EAPI

PICMG EAPI

Revision 1.0
August 8, 2010

Embedded Application Programming Interface

Open Modular Computing Specifications
Table of Contents

1 Introduction ........................................................................................................................................ 6
   1.1 Name and Logo Usage .................................................................................................................. 6
   1.2 Intellectual Property ................................................................................................................... 7
   1.3 Copyright Notice .......................................................................................................................... 8
   1.4 Trademarks ................................................................................................................................... 8
   1.5 Special Word Usage ..................................................................................................................... 9
   1.6 Acronyms / Definitions ............................................................................................................... 9
   1.7 Applicable Documents and Standards ....................................................................................... 13
   1.8 Statement of Compliance ........................................................................................................... 14

2 General ............................................................................................................................................... 15
   2.1 Parameters ..................................................................................................................................... 15
   2.2 Keywords ..................................................................................................................................... 16
   2.3 Status Codes ............................................................................................................................... 16

3 Initialization Functions .................................................................................................................... 20
   3.1 EApiLibInitialize ......................................................................................................................... 20
   3.2 EApiLibUnInitialize ....................................................................................................................... 20

4 EAPI Information Functions ............................................................................................................ 21
   4.1 EApiBoardGetStringA .................................................................................................................. 21
   4.2 EApiBoardGetValue ...................................................................................................................... 22

5 Backlight Functions .......................................................................................................................... 24
   5.1 Common Parameters for Backlight Functions ............................................................................... 24
   5.2 EApiVgaGetBacklightEnable ....................................................................................................... 25
   5.3 EApiVgaSetBacklightEnable ....................................................................................................... 25
   5.4 EApiVgaGetBacklightBrightness ............................................................................................... 26
   5.5 EApiVgaSetBacklightBrightness ............................................................................................... 27

6 Storage Functions ............................................................................................................................. 28
   6.1 Common Parameters ..................................................................................................................... 28
   6.2 EApiStorageCap ............................................................................................................................ 28
   6.3 EApiStorageAreaRead ................................................................................................................. 29
   6.4 EApiStorageAreaWrite .................................................................................................................. 30

7 Functions for the I2C Bus .................................................................................................................. 32
   7.1 Common Parameters ..................................................................................................................... 32
   7.2 Address Format for the I2C Bus .................................................................................................... 33
   7.3 I2CTransfer Types ....................................................................................................................... 34
   7.4 I2C Device Probe Types .............................................................................................................. 36
   7.5 EapiI2CGetBusCap ....................................................................................................................... 36
   7.6 EapiI2CWriteReadRaw ................................................................................................................. 37
   7.7 EapiI2CReadTransfer ................................................................................................................... 38
   7.8 EapiI2CWriteTransfer .................................................................................................................. 40
   7.9 EApiI2CProbeDevice .................................................................................................................... 41

8 WATCHDOG ....................................................................................................................................... 43
   8.1 EApiWDogGetCap ......................................................................................................................... 44
   8.2 EApiWDogStart ............................................................................................................................. 45
   8.3 EApiWDogTrigger .......................................................................................................................... 45
   8.4 EApiWDogStop ............................................................................................................................... 46

9 GPIO Functions .................................................................................................................................. 47
   9.1 Common Parameters ..................................................................................................................... 47
   9.2 EApiGPIOGetDirectionCaps ....................................................................................................... 49
   9.3 EApiGPIOGetDirection ............................................................................................................... 50
   9.4 EApiGPIOSetDirection ................................................................................................................ 51
   9.5 EApiGPIOGetLevel ....................................................................................................................... 52
   9.6 EApiGPIOSetLevel ....................................................................................................................... 53

10 Header Files .................................................................................................................................... 54
API Function Prototypes

