



## PCI-SIG ENGINEERING CHANGE NOTICE

<b>TITLE:</b>	Designated Vendor-Specific Extended Capability
<b>DATE:</b>	Proposed: February 12, 2015 Member Review: May 21, 2015 Workgroup Approval: August 13, 2015
<b>AFFECTED DOCUMENT:</b>	PCI Express Base Specification 3.1 Single Root I/O Virtualization and Sharing Specification, Revision 1.1 PCI Code and ID Assignment Specification, Version 1.6
<b>SPONSOR:</b>	Steve Glaser, Nvidia

### **Part I**

#### **1. Summary of the Functional Changes**

- 5 Define a Vendor-Specific Extended Capability that is not tied to the Vendor ID of the Component or Function.

This capability includes a Vendor ID that determines the interpretation of the remainder of the capability. It is otherwise similar to the existing Vendor-Specific Extended Capability.

#### **2. Benefits as a Result of the Changes**

- 10 The existing Vendor-Specific Extended Capability (VSEC, Section 7.19) is limited to registers associated with the vendor of the component (offset 00h in PCI compatible Configuration Space).

This makes it difficult to define Vendor-Specific registers that are shared by more than one component vendor.

#### **3. Assessment of the Impact**

- 15 No impact to existing hardware or software.

#### **4. Analysis of the Hardware Implications**

No impact.

#### **5. Analysis of the Software Implications**

No impact.

- 20 **6. Analysis of the C&I Test Implications**

No impact.

## Part II

### Detailed Description of the change

In Section 7.2.2.2, page 660, line 1 make the following changes:



#### IMPLEMENTATION NOTE

##### Device-Specific Registers in Configuration Space

5 It is strongly recommended that PCI Express devices place no registers in Configuration Space other than those in headers or Capability structures architected by applicable PCI specifications.

Device-specific registers that have legitimate reasons to be placed in Configuration Space (e.g., they need to be accessible before Memory Space is allocated) should be placed in a Vendor-Specific Capability structure (in PCI Compatible Configuration Space), ~~or~~ a Vendor-Specific Extended Capability structure, or a Designated Vendor-Specific Extended Capability structure (both in PCI Express Extended Configuration Space).

Device-specific registers accessed in the run-time environment by drivers should be placed in Memory Space that is allocated by one or more Base Address registers. Even though PCI Compatible or PCI Express Extended Configuration Space may have adequate room for run-time device-specific registers, placing them there is highly discouraged for the following reasons:

- 15  Not all Operating Systems permit drivers to access Configuration Space directly.
- 20  Some platforms provide access to Configuration Space only via firmware calls, which typically have substantially lower performance compared to mechanisms for accessing Memory Space.
- Even on platforms that provide direct access to a memory-mapped PCI Express Enhanced Configuration Mechanism, performance for accessing Configuration Space will typically be significantly lower than for accessing Memory Space since:
  - 25  Configuration Reads and Writes must usually be DWORD or smaller in size,
  - Configuration Writes are usually not posted by the platform, and
  - Some platforms support only one outstanding Configuration Write at a time.

Add new section 7.x as follows:

### **7.x Designated Vendor-Specific Extended Capability (DVSEC)**

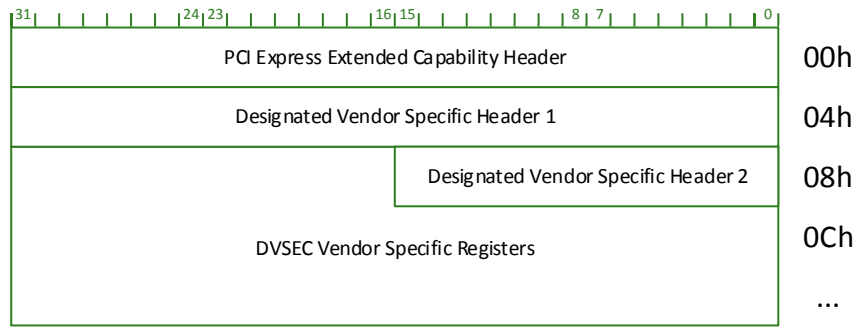
30 The PCI Express Designated Vendor-Specific Extended Capability (DVSEC) is an optional Extended Capability that is permitted to be implemented by any PCI Express Function or RCRB. This allows PCI Express component vendors to use the Extended Capability mechanism to expose vendor-specific registers that can be present in components by a variety of vendors.

