



Intel[®] Visual Compute Accelerator 2 (Intel[®] VCA 2)

Product Specification and Hardware Guide

A reference document for server OEMs providing an overview of product features, integration requirements, and validation guidelines.

Rev 1.7

December 2018

<Blank page>

Document Revision History

Date	Revision	Changes
December 2018	1.7	Update figures and Supported memory table
July 2018	1.6	Edited for clarity and Added transcoding benchmark back
December 2017	1.5	Added notes on memory speed; removed transcoding benchmarks.
December 2017	1.4	Updated supported non-ECC memory.
November 2017	1.3	Added section and appendix on validation.
November 2017	1.2	Updated supported memory to include non-ECC memory.
October 2017	1.1	Edited for clarity. Removed sections on validation and operating systems.
July 2017	1.0	Initial release.

Disclaimers

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software, or service activation. Learn more at Intel.com, or from the OEM or retailer.

You may not use or facilitate the use of this document in connection with any infringement or other legal analysis concerning Intel products described herein. You agree to grant Intel a non-exclusive, royalty-free license to any patent claim thereafter drafted which includes subject matter disclosed herein.

No license (express or implied, by estoppel or otherwise) to any intellectual property rights is granted by this document.

The products described may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Intel disclaims all express and implied warranties, including without limitation, the implied warranties of merchantability, fitness for a particular purpose, and non-infringement, as well as any warranty arising from course of performance, course of dealing, or usage in trade.

Copies of documents which have an order number and are referenced in this document may be obtained by calling 1-800-548-4725 or by visiting www.intel.com/design/literature.htm.

Intel, the Intel logo, Xeon, and Intel Xeon Phi are trademarks of Intel Corporation or its subsidiaries in the U.S. and/or other countries.

*Other names and brands may be claimed as the property of others.

Copyright © 2018 Intel Corporation. All rights reserved.

Table of Contents

1. Introduction	7
1.1 Document Outline	7
2. Product Overview	8
2.1 Order Information	8
2.2 Feature Set	8
2.3 Host System Required BIOS Features	9
2.4 Host System Minimum Memory Requirements	9
2.5 Architecture Block Diagram	10
3. Board Specifications and Support Requirements	11
3.1 Mechanical Specification	11
3.2 Card Assembly	12
3.3 Thermal and Airflow Specification	13
3.4 Power Specification	14
3.4.1 12 V AUX Power Connector Specification and Pinout	14
4. Host Server Validation Guidelines	16
4.1 Validating Hardware Compatibility	16
4.2 Host Server BIOS Guidelines	16
4.3 Host Server PCIe* Reset Guidelines	16
4.4 Quick Validation Guide for OEMs	16
4.4.1 PCIe* Device Discovery and Enumeration	16
4.4.2 Node Availability	18
4.4.3 Ethernet Over PCIe* Network Performance	19
4.4.4 Transcoding Benchmark for Simultaneous AVC-AVC Transcodes	20
4.4.5 Temperature Profile	20
5. Memory Support	22
5.1 Memory Population Rules	22
5.2 Supported Memory	22
5.3 Memory Compatibility List	23
6. Operating System Support	24
6.1 Supported Hypervisors	24
6.2 Guest Operating System	24
Appendix A. Full PCIe* Dump	25
Appendix B. Glossary	45
Appendix C. Additional Collateral	46

List of Figures

Figure 1. Product architectural block diagram	10
Figure 2. Intel® VCA 2 dimensions.....	11
Figure 3. Intel® VCA 2 detachable components	12
Figure 4. Standard airflow pattern.....	13
Figure 5. Non-standard airflow pattern.....	13
Figure 6. Intel® VCA 2 card power connectors.....	14
Figure 7. 2x3 pin 12 V AUX power connector pin diagram	14
Figure 8. 2x4 pin 12 V AUX power connector pin diagram	15
Figure 9. PCIe* device discovery	17
Figure 10. Node PCIe* link health.....	17
Figure 11. PLX PCIe* link health	18
Figure 12. CPU status after host reset.....	19
Figure 13. CPU status after booting operating system	19
Figure 14. Temperature profile while transcoding	21
Figure 15. Intel® VCA 2 card DIMM slots.....	22

List of Tables

Table 1. Order information	8
Table 2. Board feature set	8
Table 3. Processor feature set.....	8
Table 4. Requirements for standard airflow pattern.....	13
Table 5. Requirements for non-standard airflow pattern.....	13
Table 6. 2x3 pin 12 V AUX power connector pinout.....	15
Table 7. 2x4 pin 12 V AUX power connector pinout.....	15
Table 8. Bidirectional bandwidth measurement results.....	19
Table 9. Transcoding benchmark results.....	20
Table 10. Supported memory types	22
Table 11. ECC memory compatibility list.....	23
Table 12. Non-ECC memory compatibility list	23

1. Introduction

This document provides a high-level overview of the product features, functions, and support requirements of the Intel® Visual Compute Accelerator 2 (Intel® VCA 2) (VCA1585LMV).

1.1 Document Outline

This document is divided into the following chapters:

- Chapter 1 – Introduction
- Chapter 2 – Product Overview
- Chapter 3 – Board Specifications and Support Requirements
- Chapter 4 – Host Server Validation Guidelines
- Chapter 5 – Memory Support
- Chapter 6 – Operating System Support


2. Product Overview

The Intel® Visual Compute Accelerator 2 (Intel® VCA 2) equips Intel® Xeon® Scalable processor and Intel® Xeon® processor E5-based platforms with Iris® Pro Graphics and Intel® Quick Sync Video media transcode capabilities. Comprised of three Intel Xeon processors E3 1585L v5, this PCIe* add-in card delivers outstanding total cost of ownership and is supported by a rich ecosystem of server OEMs, ISVs, and solutions. Applications include:

- Broadcast – Ultra-high channel density with high visual quality.
- Remotely rendered graphics – High video quality, low latency graphics for enterprise productivity and anytime anywhere gaming.
- Multi-party communication – Video-enabled B2B, B2C, and C2C communication with massive scaling

2.1 Order Information

Table 1. Order information

Product Image	Details	Description
	<p>Intel® Visual Compute Accelerator 2 (Intel® VCA 2) VCA1585LMV</p> <p>iPC VCA1585LMV MM# 954907 UPC 7 35858 33453 2 EAN 5 0320370 99127 MOQ 1</p> <p>Product type PCIe* Add-in Card</p>	<p>Includes:</p> <p>(1) – PCIe* add-in-card with (3) Intel® Xeon® processor E3-1500 v5 product family (6) DIMM slots – (2) DIMMs/CPU</p>

2.2 Feature Set

Table 2. Board feature set

Feature	Description
Form factor	Full-length, full-height, double-width PCIe* card
CPU	(3) Intel® Xeon® processor E3-1585L v5
Max TDP	235 W
Memory	DDR4 ECC SODIMMs, 2 channels per CPU, up to 64 GB per CPU, up to 192 GB per card
PCIe* configuration	Gen3, x16, 8 lanes per CPU
BIOS	(1) 16 MB SPI flash per CPU
Operating system support on card	CentOS* 7.4 , Windows Server* 2016, Windows* 10, Ubuntu, Debian, KVM or KVMGT support if using hypervisor
Operating system support on Host	CentOS* 7.4, Ubuntu OS 16.04, Debian OS 8.7

Table 3. Processor feature set

Feature	Description
Processor Type	Intel® Xeon® processor E3-1585L v5
Cache	8 MB
Instruction set	64-bit
Instruction set extensions	SSE4.1/4.2 AVX 2.0

Feature	Description
# of cores	4
# of threads	8
Processor base frequency	3.0 GHz
Max turbo frequency	3.7 GHz
TDP	45 W
Max memory size (dependent on memory type)	64 GB
Max # of memory channels	2
ECC memory supported	Yes
Processor graphics	Iris® Pro graphics P580
Graphics base frequency	350 MHz
Graphics max dynamic frequency	1.0 GHz (capped in BIOS)
Graphics video max memory	32 GB
Execution units	72
Intel® Quick Sync Video	Yes

2.3 Host System Required BIOS Features

The host system BIOS must be configured to enable large memory-mapped input/output (MMIO), and allow for large per-device base address register (BAR) allocations. BAR must have 64-bit address enabled.

The minimum requirements for BAR and MMIO are:

- MMIO mapping above 4 GB is enabled
- Minimum MMIO size is 4 GB/CPU (node)

For example, on Intel® Server Board S2600WT based systems, this can be enabled in BIOS setup by configuring the following two options on the PCI Configuration screen.

- Set **Memory Mapped Above 4 GB** to **Enabled**
- Set **Memory Mapped IO size** to **256 GB**

2.4 Host System Minimum Memory Requirements

The host system must have sufficient free RAM (after accounting for operating system, running services, and applications) to load the bootable image for each node to be simultaneously booted. (For example, if a 2 GB bootable image would be booted simultaneously on four cards (12 nodes), there must be at least 24 GB (2 GB x 12 nodes) of free RAM when the boot command is issued.)