EApiLibInitialize.......................................................................................................................... 20
EApiLibUnInitialize......................................................................................................................... 20
EApiBoardGetStringA..................................................................................................................... 21
EApiBoardGetValue......................................................................................................................... 22
EApiVgaGetBacklightEnable........................................................................................................... 25
EApiVgaSetBacklightEnable............................................................................................................ 25
EApiVgaGetBacklightBrightness...................................................................................................... 26
EApiVgaSetBacklightBrightness...................................................................................................... 27
EApiStorageCap............................................................................................................................... 28
EApiStorageAreaRead....................................................................................................................... 29
EApiStorageAreaWrite...................................................................................................................... 30
EApiI2CGetBusCap........................................................................................................................... 36
EApiI2CWriteReadRaw...................................................................................................................... 37
EApiI2CReadTransfer....................................................................................................................... 38
EApiI2CWriteTransfer...................................................................................................................... 40
EApiI2CProbeDevice........................................................................................................................ 41
EApiWDogStart............................................................................................................................... 44
EApiWDogStart............................................................................................................................... 45
EApiWDogTrigger............................................................................................................................ 45
EApiWDogStop................................................................................................................................. 46
EApiGPIOGetDirectionCaps............................................................................................................ 49
EApiGPIOGetDirection..................................................................................................................... 50
EApiGPIOSetDirection...................................................................................................................... 51
EApiGPIOGetLevel............................................................................................................................ 52
EApiGPIOSetLevel............................................................................................................................ 53
## Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>August 8, 2010</td>
<td>Revision 1.0</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Name and Logo Usage

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No disclosures in this category were made during subcommittee review.

1.2.2 Unnecessary Claims (referring to optional features or non-normative elements)

No disclosures in this category were made during subcommittee review.
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1.5 Special Word Usage

Mandatory features are indicated by the use of the word “shall.”
Recommended features are indicated by the use of the word “should.”
Optional features are indicated by the use of the word “may.”

