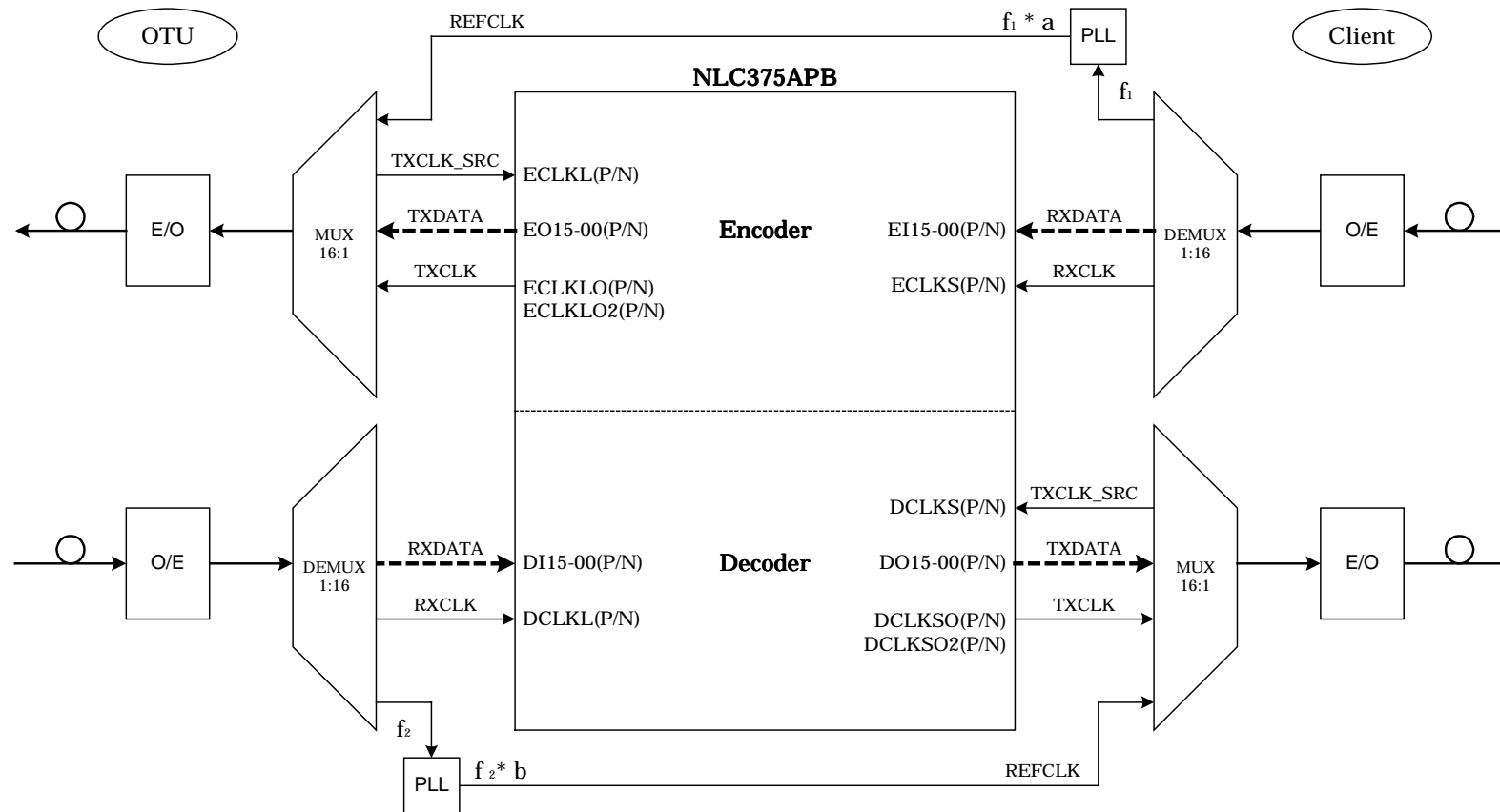
Boundary scan test circuit (JTAG) compatible with IEEE1149.1 standard is built-in