2.5 Architecture Block Diagram

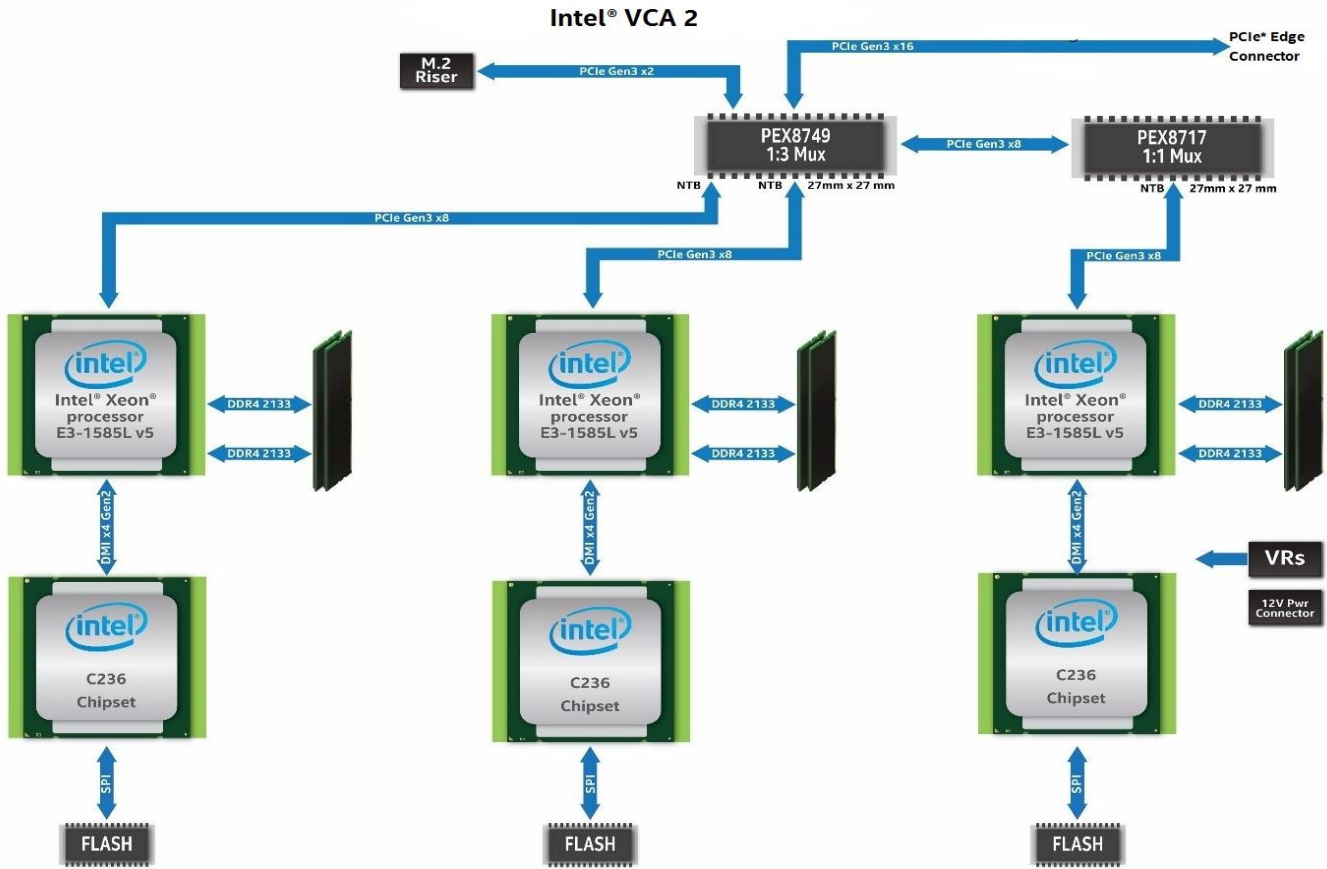


Figure 1. Product architectural block diagram

3. Board Specifications and Support Requirements

3.1 Mechanical Specification

Intel® VCA 2 is a “near” full-length, full-height, double-width PCIe* 3.0 x16 add-in card. It includes a bracket that extends the card to full length for systems that fully support the PCIe specification.

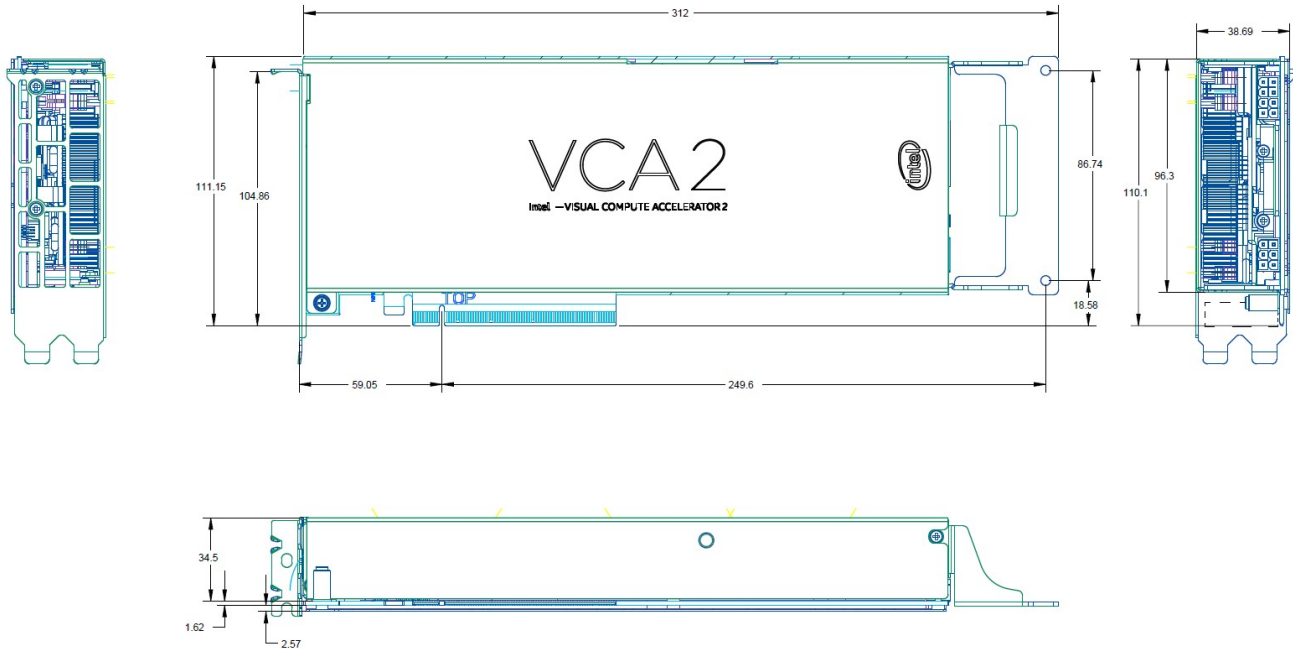


Figure 2. Intel® VCA 2 dimensions

3.2 Card Assembly

The Intel VCA 2 assembly consists of several detachable components to allow for card configuration and serviceability. Figure 3 displays the full card assembly.

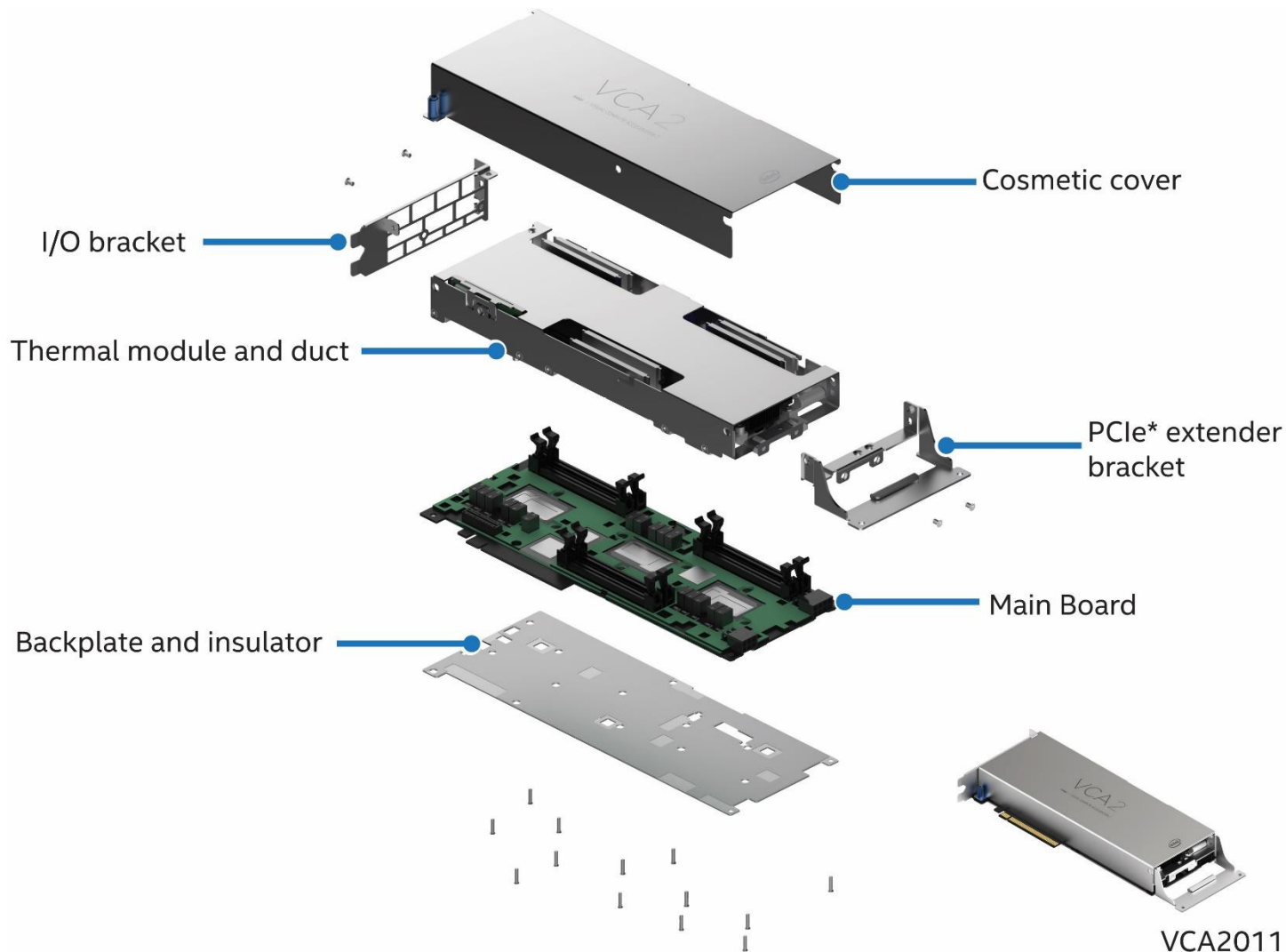


Figure 3. Intel® VCA 2 detachable components

Advisory Note: Intel VCA 2 must have the provided mechanical support bracket (or other custom support bracket) mounted to the card to ensure proper support when installed in the system. Failure to properly support the installed card may cause serious damage should the system be exposed to any level of shock or vibration or is transported to the end user location.

When in operation, the card temperature will rise. The cosmetic cover, thermal module, and duct must be in place to allow for proper airflow over and through the card assembly. Failure to have the card covers installed results in overheating which may impact performance or proper operation of the card.

3.3 Thermal and Airflow Specification

Figure 4 and Table 4 identify the thermal, airflow, and air pressure requirements that must be met by a chassis following the front-to-back air flow pattern of a common system.



Figure 4. Standard airflow pattern

Table 4. Requirements for standard airflow pattern

Card Inlet Temperature	Flow Rate (Cubic Feet per Minute (CFM))	Pressure Drop (Inches of Water ("H2O))
45° C	25.5 CFM	0.476 "H2O
35° C	18.0 CFM	0.246 "H2O

Some custom chassis configurations may orient the card such that the airflow is reversed from the standard airflow pattern shown above. In these non-standard system configurations, the thermal, airflow, and air pressure boundary conditions must meet the following requirements.