1.6 Acronyms / Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.out</td>
<td>a.out is a file format used in older versions of Unix-like computer operating systems for executable, object code, and, in later systems, shared libraries. The name stands for assembler output.</td>
</tr>
<tr>
<td>AC ‘97</td>
<td>Audio CODEC (Coder-Decoder)</td>
</tr>
<tr>
<td>ACPI</td>
<td>Advanced Configuration Power Interface – standard to implement power saving modes in PC-AT systems</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>Atomic Error Checking</td>
<td>This is used here to refer to the mechanism of validating all arguments before modifications are carried out. <strong>Examples:</strong> EapiI2CWriteReadRaw: Validation of arguments for Read operation should be carried out before write operation. Furthermore neither write nor read operation should be carried out if an error is detected in the arguments for either. GPIO: Bitmask and Direction registers should be validated before modifying GPIO state.</td>
</tr>
<tr>
<td>BBS</td>
<td>BIOS Boot Specification</td>
</tr>
<tr>
<td>BIOS</td>
<td>Basic Input Output System – firmware in PC-AT system that is used to initialize system components before handing control over to the operating system.</td>
</tr>
<tr>
<td>Boot Counter</td>
<td>A lifetime system count of the number of times the EFI/BIOS’s Post is completed. Post completion is defined as being just prior to processor control being passed to the first boot vector. Should no valid boot vectors be present it is also considered a valid boot.</td>
</tr>
<tr>
<td>Boot Entry Vector</td>
<td>Valid int19h Interrupt Handler Vector</td>
</tr>
<tr>
<td>Boot Vector</td>
<td>Short for Boot Entry Vector</td>
</tr>
<tr>
<td>Carrier Board</td>
<td>An application specific circuit board that accepts a COM Express® Module.</td>
</tr>
<tr>
<td>COFF</td>
<td>Common Object File Format</td>
</tr>
<tr>
<td>COM Express</td>
<td>PICMG Definition for Computer-On-Modules</td>
</tr>
<tr>
<td>CPU</td>
<td>Central Processing Unit.</td>
</tr>
<tr>
<td>DDC</td>
<td>Display Data Control – VESA (Video Electronics Standards Association) standard to allow identification of the capabilities of a VGA monitor</td>
</tr>
<tr>
<td>DisplayPort</td>
<td>DisplayPort is a digital display interface standard put forth by the Video Electronics Standards Association (VESA). It defines a new license free, royalty free, digital audio/video interconnect, intended to be used primarily between a computer and its display monitor.</td>
</tr>
<tr>
<td>DVI</td>
<td>Digital Visual Interface - a Digital Display Working Group (DDWG) standard that defines a standard video interface supporting both digital and analog video signals. The digital signals use TMDS.</td>
</tr>
<tr>
<td>EAPI</td>
<td>Embedded API</td>
</tr>
<tr>
<td>EApiDK</td>
<td>EAPI Development Kit. Open source project with a test bench and sample code to encourage EAPI development. <a href="http://eapidk.sourceforge.net/">http://eapidk.sourceforge.net/</a></td>
</tr>
<tr>
<td>EDB</td>
<td>Eccentric Device Behavior</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>eDP</td>
<td>Embedded Display Port</td>
</tr>
<tr>
<td>EEPROM</td>
<td>Electrically Erasable Programmable Read-Only Memory</td>
</tr>
<tr>
<td>EFI</td>
<td>Extensible Firmware Interface (Next Generation BIOS)</td>
</tr>
<tr>
<td>EFI BIOS</td>
<td>Used to explicitly distinguish EFI and Legacy BIOS.</td>
</tr>
<tr>
<td>EFP</td>
<td>External Flat Panel</td>
</tr>
<tr>
<td>ELF</td>
<td>Executable and Linkable Format</td>
</tr>
<tr>
<td>Gb</td>
<td>Gigabit</td>
</tr>
<tr>
<td>GBE</td>
<td>Gigabit Ethernet</td>
</tr>
<tr>
<td>GPI</td>
<td>General Purpose Input</td>
</tr>
<tr>
<td>GPIO</td>
<td>General Purpose Input Output</td>
</tr>
<tr>
<td>GPO</td>
<td>General Purpose Output</td>
</tr>
<tr>
<td>HDA</td>
<td>Intel High Definition Audio (HD Audio) refers to the specification released by Intel in 2004 for delivering high definition audio that is capable of playing back more channels at higher quality than AC97.</td>
</tr>
<tr>
<td>HDMI</td>
<td>High Definition Multimedia Interface</td>
</tr>
<tr>
<td>I²C</td>
<td>Inter Integrated Circuit – 2 wire (clock and data) signaling scheme allowing communication between integrated circuits, primarily used to read and load register values.</td>
</tr>
<tr>
<td>IDE</td>
<td>Integrated Device Electronics – parallel interface for hard disk drives – also known as PATA</td>
</tr>
<tr>
<td>Int19h</td>
<td>Bootstrap Loader Service. This is the interrupt that is called at end of post to boot the OS.</td>
</tr>
<tr>
<td>Interrupt Handler Vector</td>
<td>An interrupt Handler vector is the memory address of an interrupt handler, or an index into an array called an interrupt vector table or dispatch table. Interrupt vector tables contain the memory addresses of interrupt handlers. When an interrupt is generated, the processor saves its execution state via a context switch, and begins execution of the interrupt handler at the interrupt vector.</td>
</tr>
<tr>
<td>Interrupt Vector</td>
<td>Short for Interrupt Handler Vector</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>Legacy BIOS</td>
<td>Used to explicitly distinguish EFI and Legacy BIOS.</td>
</tr>
<tr>
<td>Legacy Device</td>
<td>Relics from the PC-AT computer that are not in use in contemporary PC systems: primarily the ISA bus, UART-based serial ports, parallel printer ports, PS-2 keyboards, and mice. Definitions vary as to what constitutes a legacy device. Some definitions include IDE as a legacy device.</td>
</tr>
<tr>
<td>LFP</td>
<td>Local Flat Panel</td>
</tr>
<tr>
<td>LPC</td>
<td>Low Pin-Count Interface: a low speed interface used for peripheral circuits such as Super I/O controllers, which typically combine legacy-device support into a single IC.</td>