Power supply: 1.8 V (for Core circuits) and 2.5V/3.3 V (for I/O circuits)

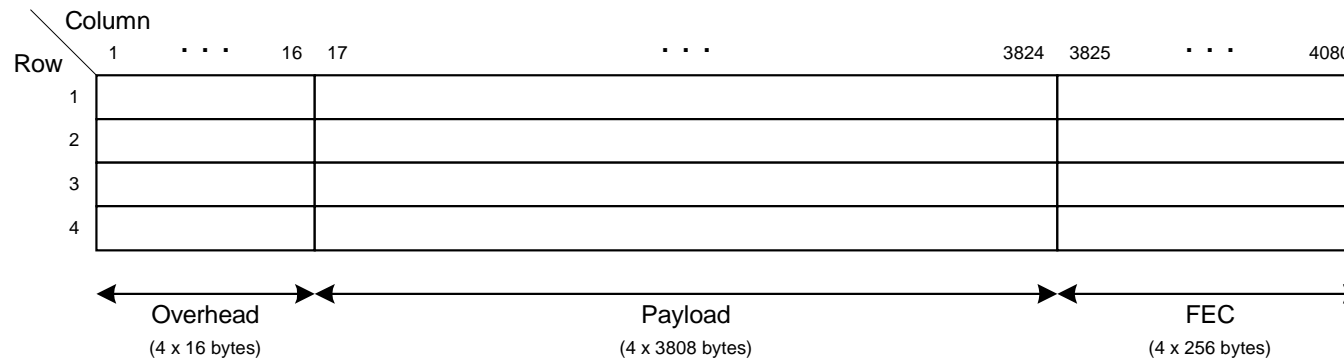
NLC0375APB < Block Diagram >



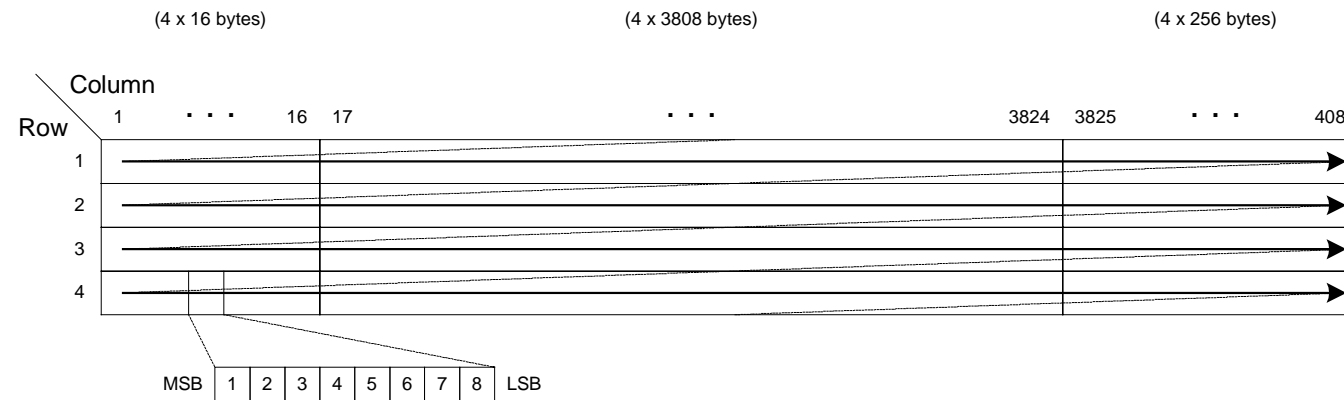
NLC0375APB < Clock System >



OTU		Client			PLL	
bitrate	clock in	signal	bitrate	clock in	a	b
10.71Gbps	669.33MHz	STM-64 OC-192	9.95Gbps	622.08MHz	85/79	79/85
		other	9.99Gbps	624.70MHz	15/14	14/15
10.66Gbps	666.52MHz	-	9.95Gbps	622.08MHz	15/14	14/15