Figure 5. Non-standard airflow pattern

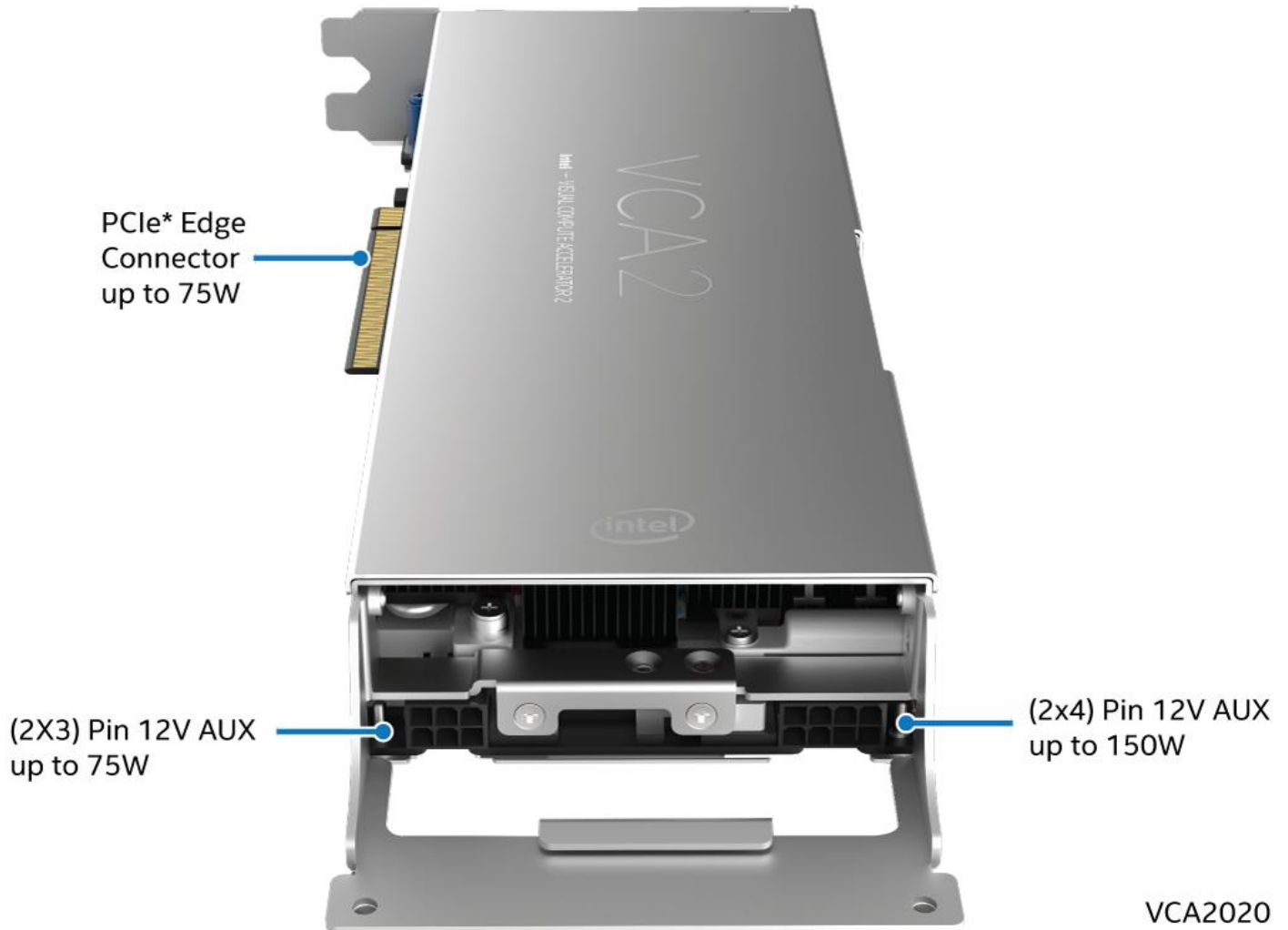
Table 5. Requirements for non-standard airflow pattern

Card Inlet Temperature	Flow Rate (Cubic Feet per Minute (CFM))	Pressure Drop (Inches of Water ("H2O))
35° C	24.1 CFM	0.208 "H2O
25° C	19.0 CFM	0.196 "H2O

Note: Intel VCA 2 CPU core temperatures must remain at or below 96 °C (204.8 °F). CPUs begin to throttle once they reach 100 °C (216 °F), impacting card performance. Should CPU temperatures continue to rise, the card may shut down due to a CPU Thermal Trip event. Should such events occur, adjustments must be made to the system fan speed controls to ensure increased airflow to the card. The `vcactl temp` command of the `vcactl` utility may be used to monitor card CPU core temperatures.

3.4 Power Specification

Intel VCA 2 has a maximum TDP of 235 W. per the PCIe specification, the PCIe x16 connector can support up to 75 W. The remaining power to the card must be supplied via the 2x3 (75 W) and 2x4 (150 W) 12 V AUX power connectors on the card as shown in Figure 6.



VCA2020

Figure 6. Intel® VCA 2 card power connectors

Note: Intel VCA 2 does not ship with cables. Contact the system supplier for 12 V AUX power cables appropriate for the system to which the card is being installed. For Intel® Server System support see <https://www.intel.com/content/www/us/en/support/articles/000024549.html>

3.4.1 12 V AUX Power Connector Specification and Pinout

3.4.1.1 2x3 Pin 12 V AUX Power Connector

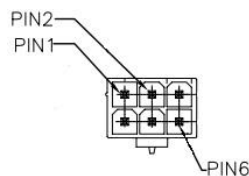


Figure 7. 2x3 pin 12 V AUX power connector pin diagram

Table 6. 2x3 pin 12 V AUX power connector pinout

Pin #	Description
1	12 V
2	12 V
3	12 V
4	GND
5	GND
6	GND

3.4.1.2 2x4 Pin 12 V AUX Power Connector

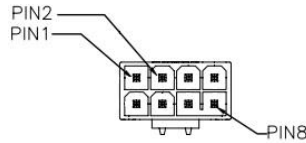


Figure 8. 2x4 pin 12 V AUX power connector pin diagram

Table 7. 2x4 pin 12 V AUX power connector pinout

Pin #	Description
1	12 V
2	12 V
3	12 V
4	GND
5	GND
6	GND
7	GND
8	GND

4. Host Server Validation Guidelines

4.1 Validating Hardware Compatibility

- Mechanical, thermal, and power supply – Refer to chapters in this guide on mechanical, airflow, and power supply specifications.
- Shock and vibration – There are no special requirements for testing shock and vibration. Use the standard testing procedure for PCIe* devices.
- Power cycling – AC, DC, reset. Recommend minimum of ten boards (20 preferred) cycled 700 times each at expected production ambient temperature with no failures.

4.2 Host Server BIOS Guidelines

- BIOS enumerates and recognizes PCIe add-in cards, x16 Gen3
- BIOS supports large MMIO regions ≥ 256 GB
- BIOS must support BAR up to 64 GB per device

4.3 Host Server PCIe* Reset Guidelines

- Signal – `PERST_N`, which is the PCIe reset signal coming from host
- Duration – Not relevant, but 10 ms is suggested
- Number of resets – Not limited, but strongly suggested two as maximum
- Time between resets – Recommended to be at least three seconds

4.4 Quick Validation Guide for OEMs

For this section, the following example configuration is assumed:

- Host
 - System: 2U x 2 GPU server
 - CPU: 2x Intel® Xeon® E5-2630 v4
 - Memory: 16 GB per socket (2x DDR4 8 GB 2400 MHz DIMMs)
 - Fans set to meet CFM requirements defined in Section 3.3 at card inlet temperature 35 °C.
- Intel® VCA
 - System: 2x Intel VCA 2
 - Memory: 32 GB per node (2x DDR4 16 GB 2133 MHz DIMMs)
 - VCA SW version: `VCA SW 2.1.292`

4.4.1 PCIe* Device Discovery and Enumeration

When recognized, each Intel VCA 2 lists the set of PCIe* devices shown in Figure 9. B/D/F may change based on the system setup, but the number of devices (13) and names should match. To display the device list, use the following command:

```
lspci | grep "(rev ca)"
```



```

82:00.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca)
82:00.2 System peripheral: Intel Corporation Device 2952 (rev ca)
82:00.4 System peripheral: Intel Corporation Device 2952 (rev ca)
83:08.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca)
83:09.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca)
83:10.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca)
83:11.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca)
84:00.0 Bridge: Intel Corporation Device 2954 (rev ca)
86:00.0 Bridge: Intel Corporation Device 2955 (rev ca)
87:00.0 PCI bridge: PLX Technology, Inc. PEX 8717 16-lane, 8-Port PCI Express Gen 3 (8.0 GT/s) Switch with DMA (rev ca)
87:00.1 System peripheral: Intel Corporation Device 2952 (rev ca)
88:01.0 PCI bridge: PLX Technology, Inc. PEX 8717 16-lane, 8-Port PCI Express Gen 3 (8.0 GT/s) Switch with DMA (rev ca)
89:00.0 Bridge: Intel Corporation Device 2956 (rev ca)

```

Figure 9. PCIe* device discovery

For a quick check on PCIe link health, check the link status properties for each device. For a full example dump refer to Appendix A. Link speed should be Gen 3 8 Gt/s. Lane count for the main PLX 8749 device depends on host configuration; x16 is the highest available lane count interfacing with the host. Individual nodes are expected to be Gen 3 8 GT/s x8 links. Not every port from PLX 8746 is used, so expect one link to be 0 lanes Gen 1.