</tr>
<tr>
<td>LS</td>
<td>Least Significant</td>
</tr>
<tr>
<td>LSB</td>
<td>Least Significant Byte</td>
</tr>
<tr>
<td>LVDS</td>
<td>Low Voltage Differential Signaling – widely used as a physical interface for TFT flat panels. LVDS can be used for many high-speed signaling applications. In this document, it refers only to TFT flat-panel applications.</td>
</tr>
<tr>
<td>MS</td>
<td>Most Significant</td>
</tr>
<tr>
<td>MSB</td>
<td>Most Significant Byte</td>
</tr>
<tr>
<td>NA</td>
<td>Not Available</td>
</tr>
<tr>
<td>NC</td>
<td>No Connect</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>OS</td>
<td>Operating System</td>
</tr>
<tr>
<td>PATA</td>
<td>Parallel AT Attachment – parallel interface standard for hard-disk drives – also known as IDE, AT Attachment, and as ATA</td>
</tr>
<tr>
<td>PC-AT</td>
<td>“Personal Computer – Advanced Technology” – an IBM trademark term used to refer to Intel x86 based personal computers in the 1990s</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed Circuit Board</td>
</tr>
<tr>
<td>PCI</td>
<td>Peripheral Component Interface</td>
</tr>
<tr>
<td>PCIe</td>
<td>Peripheral Component Interface Express – next-generation high speed Serialized I/O bus</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>PE</td>
<td>Portable Executable</td>
</tr>
<tr>
<td>PE/COFF</td>
<td>Another name for PE</td>
</tr>
<tr>
<td>PEG</td>
<td>PCI Express Graphics</td>
</tr>
<tr>
<td>PHY</td>
<td>Ethernet controller physical layer device</td>
</tr>
<tr>
<td>PNP</td>
<td>Plug and Play</td>
</tr>
<tr>
<td>PNPID</td>
<td>Microsoft Plug-And-Play ID (PNP ID). This ID can be registered at the MS web page (<a href="http://www.microsoft.com/whdc/system/pnppwr/pnp/pnpid.mspx">http://www.microsoft.com/whdc/system/pnppwr/pnp/pnpid.mspx</a>) free of charge. The PNP ID Format is XXX where 'A'&lt;=X&lt;='Z'</td>
</tr>
<tr>
<td>Post</td>
<td>Power On Self Test, For the purpose of this document this refers to period of time After CPU exits reset up until OS boot process begins. Standard definition is the Period of time after boot block if present up until OS boot process begins.</td>
</tr>
<tr>
<td>PS2</td>
<td>“Personal System 2” - an IBM trademark term used to refer to Intel x86 based personal computers in the 1990s. The term survives as a reference to the style of mouse and keyboard interface that were introduced with the PS2 system.</td>
</tr>
<tr>
<td>PS2 Keyboard</td>
<td>A lifetime System count of the number of times the system reset goes inactive. Adequate debounce protection is presumed.</td>
</tr>
<tr>
<td>PS2 Mouse</td>
<td>Read Only Memory – a legacy term – often the device referred to as a ROM can actually be written to, in a special mode. Such writable ROMs are sometimes called Flash ROMs. BIOS is stored in ROM or Flash ROM.</td>
</tr>
<tr>
<td>Reset Counter</td>
<td>Real Time Clock – battery backed circuit in PC-AT systems that keeps system time and date as well as certain system setup parameters</td>
</tr>
<tr>
<td>Run-time</td>
<td>Used to refer to the time period after post and before a CPU reset.</td>
</tr>
<tr>
<td>Run-time Services</td>
<td>Used to refer to Services, Software interfaces left active after Post. Examples Are Int13h Disk access interface and PNP.</td>
</tr>
<tr>
<td>S0, S1, S2, S3, S4, S5</td>
<td>System states describing the power and activity level</td>
</tr>
<tr>
<td>SAS</td>
<td>Serial Attached SCSI – high speed serial version of SCSI</td>
</tr>
<tr>
<td>SATA</td>
<td>Serial AT Attachment: serial-interface standard for hard disks</td>
</tr>
<tr>
<td>SCSI</td>
<td>Small Computer System Interface – an interface standard for high end disk drives and other computer peripherals</td>
</tr>
<tr>
<td>SDVO</td>
<td>Serialized Digital Video Output – Intel defined format for digital video output that can be used with Carrier Board conversion ICs to create parallel, TMDS, and LVDS flat-panel formats as well as NTSC and PAL TV outputs. SDVO is a proprietary Intel technology introduced with their 9xx-series of motherboard chipsets. The specification is not public available.</td>
</tr>
<tr>
<td>SM Bus</td>
<td>System Management Bus</td>
</tr>
<tr>
<td>SPI</td>
<td>Serial Peripheral Interface</td>
</tr>
<tr>
<td>Super I/O</td>
<td>An integrated circuit, typically interfaced via the LPC bus that provides legacy PC I/O functions including PS2 keyboard and mouse ports, serial and parallel port(s) and a floppy interface.</td>
</tr>
<tr>
<td>TFT</td>
<td>Thin Film Transistor – refers to technology used in active matrix flat-panel displays, in which there is one thin film transistor per display pixel.</td>
</tr>
<tr>
<td>TMDS</td>
<td>Transition Minimized Differential Signaling - a digital signaling protocol between the graphics subsystem and display. TMDS is used for the DVI digital signals.</td>
</tr>
<tr>
<td>TPM</td>
<td>Trusted Platform Module, chip to enhance the security features of a computer system.</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
<tr>
<td>VGA</td>
<td>Video Graphics Adapter – PC-AT graphics adapter standard defined by IBM.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Watchdog</strong></td>
<td>A hardware or software count-down timer that must be repeatedly reset or triggered at regular intervals by an operating program to prevent time-out. If the timer is not reset in time (meaning the operating program has stalled or has failed in some way), the timer times-out and alerts the system and/or operator of the failure.</td>
</tr>
<tr>
<td><strong>Watchdog Trigger</strong></td>
<td>The process or technique or resting the Watchdog counter, preventing a Watchdog timeout event.</td>
</tr>
<tr>
<td><strong>WDT</strong></td>
<td>Watch Dog Timer.</td>
</tr>
</tbody>
</table>
1.7 Applicable Documents and Standards