Frame Structure (ITU-T G.709)



Order of frame data transmission (ITU-T G.709)

Coding gain: 6db

RS encoding/decoding can be made ON/OFF

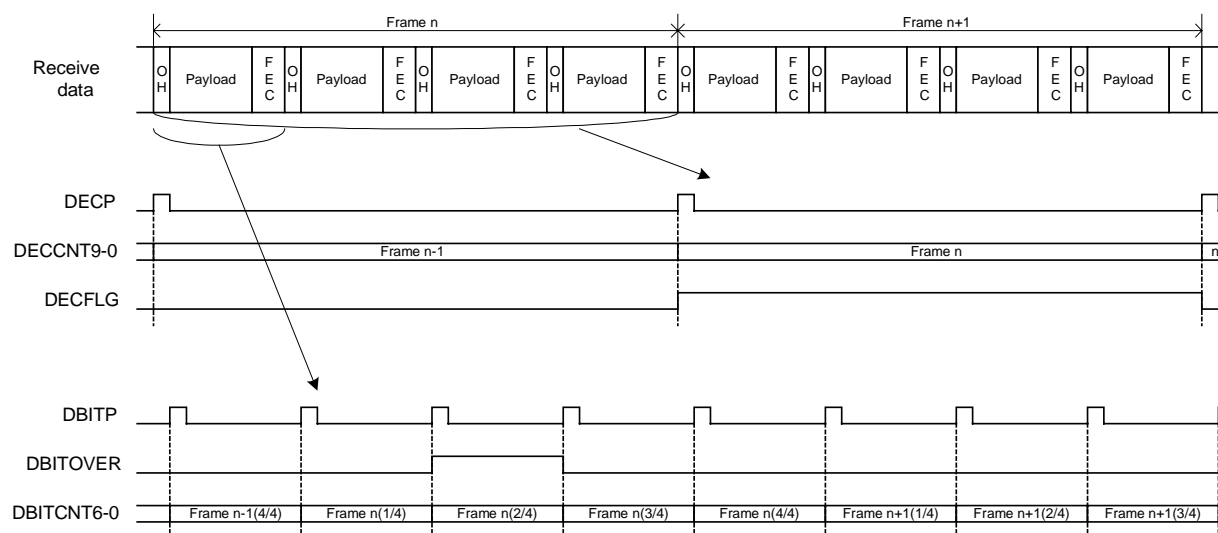
If it is impossible to correct the receive data, then error correction is not executed

Error correction information output

Number of error corrected symbols is output from external pin (DECCNT9-0)

Number of error bits is output from external pin (DBITCNT6-0)

If it is impossible to correct the receive data, then the incorrigible flag is output from external pin (DECFLG)



Error correction information output from external pin

NLC0375APB < OH Structure >



		Column															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Row	1	FAS						MFAS	SM			GCC0		RES		Mapping specific	
							TTI	BIP8	BI								
	2	RES			TCM ACT	TCM6			TCM5			TCM4			FTFL		
					TTI	BIP8	BI	TTI	BIP8	BI	TTI	BIP8	BI				
	3	TCM3			TCM2			TCM1			PM			EXP			
		TTI	BIP8	BI	TTI	BIP8	BI	TTI	BIP8	BI	TTI	BIP8	BI				
	4	GCC1		GCC2		APS/PCC				RES						PSI	

		BI							
SM	1	2	3	4	5	6	7	8	
	BEI				BDI	IAE	RES		

FAS: Frame Alignment Signal
 MFAS: Multi Frame Alignment Signal
 SM: Section Monitoring
 GCC0-2: General Communication Channel 0-2
 RES: Reserved

		BI							
PM TCM1-6	1	2	3	4	5	6	7	8	
	BEI				BDI	STAT			

PM: Path Monitoring
 TCM: Tandem Connection Monitoring
 ACT: Activation/deactivation control channel
 FTFL: Fault Type and Fault Location reporting communication channel
 EXP: Experimental
 APS: Automatic Protection Switching coordination channel
 PCC: Protection Communication Control channel