For the node, use the following command:

```
lspci -s 84:00.0 -vv
```

```

[root@localhost MV_check]# lspci -s 84:00.0 -vv
84:00.0 Bridge: Intel Corporation Device 2954 (rev ca)
Subsystem: Intel Corporation Device 1004
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr- Stepping- SERR- FastB2B- DisINTx-
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort- <MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 47
NUMA node: 1
Region 0: Memory at c8300000 (32-bit, non-prefetchable) [size=256K]
Region 2: Memory at 3ff00000000 (64-bit, prefetchable) [size=4G]
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME (D0-,D1-,D2-,D3hot-,D3cold-)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable- Count=1/8 Maskable+ 64bit+
Address: 0000000000000000 Data: 0000
Masking: 00000000 Pending: 00000000
Capabilities: [68] Express (v2) Endpoint, MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0, Latency L0s unlimited, L1 unlimited
ExtTag- AttnBtn- AttnInd- PwrInd- RBE+ FLReset- SlotPowerLimit 0.000W
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #8, Speed 8GT/s, Width x8, ASPM L0s L1, Exit Latency L0s <2us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
LnkCtl: ASPM Disabled; RCB 64 bytes Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive- BWMgmt- ABWMgmt-
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR-, OBFF Not Supported

```

Figure 10. Node PCIe* link health

For the edge connector PLX, use the following command:

```
lspci -s 82:00.0 -vv
```

```
[root@localhost MV_check]# lspci -s 82:00.0 -vv
82:00.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca) (prog-if 00 [Normal decode])
  Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr- Stepping- SERR- FastB2B- DisINTx+
  Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort- <MAbort- >SERR- <PERR- INTx-
  Latency: 0, Cache Line Size: 32 bytes
  Interrupt: pin A routed to IRQ 48
  NUMA node: 1
  Region 0: Memory at c8400000 (32-bit, non-prefetchable) [size=256K]
  Bus: primary=82, secondary=83, subordinate=89, sec-latency=0
  I/O behind bridge: 00008000-00009fff
  Memory behind bridge: c8000000-c83fffff
  Prefetchable memory behind bridge: 000003fd00000000-000003ffffffffff
  Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort- <MAbort- >SERR- <PERR-
  BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
    PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREN-
  Capabilities: [40] Power Management version 3
    Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME (D0+,D1-,D2-,D3hot+,D3cold+)
    Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
  Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
    Address: 00000000fee000d8 Data: 0000
    Masking: 000000ff Pending: 00000000
  Capabilities: [68] Express (v2) Upstream Port, MSI 00
    DevCap: MaxPayload 2048 bytes, PhantFunc 0
      ExtTag- AttnBtn- AttnInd- PwrInd- RBE+ SlotPowerLimit 25.000W
    DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
      RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
      MaxPayload 512 bytes, MaxReadReq 128 bytes
    DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
    LnkCap: Port #0, Speed 8GT/s, Width x16, ASPM L1, Exit Latency L0s <4us, L1 <4us
      ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
    LnkCtl: ASPM Disabled; Disabled- CommClk-
      ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
    LnkSta: Speed 8GT/s, Width x16, TrErr- Train- SlotClk- DLActive- BWMgmt- ABWMgmt-
    DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF Via message
    DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF Disabled
    LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-
      Transmit Margin: Normal Operating Range, EnterModifiedCompliance- ComplianceSOS-
      Compliance De-emphasis: -6dB
    LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete+, EqualizationPhase1+
      EqualizationPhase2+, EqualizationPhase3+, LinkEqualizationRequest-
  Capabilities: [a4] Subsystem: PLX Technology, Inc. Device 8749
```

Figure 11. PLX PCIe* link health

4.4.2 Node Availability

This section uses Intel VCA software to check node availability. For details on how to download and install Intel VCA software, refer to Section 4.3 in the *Intel® VCA Software Guide*.

To quickly verify that each node is up, run a status command from the Intel VCA utility. Return data is expected to be a list of CPUs per card and each individual state. It is expected that there are three CPUs listed per card and all are in the same status after a successful boot. To display CPU status, use the following command:

```
vcactl status
```

Right after host reset, it is expected to see the status shown in Figure 12.

After booting the node's operating system and network services are up, it is expected to see the status shown in Figure 13.

```
[root@localhost ~]# vcactl status
Card: 0 Cpu: 0 STATE: bios_up
Card: 0 Cpu: 1 STATE: bios_up
Card: 0 Cpu: 2 STATE: bios_up
Card: 1 Cpu: 0 STATE: bios_up
Card: 1 Cpu: 1 STATE: bios_up
Card: 1 Cpu: 2 STATE: bios_up
```

Figure 12. CPU status after host reset

```
[root@localhost MV_check]# vcactl status
Card: 0 Cpu: 0 STATE: net_device_ready
Card: 0 Cpu: 1 STATE: net_device_ready
Card: 0 Cpu: 2 STATE: net_device_ready
Card: 1 Cpu: 0 STATE: net_device_ready
Card: 1 Cpu: 1 STATE: net_device_ready
Card: 1 Cpu: 2 STATE: net_device_ready
```

Figure 13. CPU status after booting operating system

4.4.3 Ethernet Over PCIe* Network Performance

This test is a bidirectional bandwidth measurement. Both node and server are listening to each other. There are five runs for each load.

- **Tool:** iperf3 (available for download at <http://downloads.es.net/pub/iperf/>); default parameters, 5 loops by 300 s each, TCP
- **Environment:** 3 nodes bidirectional MTU-64k on x16 slot, bare metal-bare metal
- **Server setup on host:** iperf3 -s
- **Server setup on node:** iperf3 -s
- **iperf run in host:** iperf3 -t 300 -c 172.31.x.1
- **iperf run in node:** iperf3 -t 300 -c 172.31.x.254
- **Target:** Total average bandwidth > 14 Gbits/sec per node without bridging. With bridging the BW is 11 Gbits/sec.
- **Results:** See Table 8

Table 8. Bidirectional bandwidth measurement results

Node	Run #	Host to Node			Node to Host		
		Data Sent (GBytes)	Data Received (GBytes)	Bandwidth (Gbits/sec)	Data Sent (GBytes)	Data Received (GBytes)	Bandwidth (Gbits/sec)
1	1	500	500	14.3	472	472	13.5
	2	501	501	14.3	465	465	13.3
	3	501	501	14.3	471	471	13.5
	4	505	505	14.5	473	473	13.6
	5	500	500	14.3	470	470	13.5
2	1	499	499	14.3	544	544	15.6
	2	499	499	14.3	544	544	15.6
	3	500	500	14.3	544	544	15.6
	4	499	499	14.3	545	545	15.6
	5	499	499	14.3	543	543	15.6
3	1	495	495	14.2	566	566	16.2
	2	496	496	14.2	561	561	16.1
	3	495	495	14.2	566	566	16.2
	4	498	498	14.3	569	569	16.3
	5	495	495	14.2	563	563	16.1
Average				14.28667			15.08667

Node	Run #	Host to Node			Node to Host		
		Data Sent (GBytes)	Data Received (GBytes)	Bandwidth (Gbits/sec)	Data Sent (GBytes)	Data Received (GBytes)	Bandwidth (Gbits/sec)
Total Average							14.68667

4.4.4 Transcoding Benchmark for Simultaneous AVC-AVC Transcodes

This test attempts to extract the maximum number of simultaneous AVC transcodes while maintaining a minimum of 30 FPS using Intel® Media Server Studio and a web-available video sample.

- **Target:** Most number of simultaneous AVC transcodes achieved while keeping 30 FPS (real-time)
- **Test configuration:** 1x Intel VCA 2 with all 3 nodes running simultaneous transcoding
- **Environment:** Bare metal, non-persistent image
- **Card OS:** CentOS and Ubuntu
- **Transcoding software:** Intel Media Server Studio 2017 R3 (available at <https://software.intel.com/en-us/intel-media-server-studio>)
- **Script files:** Script files to execute benchmarking is available at <https://downloadcenter.intel.com/search?keyword=VCA> and select Intel® Visual Compute Accelerator AVC benchmark script
- **PAR file details:**

```
-async 3 -hw -u 7 -cqp -qpi 24 -qpp 26 -qpb 28 -gop_size 61 -dist 3 -i::h264
  /input/big_buck_bunny_1080p.h264 -o::h264 /dev/null
```
- **Results:** Results are printed on the screen and can be obtained from log file in tools\h264\logs directory.

Table 9. Transcoding benchmark results

Card: 0 Node: 0 IP Address: w.x.y.z achieved_fps: >=30 Streams: 17
Card: 0 Node: 1 IP Address: w.x.y1.z1 achieved_fps: >=30 Streams: 17
Card: 0 Node: 2 IP Address: w.x.y2.z2 achieved_fps: >=30 Streams: 17

4.4.5 Temperature Profile

The temperature while booted in idle mode is ~35 °C. Temperature during workload is expected to reach ~60 °C. During transcoding workload, the script runs the load more times to ensure frame rate achieved is correct. Also longer input file is used during temperature profile. Temperature values from the VCA nodes are captured for every 10ms during the avc_benchmark script in a log file (avc_benchmark_temp_log.txt) and sorted along the Card and CPU in log file (avc_benchmark_sorted_temp.txt). Each VCA node has 4 cores and each core temperature is captured. If the average temperature is captured is higher than ~60 °C, the possible cause of temperature is CFM requirements may not be met. Check the fan settings in BIOS. For example, on Intel® Server Board S2600WT based systems, this can be enabled in BIOS setup by configuring the following two options on the PCI Configuration screen.

- Set **Advanced->System Acoustic and Performance Configuration->Set Fan Profile** as **Performance**
- Set **Advanced->System Acoustic and Performance Configuration->Set PWM Offset** as **80**

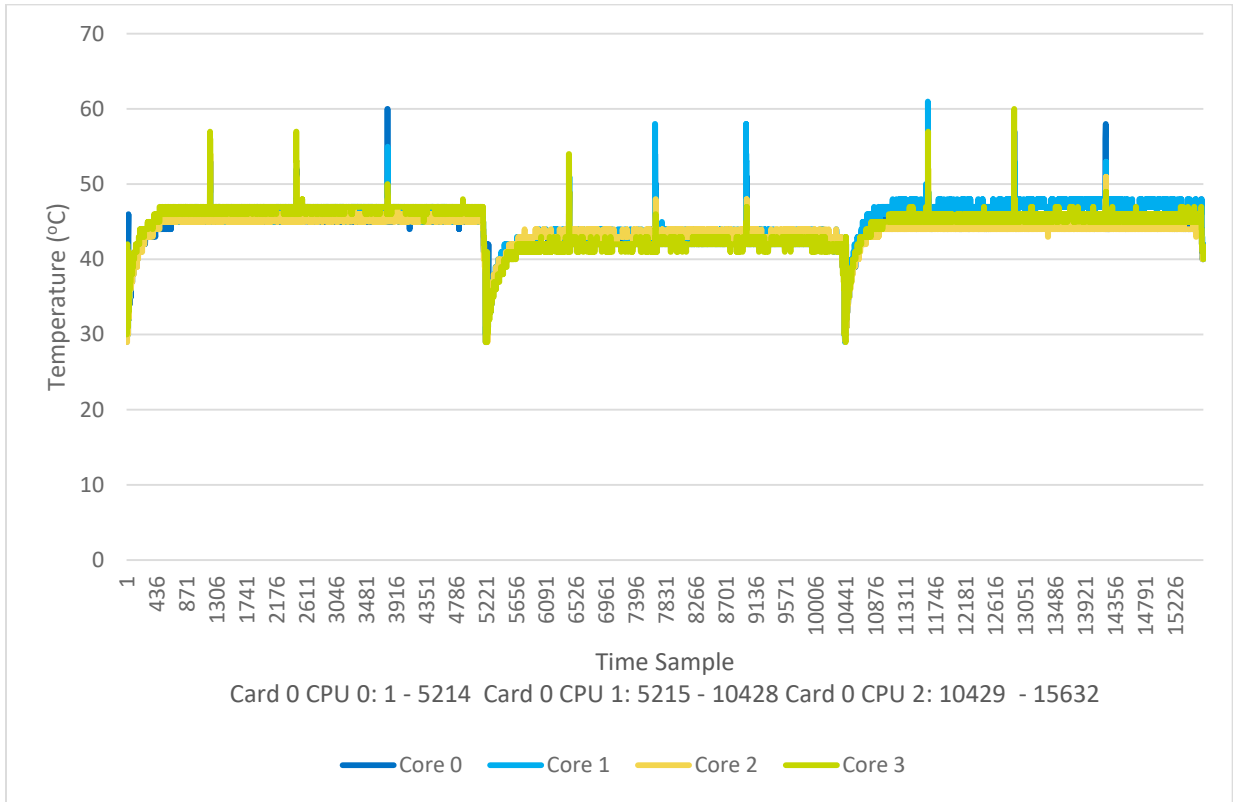


Figure 14. Temperature profile while transcoding

5. Memory Support

Intel® VCA 2 includes three processors identified as CPU 1-3. Each of the three processors includes two memory channels identified as A and B. Each memory channel supports one SODIMM socket. Each processor can support up to 64 GB of memory. Figure 15 below identifies the SODIMM sockets for each processor.