The following publications are used in conjunction with this standard. When any of the referenced specifications are superseded by an approved revision, that revision shall apply. All documents may be obtained from their respective organizations.

- Audio Codec ’97 Revision 2.3 Revision 1.0, April 2002 Copyright © 2002 Intel Corporation. All rights reserved. download.intel.com/support/motherboards/desktop/sb/ac97_r23.pdf
- ExpressCard® Standard 2.0, June 2009 Copyright © 2009 PCMCIA. All rights reserved. http://www.expresscard.org/
- HDA - High Definition Audio Specification, Revision 1.0, April 15, 2004 Copyright © 2002 Intel Corporation. All rights reserved. http://www.intel.com/standards/hdaudio/
- Intel Low Pin Count (LPC) Interface Specification Revision 1.1, August 2002 Copyright © 2002 Intel Corporation. All rights reserved. http://developer.intel.com/design/chipsets/industry/lpc.htm
- PCI Express Base Specification Revision 2.0, December 20, 2006, Copyright © 2002-2006 PCI Special Interest Group. All rights reserved. http://www.pcisig.com/
- SDIO, Secure Digital Input/Output
SD Specifications Part E1 SDIO Specification Version 2.00, February 8, 2007 Copyright 2007 SD Card Association http://www.sdcard.org
1.8 Statement of Compliance

Statements of compliance with this specification take the form specified in the PICMG® Policies and Procedures for Specification Development:

“This product provides software support for PICMG® EAPI Revision 1.0.”

Products making this simple claim of compliance must provide, at a minimum, all features defined in this specification as being mandatory by the use of the keyword “shall” in the body of the specification. Such products may also provide recommended features associated with the keyword “should” and permitted features associated with the keyword “may” as well.