35 A single PCI Express Function or RCRB is permitted to contain multiple DVSEC structures.

An example usage is a set of vendor-specific features that are intended to go into an on-going series of components from a collection of vendors. A DVSEC structure can tell vendor-specific software which features a particular component supports, including components developed after the software was released.

5 Figure 7-x1 details allocation of register fields in the DVSEC structure. The structure of the PCI Express Extended Capability header and the Designated Vendor-Specific header is architected by this specification.

The DVSEC Vendor-Specific Register area begins at offset 0Ah.



10 Figure 7-x1: Designated Vendor-Specific Extended Capability

### **7.x.1. Designated Vendor-Specific Extended Capability Header (Offset 00h)**

15 Figure 7-x2 details allocation of register fields in the Designated Vendor-Specific Extended Capability header; Table 7-x1 provides the respective bit definitions. Refer to Section 7.9.3 for a description of the PCI Express Extended Capability header. The Extended Capability ID for the Designated Vendor-Specific Capability is 0023h.

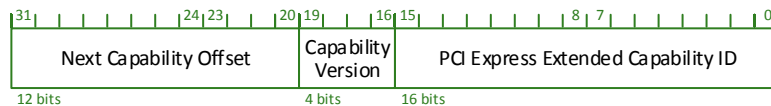


Figure 7-x2: Designated Vendor-Specific Extended Capability Header

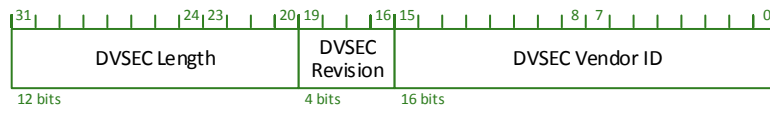
**Table 7-x1: Designated Vendor-Specific Extended Capability Header**

<b>Bit Location</b>	<b>Register Description</b>	<b>Attributes</b>
<u>15:0</u>	<b>PCI Express Extended Capability ID</b> – This field is a PCI-SIG defined ID number that indicates the nature and format of the Extended Capability. Extended Capability ID for the Designated Vendor-Specific Capability is 0023h.	<u>RO</u>
<u>19:16</u>	<b>Capability Version</b> – This field is a PCI-SIG defined version number that indicates the version of the Capability structure present. Must be 1h for this version of the specification.	<u>RO</u>
<u>31:20</u>	<b>Next Capability Offset</b> – This field contains the offset to the next PCI Express Capability structure or 000h if no other items exist in the linked list of Capabilities. For Extended Capabilities implemented in Configuration Space, this offset is relative to the beginning of PCI-compatible Configuration Space and thus must always be either 000h (for terminating list of Capabilities) or greater than 0FFh.	<u>RO</u>

## **7.x.2 Designated Vendor-Specific Header 1 (Offset 04h)**

5 Figure 7-x3 details allocation of register fields in the Designated Vendor-Specific Header 1; Table 7-x2 provides the respective bit definitions.

Vendor-specific software must qualify the DVSEC Vendor ID before attempting to interpret the DVSEC Revision field.