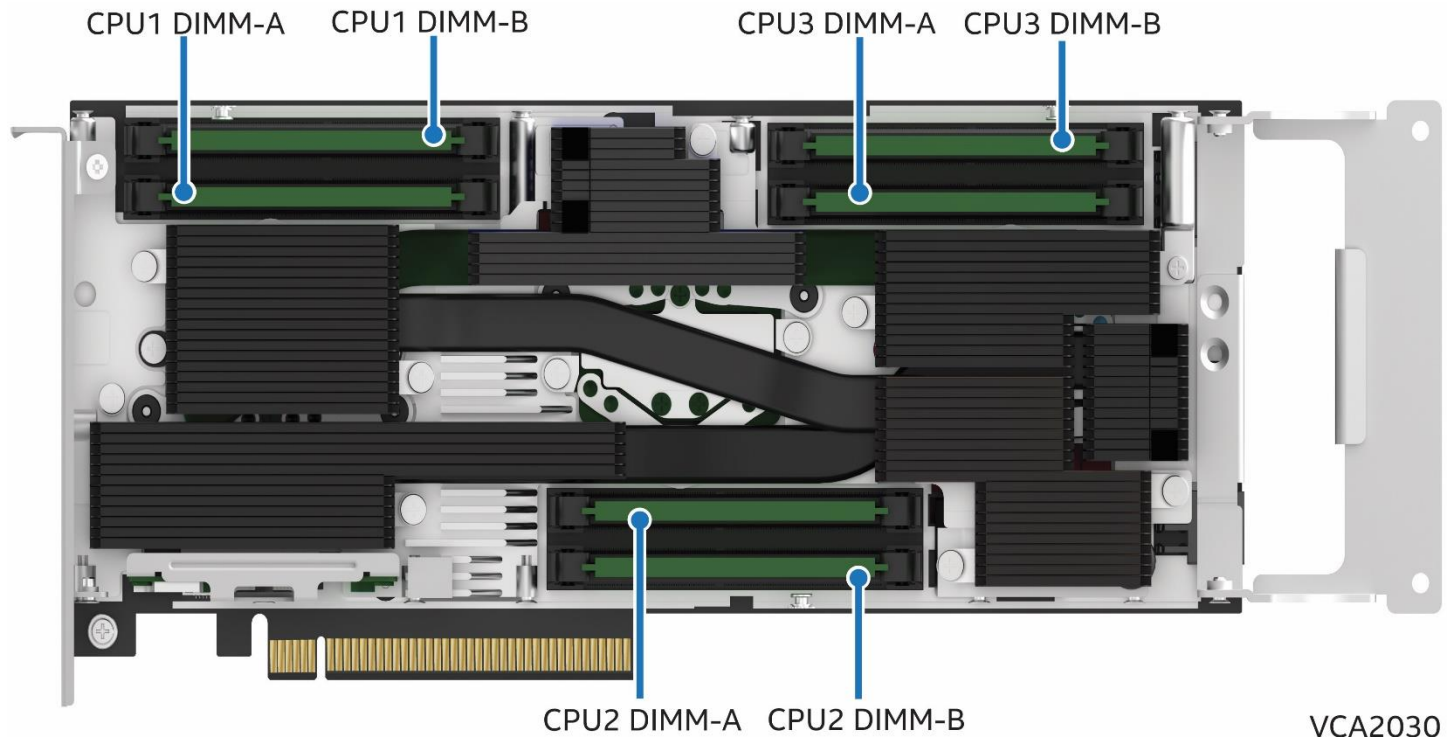


Figure 15. Intel® VCA 2 card DIMM slots

5.1 Memory Population Rules

Note: Although mixed DIMM configurations may be functional, Intel only supports and performs validation with cards that are configured with identical DIMMs installed across all CPUs

- All DIMMs must be DDR4 DIMMs.
- All processors must have at least one DIMM installed.
- To get better performance, it is recommended to install both DIMMs (e.g.: instead of 1 16GB DIMM, install 2 8GB DIMMS)
- DIMM slots for each processor must be installed in order, beginning with DIMM Slot A.
- When only one DIMM is installed for any given processor, it must be populated in the DIMM A slot.

5.2 Supported Memory

Intel VCA 2 has support for the following memory types:

Table 10. Supported memory types

Memory Type	Memory Size	Speed (MHz)	Ranks per DIMM
SODIMM DDR4L ECC	8GB, 16GB	2133 MHz ¹	Single-rank, dual-rank
SODIMM DDR4L Non-ECC	4GB, 8GB, 16GB	2133 MHz ¹	Single-rank, dual-rank

¹ Speeds greater than 2133 MHz are downclocked to 2133 MHz.

5.3 Memory Compatibility List

The following lists of memory have been validated for use on Intel VCA 2. This list will be updated as additional DIMMs are tested.

Table 11. ECC memory compatibility list

Vendor	8 GB	16 GB
Micron*	MTA18ASF1G72HZ-2G3B1 MTA8ATF1G64HZ-2G6E1	MTA18ASF2G72HZ-2G3B1
SK Hynix*	HMA41GS7AFR8N-TF HMA81GS6CJR8N-VK	HMA82GS7MFR8N-TF, HMA82GS6CJR8N-VK
Samsung*	M474A1G43DB1-CRC	M474A2K43BB1-CRC
Crucial*	CT8G4SFS8266	CT16G4TFD824A, CT16G44SFD8266
Kingston	HX426S15IB2/8	HX426S15IB2/16

Table 12. Non-ECC memory compatibility list

Vendor	4 GB	8 GB	16 GB
HyperX*	HX421S13IB/4	HX421S13IB/8	HX421S13IB/16
Crucial*	CT4G4SFS8213	CT8G4SFS8213 CT8G4SFD8213	CT16G4SFD8213
SK Hynix*	-	HMA41GS6AFR8N	HMA82GS6AFR8N-UH ¹
Samsung*	-	M471A1K43CB1-CRC ¹	M471A2K43BB1-CPB

¹ Specified speed is 2400 MHz. Downclocks to 2133 MHz when attached to Intel® Xeon® E3-1585L v5 devices.

6. Operating System Support

Note: All utility software and boot images referenced in this section can be downloaded at <https://downloadcenter.intel.com/product/98092>.

Note: Supported operating systems and instructions for bringing up Intel® VCA 2 are provided in the *Intel® Visual Compute Accelerator Family Software Guide*:
<https://www.intel.com/content/www/us/en/support/server-products/server-accessories/000016708.html>.

Intel VCA 2 boots the operating system from the host using a technology known as leverage boot. A `vcactl` utility is used to perform all boot operations. The utility loads the operating system into a RAMDisk that the CPUs boot from.

Users have the option of downloading one of several different boot images available from the Intel website or creating their own boot image. Refer to the *Intel® Visual Compute Accelerator Product Family Software Guide* for instructions on how to build a boot image.

6.1 Supported Hypervisors

- KVM
- KVMGT

6.2 Guest Operating System

Intel VCA 2 supports any operating system supported by Iris® Pro graphics, Intel® Graphics Virtualization Technology (Intel® GVT-d) virtualization, and the Intel® Media Server Studio.

Appendix A. Full PCIe* Dump

For more information on PCIe* link health for Intel VCA 2, refer to Section 4.4.1.

```

82:00.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca) (prog-if 00
[Normal decode])
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 48
NUMA node: 1
Region 0: Memory at c8400000 (32-bit, non-prefetchable) [size=256K]
Bus: primary=82, secondary=83, subordinate=89, sec-latency=0
I/O behind bridge: 00008000-00009fff
Memory behind bridge: c8000000-c83ffffff
Prefetchable memory behind bridge: 000003fd00000000-000003fffffffffff
Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- <SERR- <PERR-
BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREn-
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME (D0+,D1-,D2-
,D3hot+,D3cold+)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee000d8 Data: 0000
Masking: 000000ff Pending: 00000000
Capabilities: [68] Express (v2) Upstream Port, MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0
ExtTag- AttnBtn- AttnInd- PwrInd- RBE+ SlotPowerLimit 25.000W
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #0, Speed 8GT/s, Width x16, ASPM L1, Exit Latency L0s
<4us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
LnkCtl: ASPM Disabled; Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x16, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt-
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF
Via message
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-
Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
Compliance De-emphasis: -6dB

```

Intel® VCA 2 Product Specification and Hardware Guide

LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete+,
EqualizationPhase1+
EqualizationPhase2+, EqualizationPhase3+,
LinkEqualizationRequest-
Capabilities: [a4] Subsystem: PLX Technology, Inc. Device 8749
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESSta: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmplt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UESvrt: DLP+ SDES+ TLP+ FCP+ CmpltTO- CmpltAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr+
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [138 v1] Power Budgeting <?>
Capabilities: [10c v1] #19
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=8
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status: InProgress-
VC0: Caps: PATOffset=03 MaxTimeSlots=1 RejSnoopTrans-
Arb: Fixed- WRR32- WRR64+ WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=WRR64 TC/VC=ff
Status: NegoPending- InProgress-
Port Arbitration Table <?>
Capabilities: [e00 v1] #12
Capabilities: [b00 v1] Latency Tolerance Reporting
Max snoop latency: 0ns
Max no snoop latency: 0ns
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: pcieport
Kernel modules: shpchp