Because the specification provides for a number of recommended and permitted features beyond the mandatory minimum set and a wide range of performance capabilities, more complete descriptions of product compliance are encouraged.
2 General

COM Express specifies functions for industrial applications which do not feature a common programming interface. Target is to avoid software modifications when changing COM Express module suppliers. This section describes a proposal for a common API to unify the software control for:

- System information
- Watchdog timer
- I2C Bus
- Flat Panel brightness control
- User storage area
- GPIO

The EAPI definition is open to be used for other embedded form factors too.

2.1 Parameters

Parameters which can return a value are defined as pointers to the data. The other parameters are defined as values. The immediate return value is an error code.

Parameters should be validated using ‘Atomic Error Checking’ (See chapter 1.5 page 9).
### 2.2 Keywords

In order to improve the readability this document features keywords used before variables.

#### 2.2.1 __IN

<table>
<thead>
<tr>
<th>Parameter Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate value</td>
<td>Input value that must be specified and is essential</td>
</tr>
<tr>
<td>Pointer</td>
<td>Valid pointer to initialized buffer/variable</td>
</tr>
</tbody>
</table>

#### 2.2.2 __OUT

<table>
<thead>
<tr>
<th>Parameter Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pointer</td>
<td>Valid pointer to destination buffer/variable</td>
</tr>
</tbody>
</table>

#### 2.2.3 __INOPT

<table>
<thead>
<tr>
<th>Parameter Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pointer</td>
<td>Valid pointer to initialized buffer/variable, or NULL Pointer. Note: refer to function specification for specifics.</td>
</tr>
</tbody>
</table>

#### 2.2.4 __OUTOPT

<table>
<thead>
<tr>
<th>Parameter Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pointer</td>
<td>Valid pointer to destination buffer/variable, or NULL Pointer. Note: refer to function specification for specifics.</td>
</tr>
</tbody>
</table>

#### 2.2.5 __INOUT

<table>
<thead>
<tr>
<th>Parameter Type</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pointer</td>
<td>Valid pointer to initialized buffer/variable. Contents of buffer/variable updated before return.</td>
</tr>
</tbody>
</table>

### 2.3 Status Codes

All *EApi* functions immediately return a status code from a common list of possible errors.

Any function may return any of the defined status codes.

#### 2.3.1 Status Code Description

**EAPI_STATUS_NOT_INITIALIZED**

**Description**
The EAPI library is not yet or unsuccessfully initialized. *EApiLibInitialize* needs to be called prior to the first access of any other EAPI function.

**Actions**
Call *EApiLibInitialize*. 
**EAPI_STATUS_INITIALIZED**

**Description**
Library is initialized.

**Actions**
none.

**EAPI_STATUS_ALLOC_ERROR**

**Description**
Memory Allocation Error.

**Actions**
Free memory and try again.

**2.3.2 EAPI_STATUS_SW_TIMEOUT**

**Description**
Software time out. This is Normally caused by hardware/software semaphore timeout.

**Actions**
Retry.

**EAPI_STATUS_INVALID_PARAMETER**

**Description**
One or more of the EAPI function call parameters are out of the defined range.

**Actions**
Verify Function Parameters.

**EAPI_STATUS_INVALID_BLOCK_LENGTH**

**Description**
This means that the Block length is too long.

**Actions**
Use relevant Capabilities information to correct select block lengths.

**EAPI_STATUS_INVALID_BLOCK_ALIGNMENT**

**Description**
The Block Alignment is incorrect.

**Actions**
Use Alignment Capabilities information to correctly align write access.

**EAPI_STATUS_INVALID_DIRECTION**

**Description**
The current Direction Argument attempts to set GPIOs to a unsupported directions. I.E. Setting GPI to Output.

**Actions**
Use pInputs and pOutputs to correctly select input and outputs.

**EAPI_STATUS_INVALID_BITMASK**

**Description**
The Bitmask Selects bits/GPIOs which are not supported for the current ID.

**Actions**
Use pInputs and pOutputs to probe supported bits.
EAPI_STATUS_UNSUPPORTED

Description
This function or ID is not supported at the actual hardware environment.