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**Figure 7-x3: Designated Vendor-Specific Header 1**

**Table 7-x2: Designated Vendor-Specific Header 1**

<b>Bit Location</b>	<b>Register Description</b>	<b>Attributes</b>
<u>15:0</u>	<b>DVSEC Vendor ID</b> – This field is the Vendor ID associated with the vendor that defined the contents of this capability.	<u>RO</u>
<u>19:16</u>	<b>DVSEC Revision</b> – This field is a vendor-defined version number that indicates the version of the DVSEC structure. Software must qualify the DVSEC Vendor ID and DVSEC ID before interpreting this field.	<u>RO</u>
<u>31:20</u>	<b>DVSEC Length</b> – This field indicates the number of bytes in the entire DVSEC structure, including the PCI Express Extended Capability header, the DVSEC Header 1, DVSEC Header 2, and DVSEC Vendor-Specific registers.	<u>RO</u>

### **7.x.3 Designated Vendor-Specific Header 2 (Offset 08h)**

Figure 7-x4 details allocation of register fields in the Designated Vendor-Specific Header 2; Table 7-x3 provides the respective bit definitions.

- 5 Vendor-specific software must qualify the DVSEC Vendor ID before attempting to interpret the DVSEC ID field.



**Figure 7-x4: Designated Vendor-Specific Header 2**

**Table 7-x3: Designated Vendor-Specific Header 2**

<b><u>Bit Location</u></b>	<b><u>Register Description</u></b>	<b><u>Attributes</u></b>
<u>15:0</u>	<u>DVSEC ID – This field is a vendor-defined ID that indicates the nature and format of the DVSEC structure. Software must qualify the DVSEC Vendor ID before interpreting this field.</u>	<u>RO</u>

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*For reference purposes, a copy of Section 7.19 follows. This was extracted from the PCI Express Base Specification, Revision 3.1.*

## 7.19. Vendor-Specific Capability

The PCI Express Vendor-Specific Extended Capability (VSEC) is an optional Extended Capability that is permitted to be implemented by any PCI Express Function or RCRB. This allows PCI Express component vendors to use the Extended Capability mechanism to expose vendor-specific registers.

A single PCI Express Function or RCRB is permitted to contain multiple VSEC structures.

An example usage is a set of vendor-specific features that are intended to go into an on-going series of components from that vendor. A VSEC structure can tell vendor-specific software which features a particular component supports, including components developed after the software was released.

Figure 7-91 details allocation of register fields in the VSEC structure. The structure of the PCI Express Extended Capability header and the Vendor-Specific header is architected by this specification.

With a PCI Express Function, the structure and definition of the Vendor-Specific Registers area is determined by the vendor indicated by the Vendor ID field located at byte offset 00h in PCI-compatible Configuration Space. With an RCRB, a VSEC is permitted only if the RCRB also contains an RCRB Header Capability structure, which contains a Vendor ID field indicating the vendor.

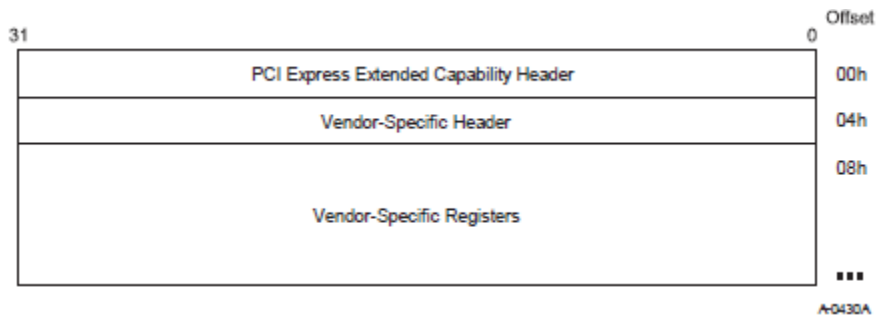
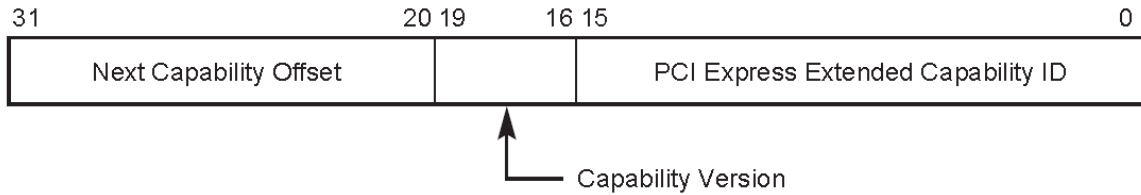


