APPS041-Codensity T408™ and T432 ™ SMBus Application Note

V2.0

2021-12-08

Table of Contents

1 Table of Abbreviations

Abbreviation:	**Full Form:**
SMBus	System Management Bus
AI	Artificial Intelligence
API	Application Programming Interface
AUD	Access Unit Delimiters
AV	Audio Video
AV1	Alliance Open Media Video 1 Codec
CABAC	Context Adaptive Binary Arithmetic Coding
CBR	Constant Bit Rate
CPU	Central Processing Unit
CRF	Constant Rate Factor
DSP	Digital Signal Processing
EOF	End Of File
FIXQB	Fixed Quantization Parameter
FF	Form Factor
FPS	Frames Per Second
GOP	Group of pictures
HDR	High Dynamic Range
HHHL	Half Height, Half Length
HHFL	Half Height, Full Length
HLG	Hybrid Log Gamma
HRD	Hypothetical Reference Decoder
IE	Inference Engine
Mbps	Mega Bit per second
MBps	Mega Byte per second
NLP	Natural Language Processing
NPU	Neural Processing Unit
NVMe	Non-Volatile Memory express
PCIe	Peripheral Component Interconnect express
PPS	Picture Parameter Set
QP	Quoted Printable
RGB	Red Green Blue
RGBA	Red Green Blue Alpha
RDO	Optimization
ROI	Region of interest
SDK	Software Development Kit

SEI	Supplemental Enhancement Information
SRIOV	Single Root I/O Virtualization
SPS	Sequence Parameter Set
VBR	Variable Bit Rat
VCL	Video Coding Layer
VPS	Video Parameter Set
VUI	Video Usability Information

2 References

Technical Notes:
-NVMe Simple Management Interface V1.0 – NVM Express.

Specifications:

-System Management Bus (SMBus) Specification V2.0 - SBS Implementers Forum

-NVM Express - Base Specification V1.3 – NVM Express.

3 Background

This document describes how to use SMBus interface of NETINT T408 transcoder. It describes NETINT implementation for "NVMe Simple Management Interface".

3.1 Intended Audience

This document is intended to help engineers/technicians/developers integrating NETINT transcoders to SMBus applications.

3.2 Compatibility

Software Compatibility

This guide is intended to be used with NETINT Codensity T408 Video Transcoder software Release 2.5.0 or newer.

Hardware Compatibility

Release 2.5.0 supports NETINT Codensity T408 Video Transcoder hardware.

Operation system

N/A.

4 SMBus

4.1 Message Format Definitions

The table below describe the SMBus message parts, then we have the write and read frames as used by NETINT.

Symbol	Size (bits)	Description
S	1	Start bit
P	1	Stop bit
Rd/Wr	1	Read/Write bit. Rd equals 0, Wr equals 1 (Since NETINT T4XX series do not support WR, this value shall be set to 0 at all time for CRC32 validation purposes)
A/NA	1	Accept and reverse accept bit
Addr	7	7-bit address. NETINT address is 0x46 for T408, and 0x46-49 for T432
Register	8	Initial Register to read selection
Data	8	A plain data byte
Count	8	A data byte containing the length of a block operation

Data direction

From Host to Device	From Device to Host

Write Frame Format

S	Addr	Wr	A	Register	A	P

Read Frame Format

S	Addr	Rd	A	Count/Data	A	Data	A	Data	NA	P

4.2 Reading data

All the communication is started by the host (SMBus Master). Host will send a write command to set the initial register it wants to read, then send a read command to get as many bytes as it wants. The device (SMBus Slave) will start sending the data from the register set by the host and auto increment for each new byte read, if the host reads more than the frame size, the device will respond with “0”. The Host can start reading any register.

The device address is different for different NETINT product**,** see attached table below for the device addresses and some examples of messages exchange.

Device Address

Device	Device Address
T408	0x46
T432 – Core A	0x46
T432 – Core B	0x47
T432 – Core C	0x48
T432 – Core D	0x49

Example 1 - Reading variable length from Register 0:

Write

S	0x46	0b	A	00u	A	P

Read

S	0x46	1b	A	Byte 0 (06u)	A	Byte 1	A	Byte 2	A	…	Byte n	NA	P

Example 2 - Reading from Register 32 (vendor specific data) to the end:

Write

S	0x46	0b	A	32u	A	P

Read

S	0x46	1b	A	Byte 32 (30u)	A	Byte 33	A	Byte 34	A	…	Byte 63 (PEC)	NA	P

4.3 Frame Validation

The frame has multiples CRC-8 calculations to validate it, they are identified in the frame as PEC1, PEC2, PEC3. Each PEC refers to a part of the frame, this way the host can read and validate just the part that it needs.