82:00.2 System peripheral: Intel Corporation Device 2952 (rev ca)
Subsystem: PLX Technology, Inc. Device 87d0
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin B routed to IRQ 146
NUMA node: 1
Region 0: Memory at c8442000 (32-bit, non-prefetchable) [size=8K]
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0-,D1-,D2-,D3hot-
,D3cold-)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-

Intel® VCA 2 Product Specification and Hardware Guide

Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee001f8 Data: 0000
Masking: 000000fe Pending: 00000000
Capabilities: [68] Express (v2) Endpoint, MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0, Latency L0s unlimited,
L1 unlimited
ExtTag+ AttnBtn- AttnInd- PwrInd- RBE+ FLReset+ SlotPowerLimit
0.000W
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+ FLReset-
MaxPayload 512 bytes, MaxReadReq 512 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #0, Speed 8GT/s, Width x16, ASPM L1, Exit Latency L0s
<4us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
LnkCtl: ASPM Disabled; RCB 64 bytes Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x16, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt-
DevCap2: Completion Timeout: Range ABCD, TimeoutDis+, LTR+, OBFF Via
message
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis+, LTR-, OBFF
Disabled
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-,
EqualizationPhase1-
EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESSta: DLP- SDES- TLP- FCP- CmplttO- CmplttAbrt- UnxCmpltt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmplttO- CmplttAbrt+ UnxCmpltt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UESvrt: DLP+ SDES+ TLP+ FCP+ CmplttO+ CmplttAbrt- UnxCmpltt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr-
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [1f0 v1] Vendor Specific Information: ID=0010 Rev=0 Len=0c4
<?>
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: plx87xx_dma
Kernel modules: plx87xx_dma

82:00.4 System peripheral: Intel Corporation Device 2952 (rev ca)
Subsystem: PLX Technology, Inc. Device 87d0
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes

Intel® VCA 2 Product Specification and Hardware Guide

```
Interrupt: pin B routed to IRQ 147
NUMA node: 1
Region 0: Memory at c8440000 (32-bit, non-prefetchable) [size=8K]
Capabilities: [40] Power Management version 3
  Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0-,D1-,D2-,D3hot-,
,D3cold-)
  Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
  Address: 00000000fee00218 Data: 0000
  Masking: 000000fe Pending: 00000000
Capabilities: [68] Express (v2) Endpoint, MSI 00
  DevCap: MaxPayload 2048 bytes, PhantFunc 0, Latency L0s unlimited,
L1 unlimited
    ExtTag+ AttnBtn- AttnInd- PwrInd- RBE+ FLReset+ SlotPowerLimit
0.000W
  DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
    RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+ FLReset-
    MaxPayload 512 bytes, MaxReadReq 512 bytes
  DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
  LnkCap: Port #0, Speed 8GT/s, Width x16, ASPM L1, Exit Latency L0s
<4us, L1 <4us
    ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
  LnkCtl: ASPM Disabled; RCB 64 bytes Disabled- CommClk-
    ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
  LnkSta: Speed 8GT/s, Width x16, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt-
  DevCap2: Completion Timeout: Range ABCD, TimeoutDis+, LTR+, OBFF Via
message
  DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis+, LTR-, OBFF
Disabled
  LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-,
EqualizationPhase1-
    EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
  UESSta: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
  UEMsk: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmplt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
  UESvrt: DLP+ SDES+ TLP+ FCP+ CmpltTO+ CmpltAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
  CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr-
  CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
  AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [1f0 v1] Vendor Specific Information: ID=0010 Rev=0 Len=0c4
<?>
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: plx87xx_dma
Kernel modules: plx87xx_dma
```

Intel® VCA 2 Product Specification and Hardware Guide

```

83:08.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca) (prog-if 00
[Normal decode])
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 49
NUMA node: 1
Bus: primary=83, secondary=84, subordinate=84, sec-latency=0
I/O behind bridge: 0000f000-00000fff
Memory behind bridge: c8300000-c83fffff
Prefetchable memory behind bridge: 000003fff0000000-000003ffffffffff
Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- <SERR- <PERR-
BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREN-
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0+,D1-,D2-
,D3hot+,D3cold+)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee000f8 Data: 0000
Masking: 000000ff Pending: 00000000
Capabilities: [68] Express (v2) Downstream Port (Slot-), MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0
ExtTag- RBE+
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #8, Speed 8GT/s, Width x8, ASPM L1, Exit Latency L0s
<4us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot+ ASPMOptComp+
LnkCtl: ASPM Disabled; Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt+
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF
Via message ARIFwd+
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled ARIFwd-
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-,
Selectable De-emphasis: -6dB
Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-,
EqualizationPhase1-
EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [a4] Subsystem: PLX Technology, Inc. Device 8749

```

Intel® VCA 2 Product Specification and Hardware Guide

Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESSta: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmplt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol+
UESvrt: DLP+ SDES+ TLP+ FCP+ CmpltTO- CmpltAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr+
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [138 v1] Power Budgeting <?>
Capabilities: [10c v1] #19
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=8
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status: InProgress-
VC0: Caps: PATOffset=03 MaxTimeSlots=1 RejSnoopTrans-
Arb: Fixed- WRR32- WRR64+ WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=WRR64 TC/VC=ff
Status: NegoPending- InProgress-
Port Arbitration Table <?>
Capabilities: [e00 v1] #12
Capabilities: [f24 v1] Access Control Services
ACSCap: SrcValid+ TransBlk+ ReqRedir+ CmpltRedir+ UpstreamFwd+
EgressCtrl+ DirectTrans+
ACSCtl: SrcValid- TransBlk- ReqRedir- CmpltRedir- UpstreamFwd-
EgressCtrl- DirectTrans-
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: pcieport
Kernel modules: shpchp

83:09.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca) (prog-if 00
[Normal decode])
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 51
NUMA node: 1
Bus: primary=83, secondary=85, subordinate=85, sec-latency=0
I/O behind bridge: 00008000-00008fff
Memory behind bridge: fff00000-000fffff
Prefetchable memory behind bridge: 00000000fff00000-000000000000fffff
Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- <SERR- <PERR-
BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREN-
Capabilities: [40] Power Management version 3

Intel® VCA 2 Product Specification and Hardware Guide

Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME (D0+,D1-,D2-,D3hot+,D3cold+)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee00138 Data: 0000
Masking: 000000fe Pending: 00000000
Capabilities: [68] Express (v2) Downstream Port (Slot+), MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0
ExtTag- RBE+
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #9, Speed 8GT/s, Width x8, ASPM L1, Exit Latency L0s
<4us, L1 <4us
ClockPM- Surprise+ LLActRep+ BwNot+ ASPMOptComp+
LnkCtl: ASPM Disabled; Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 2.5GT/s, Width x0, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt-
SltCap: AttnBtn+ PwrCtrl+ MRL+ AttnInd+ PwrInd+ HotPlug+ Surprise-
Slot #73, PowerLimit 25.000W; Interlock- NoCompl-
SltCtl: Enable: AttnBtn+ PwrFlt- MRL+ PresDet- CmdCplt+ HPIrq+
LinkChg+
Control: AttnInd Off, PwrInd Off, Power+ Interlock-
SltSta: Status: AttnBtn- PowerFlt- MRL+ CmdCplt- PresDet-
Interlock-
Changed: MRL- PresDet- LinkState-
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF
Via message ARIFwd+
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled ARIFwd-
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-,
Selectable De-emphasis: -6dB
Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -3.5dB, EqualizationComplete-,
EqualizationPhase1-
EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [a4] Subsystem: PLX Technology, Inc. Device 8749
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESSta: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmpl- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmpl+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol+
UESvrt: DLP+ SDES+ TLP+ FCP+ CmpltTO- CmpltAbrt- UnxCmpl- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr+
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+

Intel® VCA 2 Product Specification and Hardware Guide

AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [138 v1] Power Budgeting <?>
Capabilities: [10c v1] #19
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=8
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status: InProgress-
VC0: Caps: PATOffset=03 MaxTimeSlots=1 RejSnoopTrans-
Arb: Fixed- WRR32- WRR64+ WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=WRR64 TC/VC=ff
Status: NegoPending+ InProgress-
Port Arbitration Table <?>
Capabilities: [e00 v1] #12
Capabilities: [f24 v1] Access Control Services
ACSCap: SrcValid+ TransBlk+ ReqRedir+ CmpltRedir+ UpstreamFwd+
EgressCtrl+ DirectTrans+
ACSCtl: SrcValid- TransBlk- ReqRedir- CmpltRedir- UpstreamFwd-
EgressCtrl- DirectTrans-
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: pcieport
Kernel modules: shpchp

83:10.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca) (prog-if 00
[Normal decode])
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 52
NUMA node: 1
Bus: primary=83, secondary=86, subordinate=86, sec-latency=0
I/O behind bridge: 0000f000-00000fff
Memory behind bridge: c8200000-c82fffff
Prefetchable memory behind bridge: 000003fe00000000-000003feffffffffff
Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- <SERR- <PERR-
BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREn-
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0+,D1-,D2-
,D3hot+,D3cold+)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee00158 Data: 0000
Masking: 000000ff Pending: 00000000
Capabilities: [68] Express (v2) Downstream Port (Slot-), MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0
ExtTag- RBE+
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+

Intel® VCA 2 Product Specification and Hardware Guide

RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsupReq+ AuxPwr- TransPend-
LnkCap: Port #16, Speed 8GT/s, Width x8, ASPM L1, Exit Latency L0s
<4us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot+ ASPMOptComp+
LnkCtl: ASPM Disabled; Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt+
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF
Via message ARIFwd+
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled ARIFwd-
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-,
Selectable De-emphasis: -6dB
Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-,
EqualizationPhase1-
EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [a4] Subsystem: PLX Technology, Inc. Device 8749
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESta: DLP- SDES- TLP- FCP- CmplTTO- CmplTAbrt- UnxCmplT- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmplTTO- CmplTAbrt+ UnxCmplT+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol+
UESvrt: DLP+ SDES+ TLP+ FCP+ CmplTTO- CmplTAbrt- UnxCmplT- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr+
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [138 v1] Power Budgeting <?>
Capabilities: [10c v1] #19
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=8
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status: InProgress-
VC0: Caps: PATOffset=03 MaxTimeSlots=1 RejsSnoopTrans-
Arb: Fixed- WRR32- WRR64+ WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=WRR64 TC/VC=ff
Status: NegoPending- InProgress-
Port Arbitration Table <?>
Capabilities: [e00 v1] #12
Capabilities: [f24 v1] Access Control Services
ACSCap: SrcValid+ TransBlk+ ReqRedir+ CmplTRedir+ UpstreamFwd+
EgressCtrl+ DirectTrans+