TTI: Trail Trace Identifier
 BIP8: Bit Interleaved Parity - level 8
 BI: Backward Indications
 BEI: Backward Error Indication
 BDI: Backward Defect Indication
 IAE: Incoming Alignment Error
 STAT: Status

PSI: Payload Structure Identifier

Contents of OH (ITU-T G.709)

OH insertion

The objects of insertion are all fields of OH

OH insertion method:

- (1) Generated in LSI
- (2) Port setting (Setting from Host CPU I/F)
- (3) From the external pin (Inputs from OH/IF)
- (4) Do not insert

Switching of insertion data is possible by byte-unit
(in case of FAS, by field-unit)

BIP-8 operation

Computation of BIP-8 for transmission frame

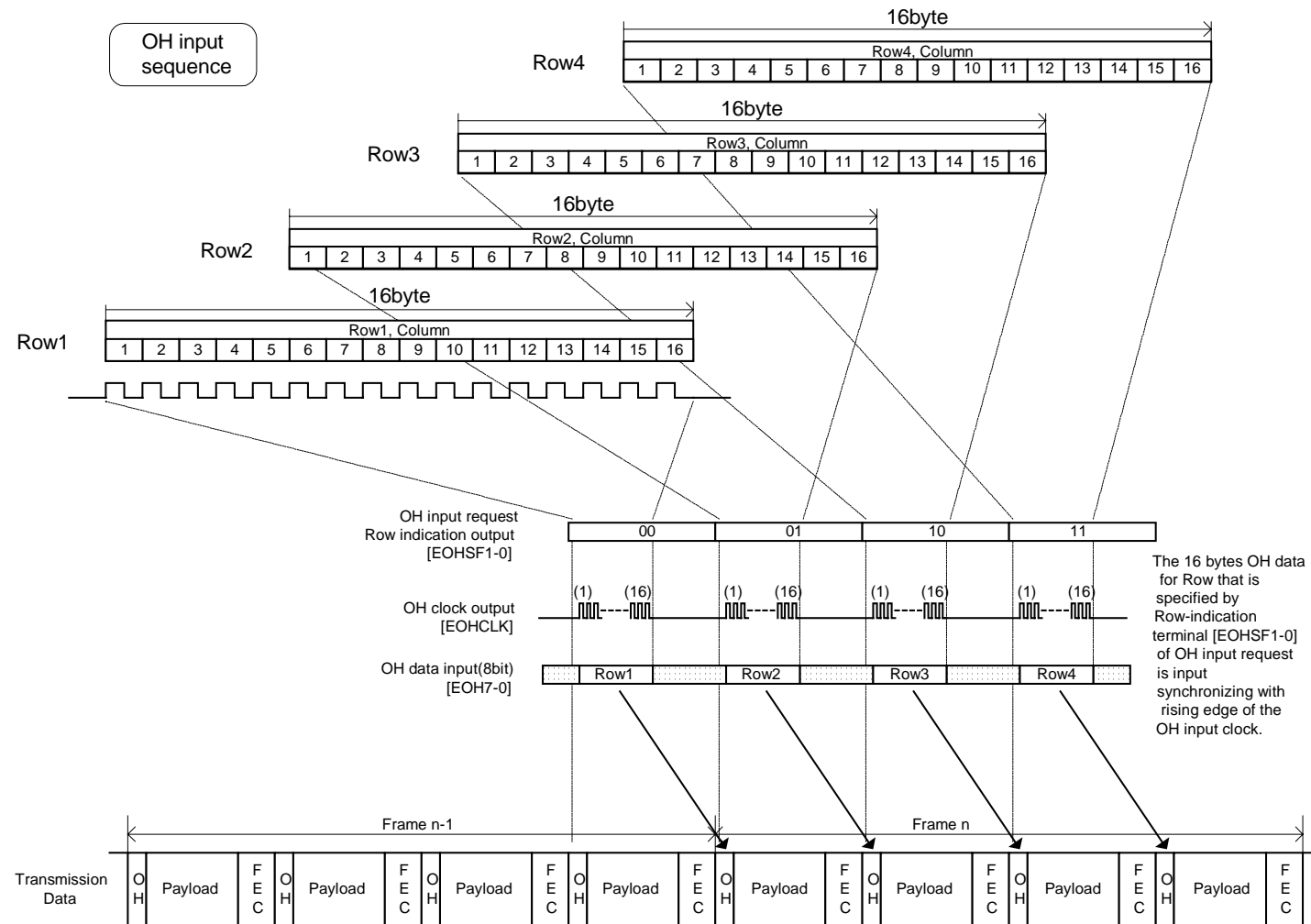
Result of BIP-8 computation:

- Inserting OH (SM BIP-8 and PM BIP-8 field only)
- Outputs from external pin

Alarm sending

Sending ODU-AIS, ODU-OCI and ODU-LCK signal

NLC0375APB < OH inputs from external pin (OH-I/F) >



OH extraction

OH extract all the data except for FAS field

OH extraction outputs:

Outputs from external pin (Outputs from OH-I/F)

Port indication (Reading from Host CPU I/F)

BIP-8 operation

Computation of BIP-8 on receive frame

Checking of BIP-8 errors (Comparing SM BIP-8 and PM BIP8 field)

Accumulates the number of BIP-8 errors in every one seconds

Outputs BIP-8 computation result from external pin (Outputs from OH-I/F)

APS/PCC detection

Updating detection of APS/PCC (with protection)

Receive protection value: Port indication (Reading from Host CPU I/F)

Alarm detection

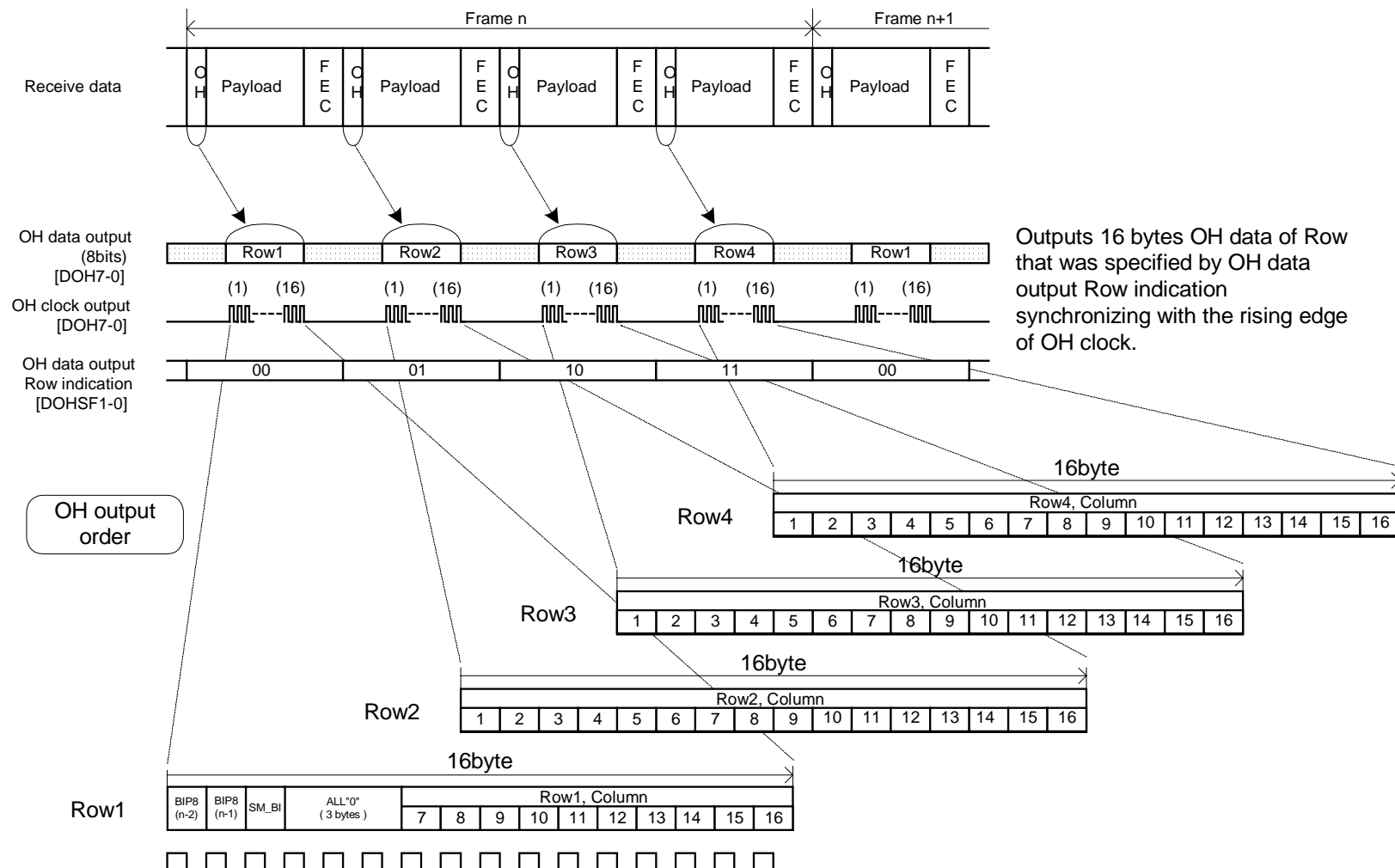
Detection of ODU-AIS, ODU-OCI and ODU-LCK (with protection)