The frame uses CRC-8 with the polynomial “X8+X2+X1+1” to validate data, the calculation includes the host write and read commands. See the in the example below which data is used on the PEC calculation - notice that address 0x46 is shifted left (0x46 << 1) and includes R/W bit (0x8D/0x8C), however, since NETINT T4XX series do not support SMBus write command, the R/W bit will not take any effect and shall always be set to 0 even for a read command and thus 0x8C.

Ex. PEC calculation array starting on 0 and reading first part of the frame (8 bytes including PEC):

Address and commands	Data Read (7 bytes)	PEC (1 byte)
0x8C 0x00 0x8C	0xXX 0xXX 0xXX 0xXX 0xXX 0x00 0x00	PEC1

The PEC bytes are on fixed positions on the frame. That means if the reading stops before the next PEC position is reached, there will be data that cannot be validated:

Ex. Read 8 bytes but starting on position 1:

Address and commands	Data Read (6 bytes)	PEC (1 byte)	Data Read 2 (1 byte)
0x8C 0x01 0x8C	0xXX 0xXX 0xXX 0xXX 0x00 0x00	PEC1	0xXX

Notice that “Data Read 2” is not used on the PEC calculation.

4.4 Registers Description

Register	**Name**	**Description**
		Status Data
00	Length Status	Length of Status Data, except this byte and PEC. Fixed in 6
01.7	SFLGS.Arbitration	SMBus Arbitration – Arbitration is not supported
01.6	SFLGS.Power	Set to 1 when NVME CC is enabled, 0 otherwise
01.5	SFLGS.Functional	Set to 0 when NVME CC is enabled, 1 otherwise
01.4	SFLGS.ResetNotRequired	Set to 0 if a fatal error happened and the board need to be reset.
01.3	SFLGS.PCIeActive	Set to 0 when the PCIe link is not active

01.2-01.0	SFLGS.Reserved	All 1s
02	SMART Warnings	Refer to Critical Warning field (byte 0) of the NVMe SMART / Health Information log.
03	Composite Temp	Composite Temperature – see format below.
04	PLDU	Percentage Drive Life Used - Not used (0)
06:05	Reserved	All 0s
07	PEC1	CRC-8 calculation for Status Data
Identification Data		
08	Length ID	Length of ID, except this byte and last byte (PEC) fixed in 22
10:09	Vendor ID	PCI SIG Vendor ID (0x1D82)
30:11	Serial Number	ASCII Serial Number
31	PEC2	CRC-8 calculation for ID Data
Vendor Specific Data		
32	Length Vendor	Length of vendor specific frame except this byte and last byte (PEC) fixed in 30
33	Link Speed	Negotiated link speed of the device per lane. 1 = 2.5 GT/s 2 = 5 GT/s 3 = 8 GT/s 4 = 16 GT/s
34	Link width	Set at the end of link training to the actual link width negotiated between the two sides. Value is undefined before link training.
42:35	Model Number	ASCII Model Number
44:43	Decoder Instances	Decoder - Number of Active instances
46:45	Encoder Instances	Encoder - Number of Active instances

48:47	Decoder VPU Load	Decoder VPU Load
50:49	Encoder VPU Load	Encoder VPU Load
52:51	Decoder Errors	Decoder - Number of errors
54:53	Encoder Errors	Encoder – Number of errors
62:55	FW Revision	ASCII Firmware Version
63	PEC3	CRC-8 calculation for Vendor Specific Data

Table below describes the composite temperature format (Register 3)

Value	Description
00h-7Eh	Temperature is measured in degrees Celsius (0°C to 126°C)
7fh	127°C or higher
80h	No temperature data, or temperature data is more than 5 seconds old
81h	Temperature sensor failure
82h-C3h	Reserved
C4h	Temperature is -60°C or lower
C5h-FFh	Temperature measured in degrees Celsius is represented in twos complement (-1°C to -59°C)

Figure 1 Temperature format

5 Revision History

Version	Change	Create Date	Author
1.0	Document Created	Jul 26,2020	Magnus Lucchese
1.1	Add FW Revision field	Jul 23,2020	Magnus Lucchese
1.2	Fix “Ex. Read 8 bytes but starting on position 1:”	August 19, 2020	Magnus Lucchese
1.3	Add T432 Addressing	September 12, 2021	Savio Lam
2.0	Updated as per new app note template	December 8, 2021	Balwinder Sidhu

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