Intel® VCA 2 Product Specification and Hardware Guide

ACSCtl: SrcValid- TransBlk- ReqRedir- CmpltRedir- UpstreamFwd-
EgressCtrl- DirectTrans-
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: pcieport
Kernel modules: shpchp

83:11.0 PCI bridge: PLX Technology, Inc. Device 8749 (rev ca) (prog-if 00
[Normal decode])
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 53
NUMA node: 1
Bus: primary=83, secondary=87, subordinate=89, sec-latency=0
I/O behind bridge: 00009000-00009fff
Memory behind bridge: c8000000-c81fffff
Prefetchable memory behind bridge: 000003fd00000000-000003fdffffff
Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- <SERR- <PERR-
BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREN-
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0+,D1-,D2-
,D3hot+,D3cold+)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee00178 Data: 0000
Masking: 000000fe Pending: 00000000
Capabilities: [68] Express (v2) Downstream Port (Slot+), MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0
ExtTag- RBE+
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #17, Speed 8GT/s, Width x8, ASPM L1, Exit Latency L0s
<4us, L1 <4us
ClockPM- Surprise+ LLActRep+ BwNot+ ASPMOptComp+
LnkCtl: ASPM Disabled; Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive+
BWMgmt+ ABWMgmt-
SltCap: AttnBtn+ PwrCtrl+ MRL+ AttnInd+ PwrInd+ HotPlug+ Surprise-
Slot #81, PowerLimit 25.000W; Interlock- NoCompl-
SltCtl: Enable: AttnBtn+ PwrFlt- MRL+ PresDet- CmdCplt+ HPIrq+
LinkChg+
Control: AttnInd Off, PwrInd Off, Power+ Interlock-
SltSta: Status: AttnBtn- PowerFlt- MRL+ CmdCplt- PresDet+
Interlock-

Intel® VCA 2 Product Specification and Hardware Guide

```
Changed: MRL- PresDet- LinkState-
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF
Via message ARIFwd+
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled ARIFwd-
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-,
Selectable De-emphasis: -6dB
    Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
    Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete+,
EqualizationPhase1+
    EqualizationPhase2+, EqualizationPhase3+,
LinkEqualizationRequest-
Capabilities: [a4] Subsystem: PLX Technology, Inc. Device 8749
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESSta:    DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk:    DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmplt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol+
UESvrt:    DLP+ SDES+ TLP+ FCP+ CmpltTO- CmpltAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta:    RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr+
CEMsk:    RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap:    First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [138 v1] Power Budgeting <?>
Capabilities: [10c v1] #19
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=8
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status:    InProgress-
VC0: Caps: PATOffset=03 MaxTimeSlots=1 RejSnoopTrans-
Arb: Fixed- WRR32- WRR64+ WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=WRR64 TC/VC=ff
Status:    NegoPending- InProgress-
Port Arbitration Table <?>
Capabilities: [e00 v1] #12
Capabilities: [f24 v1] Access Control Services
ACSCap:    SrcValid+ TransBlk+ ReqRedir+ CmpltRedir+ UpstreamFwd+
EgressCtrl+ DirectTrans+
ACSCtl:    SrcValid- TransBlk- ReqRedir- CmpltRedir- UpstreamFwd-
EgressCtrl- DirectTrans-
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: pcieport
Kernel modules: shpchp
```

```
84:00.0 Bridge: Intel Corporation Device 2954 (rev ca)
Subsystem: Intel Corporation Device 1004
```

Intel® VCA 2 Product Specification and Hardware Guide

Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr- Stepping- SERR- FastB2B- DisINTx-
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort- <MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 47
NUMA node: 1
Region 0: Memory at c8300000 (32-bit, non-prefetchable) [size=256K]
Region 2: Memory at 3ff00000000 (64-bit, prefetchable) [size=4G]
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0-,D1-,D2-,D3hot-,D3cold-)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable- Count=1/8 Maskable+ 64bit+
Address: 0000000000000000 Data: 0000
Masking: 00000000 Pending: 00000000
Capabilities: [68] Express (v2) Endpoint, MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0, Latency L0s unlimited, L1 unlimited
ExtTag- AttnBtn- AttnInd- PwrInd- RBE+ FLReset- SlotPowerLimit 0.000W
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+ RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+ MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #8, Speed 8GT/s, Width x8, ASPM L0s L1, Exit Latency L0s <2us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
LnkCtl: ASPM Disabled; RCB 64 bytes Disabled- CommClk- ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive- BWMgmt- ABWMgmt-
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR-, OBFF Not Supported
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF Disabled
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis- Transmit Margin: Normal Operating Range, EnterModifiedCompliance- ComplianceSOS- Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-, EqualizationPhase1- EqualizationPhase2-, EqualizationPhase3-, LinkEqualizationRequest-
Capabilities: [c8] Vendor Specific Information: Len=00 <?>
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESta: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmpl- RxOF- MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmpl+ RxOF- MalftTLP- ECRC- UnsupReq- ACSViol-

Intel® VCA 2 Product Specification and Hardware Guide

```
UESvrt:    DLP+ SDES+ TLP+ FCP+ CmpltTO+ CmpltAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta:     RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr-
CEMsk:     RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap:    First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=1
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status:    InProgress-
VC0: Caps: PATOffset=00 MaxTimeSlots=1 RejSnoopTrans-
Arb: Fixed- WRR32- WRR64- WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=Fixed TC/VC=ff
Status:    NegoPending- InProgress-
Capabilities: [c34 v1] Vendor Specific Information: ID=0003 Rev=0 Len=078
<?>
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: plx87xx_vca
Kernel modules: plx87xx
```

```
86:00.0 Bridge: Intel Corporation Device 2955 (rev ca)
Subsystem: Intel Corporation Device 1004
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx-
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 47
NUMA node: 1
Region 0: Memory at c8200000 (32-bit, non-prefetchable) [size=256K]
Region 2: Memory at 3fe00000000 (64-bit, prefetchable) [size=4G]
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0-,D1-,D2-,D3hot-,
,D3cold-)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable- Count=1/8 Maskable+ 64bit+
Address: 0000000000000000 Data: 0000
Masking: 00000000 Pending: 00000000
Capabilities: [68] Express (v2) Endpoint, MSI 00
DevCap:    MaxPayload 2048 bytes, PhantFunc 0, Latency L0s unlimited,
L1 unlimited
ExtTag- AttnBtn- AttnInd- PwrInd- RBE+ FLReset- SlotPowerLimit
0.000W
DevCtl:    Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta:    CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap:    Port #16, Speed 8GT/s, Width x8, ASPM L0s L1, Exit Latency
L0s <2us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
LnkCtl:    ASPM Disabled; RCB 64 bytes Disabled- CommClk-
```

Intel® VCA 2 Product Specification and Hardware Guide

```
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt-
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR-, OBFF
Not Supported
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-
Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-,
EqualizationPhase1-
EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [c8] Vendor Specific Information: Len=00 <?>
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESta: DLP- SDES- TLP- FCP- CmplTTO- CmplTAbrt- UnxCmplt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmplTTO- CmplTAbrt+ UnxCmplt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UESvrt: DLP+ SDES+ TLP+ FCP+ CmplTTO+ CmplTAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr-
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=1
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status: InProgress-
VC0: Caps: PATOffset=00 MaxTimeSlots=1 RejSnoopTrans-
Arb: Fixed- WRR32- WRR64- WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=Fixed TC/VC=ff
Status: NegoPending- InProgress-
Capabilities: [c34 v1] Vendor Specific Information: ID=0003 Rev=0 Len=078
<?>
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: plx87xx_vca
Kernel modules: plx87xx
```

```
87:00.0 PCI bridge: PLX Technology, Inc. PEX 8717 16-lane, 8-Port PCI
Express Gen 3 (8.0 GT/s) Switch with DMA (rev ca) (prog-if 00 [Normal
decode])
Physical Slot: 81-1
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
```

Intel® VCA 2 Product Specification and Hardware Guide

Interrupt: pin A routed to IRQ 54
NUMA node: 1
Region 0: Memory at c8100000 (32-bit, non-prefetchable) [size=256K]
Bus: primary=87, secondary=88, subordinate=89, sec-latency=0
I/O behind bridge: 0000f000-00000fff
Memory behind bridge: c8000000-c80fffff
Prefetchable memory behind bridge: 000003fd00000000-000003fdffffff
Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- <SERR- <PERR-
BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREN-
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0+,D1-,D2-
,D3hot+,D3cold+)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee00198 Data: 0000
Masking: 000000ff Pending: 00000000
Capabilities: [68] Express (v2) Upstream Port, MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0
ExtTag- AttnBtn- AttnInd- PwrInd- RBE+ SlotPowerLimit 25.000W
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 512 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #0, Speed 8GT/s, Width x8, ASPM L1, Exit Latency L0s
<4us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
LnkCtl: ASPM Disabled; Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt-
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF
Via message
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-
Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete+,
EqualizationPhase1+
EqualizationPhase2+, EqualizationPhase3+,
LinkEqualizationRequest-
Capabilities: [a4] Subsystem: PLX Technology, Inc. PEX 8717 16-lane, 8-
Port PCI Express Gen 3 (8.0 GT/s) Switch with DMA
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESta: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmplt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-

Intel® VCA 2 Product Specification and Hardware Guide

```
UESvrt:    DLP+ SDES+ TLP+ FCP+ CmpltTO- CmpltAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta:    RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr+
CEMsk:    RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap:    First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [138 v1] Power Budgeting <?>
Capabilities: [10c v1] #19
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=8
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status:    InProgress-
VC0: Caps: PATOffset=03 MaxTimeSlots=1 RejSnoopTrans-
Arb: Fixed- WRR32- WRR64+ WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=WRR64 TC/VC=ff
Status:    NegoPending- InProgress-
Port Arbitration Table <?>
Capabilities: [e00 v1] #12
Capabilities: [b00 v1] Latency Tolerance Reporting
Max snoop latency: 0ns
Max no snoop latency: 0ns
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: pcieport
Kernel modules: shpchp
```

```
87:00.1 System peripheral: Intel Corporation Device 2952 (rev ca)
Subsystem: PLX Technology, Inc. Device 87d0
Physical Slot: 81-1
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin B routed to IRQ 148
NUMA node: 1
Region 0: Memory at c8140000 (32-bit, non-prefetchable) [size=8K]
Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0-,D1-,D2-,D3hot-
,D3cold-)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee00238 Data: 0000
Masking: 000000fe Pending: 00000000
Capabilities: [68] Express (v2) Endpoint, MSI 00
DevCap:    MaxPayload 2048 bytes, PhantFunc 0, Latency L0s unlimited,
L1 unlimited
ExtTag+ AttnBtn- AttnInd- PwrInd- RBE+ FLReset+ SlotPowerLimit
0.000W
DevCtl:    Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+ FLReset-
MaxPayload 512 bytes, MaxReadReq 512 bytes
```