Others

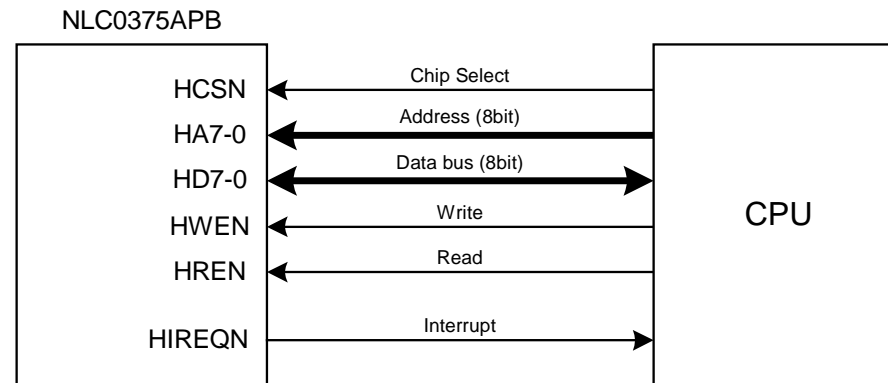
Accumulates the number of SM/PM BEI in every one seconds

Detection of SM/PM BDI and SM IAE (with protection)

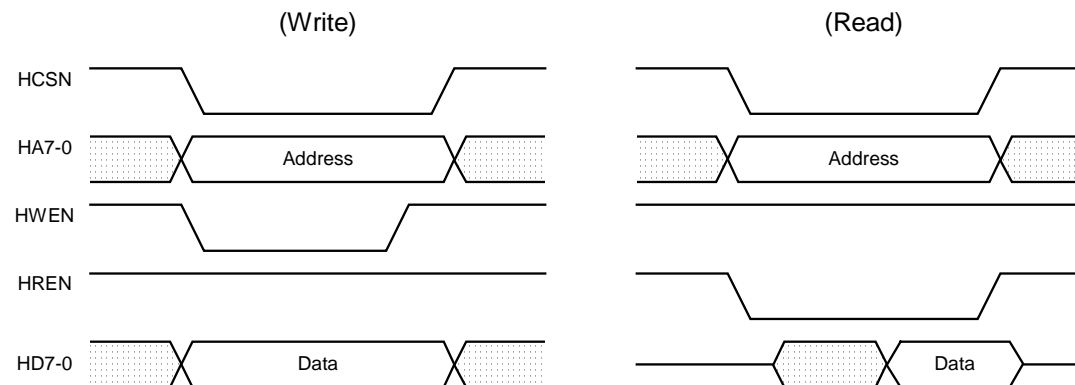
NLC0375APB < OH outputs from external pin (OH-I/F) >