Figure 7-91: PCI Express VSEC Structure

### 7.19.1. Vendor-Specific Extended Capability Header (Offset 00h)

Figure 7-92 details allocation of register fields in the Vendor-Specific Extended Capability header; Table 7-81 provides the respective bit definitions. Refer to Section 7.9.3 for a description of the PCI Express Extended Capability header. The Extended Capability ID for the Vendor-Specific Capability is 000Bh.



**Figure 7-92: Vendor-Specific Extended Capability Header**

**Table 7-81: Vendor-Specific Extended Capability Header**

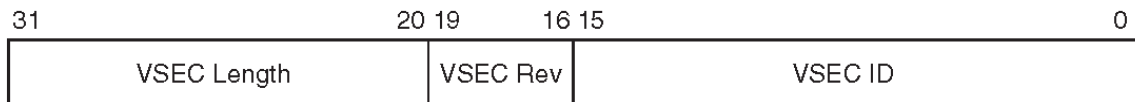
Bit Location	Register Description	Attributes
15:0	<b>PCI Express Extended Capability ID</b> – This field is a PCI-SIG defined ID number that indicates the nature and format of the Extended Capability. Extended Capability ID for the Vendor-Specific Capability is 000Bh.	RO
19:16	<b>Capability Version</b> – This field is a PCI-SIG defined version number that indicates the version of the Capability structure present. Must be 1h for this version of the specification.	RO
31:20	<b>Next Capability Offset</b> – This field contains the offset to the next PCI Express Capability structure or 000h if no other items exist in the linked list of Capabilities. For Extended Capabilities implemented in Configuration Space, this offset is relative to the beginning of PCI-compatible Configuration Space and thus must always be either 000h (for terminating list of Capabilities) or greater than 0FFh.	RO

5 **7.19.2. Vendor-Specific Header (Offset 04h)**

Figure 7-93 details allocation of register fields in the Vendor-Specific header; Table 7-82 provides the respective bit definitions.

Vendor-specific software must qualify the associated Vendor ID of the PCI Express Function or RCRB before attempting to interpret the values in the VSEC ID or VSEC Rev fields.

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**Figure 7-93: Vendor-Specific Header**

**Table 7-82: Vendor-Specific Header**

Bit Location	Register Description	Attributes
15:0	<b>VSEC ID</b> – This field is a vendor-defined ID number that indicates the nature and format of the VSEC structure. Software must qualify the Vendor ID before interpreting this field.	RO
19:16	<b>VSEC Rev</b> – This field is a vendor-defined version number that indicates the version of the VSEC structure. Software must qualify the Vendor ID and VSEC ID before interpreting this field.	RO
31:20	<b>VSEC Length</b> – This field indicates the number of bytes in the entire VSEC structure, including the PCI Express Extended Capability header, the Vendor- Specific header, and the Vendor-Specific registers.	RO



*In the SR-IOV Specification, add a row at the end of Table 3-22 as follows:*

**Table 3-22: SR-IOV Usage of PCI Express Extended Capabilities**

<b>Extended Capability ID</b>	<b>Description</b>	<b>PF Attributes</b>	<b>VF Attributes</b>
...	...	...	...
<u>0023h</u>	<u>Designated Vendor Specific</u>	<u>Base</u>	<u>Base</u>

*In the Codes and ID Specification, add a row at the end of Table 3-1 as follows:*

**Table 3-1: Extended Capability IDs**

<b>ID</b>	<b>Extended Capability</b>
...	...
<u>0023h</u>	<u>Designated Vendor Specific Extended Capability (DVSEC)</u>