Intel® VCA 2 Product Specification and Hardware Guide

```
DevSta: CorrErr+ UncorrErr- FatalErr- UnsupReq+ AuxPwr- TransPend-
LnkCap: Port #0, Speed 8GT/s, Width x8, ASPM L1, Exit Latency L0s
<4us, L1 <4us
      ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
LnkCtl: ASPM Disabled; RCB 64 bytes Disabled- CommClk-
      ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt-
DevCap2: Completion Timeout: Range ABCD, TimeoutDis+, LTR+, OBFF Via
message
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis+, LTR-, OBFF
Disabled
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-,
EqualizationPhase1-
      EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESta: DLP- SDES- TLP- FCP- CmplTTO- CmplTAbrt- UnxCmplT- RxOF-
MalFTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmplTTO- CmplTAbrt+ UnxCmplT+ RxOF-
MalFTLP- ECRC- UnsupReq- ACSViol-
UESvrt: DLP+ SDES+ TLP+ FCP+ CmplTTO+ CmplTAbrt- UnxCmplT- RxOF+
MalFTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr-
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [1f0 v1] Vendor Specific Information: ID=0010 Rev=0 Len=0c4
<?>
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: plx87xx_dma
Kernel modules: plx87xx_dma
```

```
88:01.0 PCI bridge: PLX Technology, Inc. PEX 8717 16-lane, 8-Port PCI
Express Gen 3 (8.0 GT/s) Switch with DMA (rev ca) (prog-if 00 [Normal
decode])
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx+
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 56
NUMA node: 1
Bus: primary=88, secondary=89, subordinate=89, sec-latency=0
I/O behind bridge: 0000f000-00000fff
Memory behind bridge: c8000000-c80fffff
Prefetchable memory behind bridge: 000003fd00000000-000003fdffffff
Secondary status: 66MHz- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- <SERR- <PERR-
BridgeCtl: Parity+ SERR+ NoISA- VGA- MAbort- >Reset- FastB2B-
PriDiscTmr- SecDiscTmr- DiscTmrStat- DiscTmrSERREN-
```

Intel® VCA 2 Product Specification and Hardware Guide

Capabilities: [40] Power Management version 3
Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0+,D1-,D2-,D3hot+,D3cold+)
Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable+ Count=1/8 Maskable+ 64bit+
Address: 00000000fee001d8 Data: 0000
Masking: 000000ff Pending: 00000000
Capabilities: [68] Express (v2) Downstream Port (Slot-), MSI 00
DevCap: MaxPayload 2048 bytes, PhantFunc 0
ExtTag- RBE+
DevCtl: Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
MaxPayload 256 bytes, MaxReadReq 128 bytes
DevSta: CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
LnkCap: Port #1, Speed 8GT/s, Width x8, ASPM L1, Exit Latency L0s
<4us, L1 <4us
ClockPM- Surprise- LLActRep- BwNot+ ASPMOptComp+
LnkCtl: ASPM Disabled; Disabled- CommClk-
ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
LnkSta: Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt+
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR+, OBFF
Via message ARIFwd+
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled ARIFwd-
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-,
Selectable De-emphasis: -6dB
Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-,
EqualizationPhase1-
EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [a4] Subsystem: PLX Technology, Inc. PEX 8717 16-lane, 8-
Port PCI Express Gen 3 (8.0 GT/s) Switch with DMA
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESta: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmplt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol+
UESvrt: DLP+ SDES+ TLP+ FCP+ CmpltTO- CmpltAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr+
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [138 v1] Power Budgeting <?>
Capabilities: [10c v1] #19
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=8
Arb: Fixed- WRR32- WRR64- WRR128-

Intel® VCA 2 Product Specification and Hardware Guide

```
Ctrl: ArbSelect=Fixed
Status:      InProgress-
VC0: Caps: PATOffset=03 MaxTimeSlots=1 RejSnoopTrans-
      Arb: Fixed- WRR32- WRR64+ WRR128- TWRR128- WRR256-
      Ctrl: Enable+ ID=0 ArbSelect=WRR64 TC/VC=ff
      Status:      NegoPending- InProgress-
      Port Arbitration Table <?>
Capabilities: [e00 v1] #12
Capabilities: [f24 v1] Access Control Services
  ACSCap:      SrcValid+ TransBlk+ ReqRedir+ CmpltRedir+ UpstreamFwd+
  EgressCtrl+ DirectTrans+
  ACSCtl:      SrcValid- TransBlk- ReqRedir- CmpltRedir- UpstreamFwd-
  EgressCtrl- DirectTrans-
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: pcieport
Kernel modules: shpchp
```

```
89:00.0 Bridge: Intel Corporation Device 2956 (rev ca)
Subsystem: Intel Corporation Device 1004
Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B- DisINTx-
Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=fast >TAbort- <TAbort-
<MAbort- >SERR- <PERR- INTx-
Latency: 0, Cache Line Size: 32 bytes
Interrupt: pin A routed to IRQ 55
NUMA node: 1
Region 0: Memory at c8000000 (32-bit, non-prefetchable) [size=256K]
Region 2: Memory at 3fd00000000 (64-bit, prefetchable) [size=4G]
Capabilities: [40] Power Management version 3
  Flags: PMEClk- DSI- D1- D2- AuxCurrent=0mA PME(D0-,D1-,D2-,D3hot-
,D3cold-)
  Status: D0 NoSoftRst+ PME-Enable- DSel=0 DScale=0 PME-
Capabilities: [48] MSI: Enable- Count=1/8 Maskable+ 64bit+
  Address: 0000000000000000 Data: 0000
  Masking: 00000000 Pending: 00000000
Capabilities: [68] Express (v2) Endpoint, MSI 00
  DevCap:      MaxPayload 2048 bytes, PhantFunc 0, Latency L0s unlimited,
L1 unlimited
    ExtTag- AttnBtn- AttnInd- PwrInd- RBE+ FLReset- SlotPowerLimit
0.000W
  DevCtl:      Report errors: Correctable- Non-Fatal+ Fatal+ Unsupported+
RlxdOrd+ ExtTag- PhantFunc- AuxPwr- NoSnoop+
    MaxPayload 512 bytes, MaxReadReq 128 bytes
  DevSta:      CorrErr+ UncorrErr- FatalErr- UnsuppReq+ AuxPwr- TransPend-
  LnkCap:      Port #1, Speed 8GT/s, Width x8, ASPM L0s L1, Exit Latency
L0s <2us, L1 <4us
    ClockPM- Surprise- LLActRep- BwNot- ASPMOptComp+
  LnkCtl:      ASPM Disabled; RCB 64 bytes Disabled- CommClk-
    ExtSynch- ClockPM- AutWidDis- BWInt- AutBWInt-
  LnkSta:      Speed 8GT/s, Width x8, TrErr- Train- SlotClk- DLActive-
BWMgmt- ABWMgmt-
```

Intel® VCA 2 Product Specification and Hardware Guide

```
DevCap2: Completion Timeout: Not Supported, TimeoutDis-, LTR-, OBFF
Not Supported
DevCtl2: Completion Timeout: 50us to 50ms, TimeoutDis-, LTR-, OBFF
Disabled
LnkCtl2: Target Link Speed: 8GT/s, EnterCompliance- SpeedDis-
Transmit Margin: Normal Operating Range,
EnterModifiedCompliance- ComplianceSOS-
Compliance De-emphasis: -6dB
LnkSta2: Current De-emphasis Level: -6dB, EqualizationComplete-,
EqualizationPhase1-
EqualizationPhase2-, EqualizationPhase3-,
LinkEqualizationRequest-
Capabilities: [c8] Vendor Specific Information: Len=00 <?>
Capabilities: [100 v1] Device Serial Number ca-87-00-10-b5-df-0e-00
Capabilities: [fb4 v1] Advanced Error Reporting
UESSta: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt- UnxCmplt- RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UEMsk: DLP- SDES- TLP- FCP- CmpltTO- CmpltAbrt+ UnxCmplt+ RxOF-
MalftTLP- ECRC- UnsupReq- ACSViol-
UESvrt: DLP+ SDES+ TLP+ FCP+ CmpltTO+ CmpltAbrt- UnxCmplt- RxOF+
MalftTLP+ ECRC+ UnsupReq- ACSViol-
CESta: RxErr- BadTLP- BadDLLP- Rollover- Timeout- NonFatalErr-
CEMsk: RxErr+ BadTLP+ BadDLLP+ Rollover+ Timeout+ NonFatalErr+
AERCap: First Error Pointer: 1f, GenCap+ CGenEn+ ChkCap+ ChkEn+
Capabilities: [148 v1] Virtual Channel
Caps: LPEVC=0 RefClk=100ns PATEntryBits=1
Arb: Fixed- WRR32- WRR64- WRR128-
Ctrl: ArbSelect=Fixed
Status: InProgress-
VC0: Caps: PATOffset=00 MaxTimeSlots=1 RejSnoopTrans-
Arb: Fixed- WRR32- WRR64- WRR128- TWRR128- WRR256-
Ctrl: Enable+ ID=0 ArbSelect=Fixed TC/VC=ff
Status: NegoPending- InProgress-
Capabilities: [c34 v1] Vendor Specific Information: ID=0003 Rev=0 Len=078
<?>
Capabilities: [b70 v1] Vendor Specific Information: ID=0001 Rev=0 Len=010
<?>
Kernel driver in use: plx87xx_vca
Kernel modules: plx87xx
```

Appendix B. Glossary

Term	Definition
AVC	Advanced Video Coding
BAR	Base Address Register
BIOS	Basic Input/Output System
ECC	Error Correction Code
HEVC	High Efficiency Video Coding
iPC	Intel Product Code
KVM	Keyboard, video, mouse
MMIO	Memory-Mapped Input/Output
NFS	Network File System
NVMe*	NVM Express*
PCH	Platform Controller Hub
PCIe*	PCI Express*
SPI	Serial Peripheral Interface
Intel® VCA	Intel® Visual Compute Accelerator

Appendix C. Additional Collateral

- Intel® VCA 2 Product Brief: <https://www.intel.com/content/www/us/en/servers/accelerators/vca2-product-brief.html>
- Intel® VCA Product Family Software Guide: <https://www.intel.com/content/www/us/en/support/server-products/server-accessories/000016708.html>
- Intel® VCA Product Family Software Release notes <https://www.intel.com/content/www/us/en/support/articles/000028711/server-products/server-accessories.html>