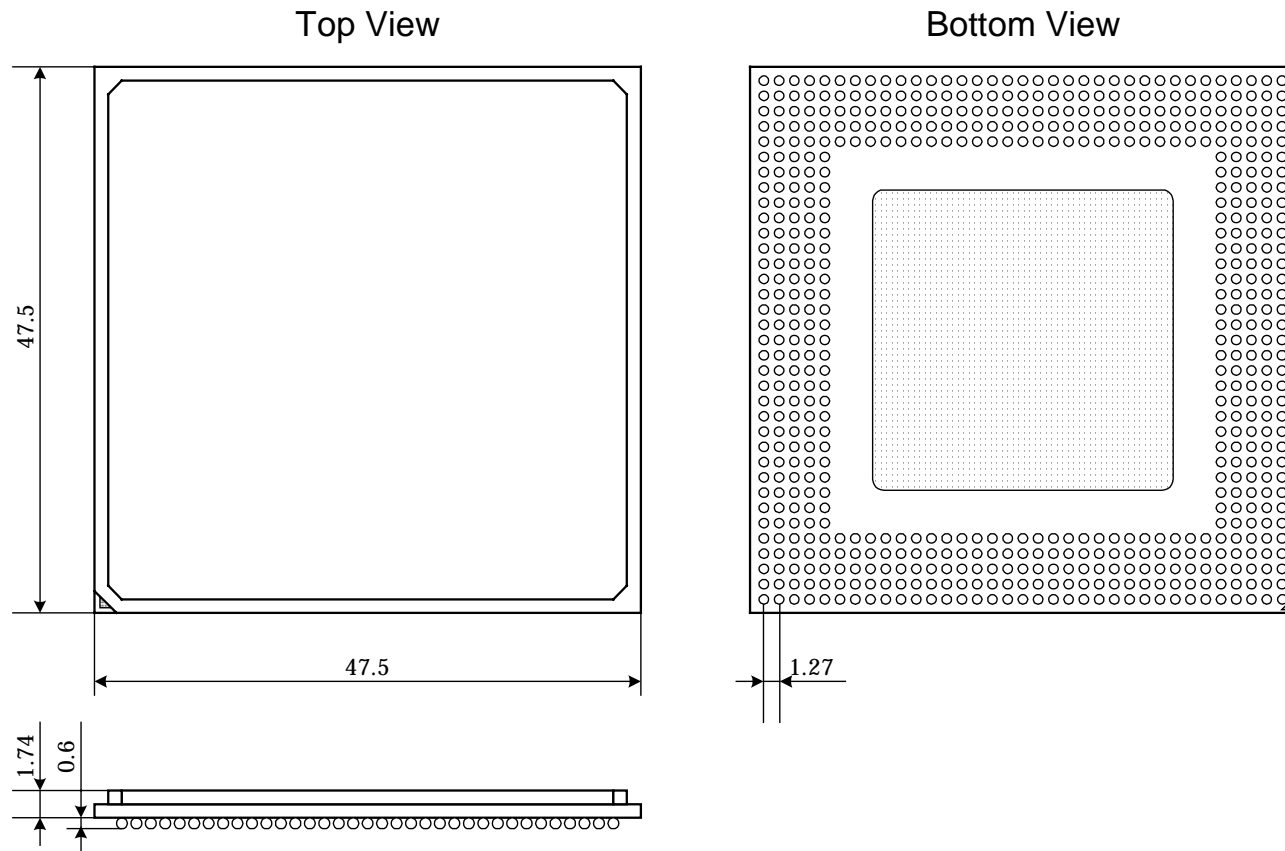
NLC0375APB < Host CPU Interface >



Example of connecting to Host CPU



Read/Write access timing in Host CPU interface

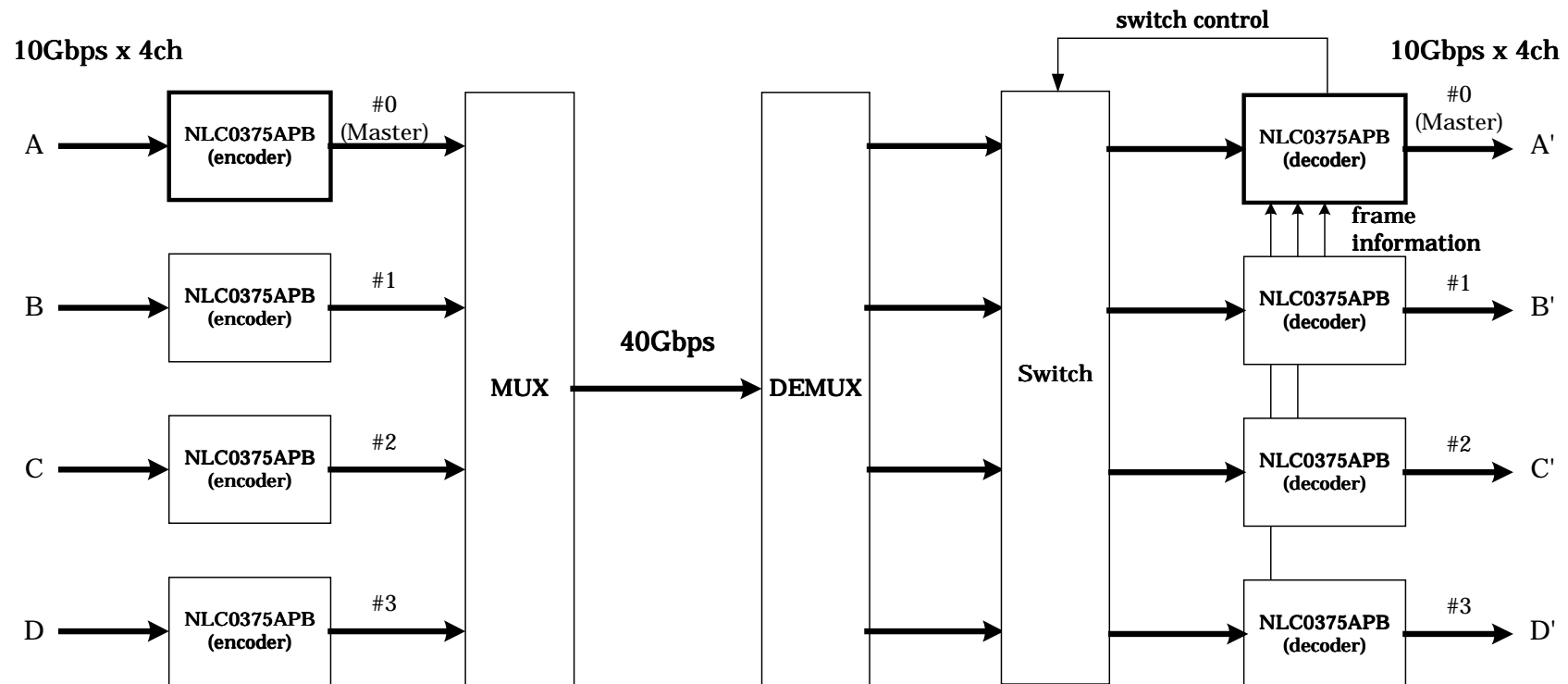


600-pin BGA Package

NLC0375APB < 40Gbps System >



Provide a function in order to assure right data transmission between A-A',.....D-D'



40Gbps System Configuration

NLC0375APB < System Structure Example >