Actions
none.

EAPI_STATUS_NOT_FOUND

Description
Selected device was not found.

Example
The I2C device address is not Acknowledged, device is not present or inactive.

Actions
none.

EAPI_STATUS_BUSY_COLLISION

Description
The selected device or ID is busy or a data collision was detected.

Example
The addressed I2C bus is busy or there is a bus collision. The I2C bus is in use. Either CLK or DAT are low. Arbitration loss or bus Collision, data remains low when writing a 1.

Actions
Retry.

EAPI_STATUS_RUNNING

Description
Watchdog timer already started.

Actions
Call EApiWDogStop, before retrying.

2.3.3 EAPI_STATUS_HW_TIMEOUT

Description
Function call timed out

Example
I2C operation lasted too long.

Actions
Retry.

EAPI_STATUS_READ_ERROR

Description
An error was detected during a read operation.

Example
I2C Read function was not successful

Actions
Retry.
EAPI_STATUS_WRITE_ERROR

Description
An error was detected during a write operation.

Example
I2C Write function was not successful.
No Acknowledge was received after writing any byte after the first address byte.
Can be caused by unsupported device command/index.
10Bit Address Device Not Present
Storage Write Error

Actions
Retry.

EAPI_STATUS_MORE_DATA

Description
The amount of available data exceeds the buffer size.
Storage buffer overflow was prevented. Read count was larger then the defined buffer length.

Actions
Either increase the buffer size or reduce the block length.

EAPI_STATUS_ERROR

Description
Generic error message. No further error details are available.

Actions
none.

EAPI_STATUS_SUCCESS

The value for this status code is defined as 0.

Description
The operation was successful.

Actions
None.

Macros for Status Codes

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_TEST_SUCCESS</td>
<td>Can be used to check if the status is EAPI_STATUS_SUCCESS.</td>
</tr>
</tbody>
</table>
3 Initialization Functions

3.1 EApiLibInitialize

```
uint32_t
EAPI_CALLTYPE
EApiLibInitialize(void);
```

3.1.1 Description:
General initialization of the EAPI. Prior to calling any EAPI function the library needs to be initialized by calling this function. The status code for all EAPI function will be `EAPI_STATUS_NOT_INITIALIZED` unless this function is called.

3.1.2 Parameters
None.

3.1.3 Return Status Code

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library initialized</td>
<td><code>EAPI_STATUS_INITIALIZED</code></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td><code>EAPI_STATUS_SUCCESS</code></td>
</tr>
</tbody>
</table>

3.2 EApiLibUnInitialize

```
uint32_t
EAPI_CALLTYPE
EApiLibUnInitialize(void);
```

3.2.1 Description:
General function to uninitialized the EAPI library. Should be called before program exit.

In a dynamic library environment this function is not expected to replace the native uninitialize routines. It is expected that in this environments this function has no functionality.

3.2.2 Parameters
None.

3.2.3 Return Status Code

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><code>EAPI_STATUS_NOT_INITIALIZED</code></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td><code>EAPI_STATUS_SUCCESS</code></td>
</tr>
</tbody>
</table>
# 4 EAPI Information Functions

## 4.1 EApiBoardGetStringA

```c
uint32_t EAPI_CALLTYPE EApiBoardGetStringA(
    __IN uint32_t Id,  /* Name Id */
    __OUT char *pBuffer, /* Destination pBuffer */
    __INOUT uint32_t *pBufLen /* pBuffer Length */
);
```

### 4.1.1 Description:
Text information about the hardware platform.

### 4.1.2 Parameters

- **Id**
  - **__IN** Selects the Get String Sub function Id.

- **pBuffer**
  - **__OUT** Pointer to a buffer that receives the value's data. This parameter can be NULL if the data is not required.

- **pBufLen**
  - **__INOUT** Pointer to a variable that specifies the size, in bytes, of the buffer pointed to by the `pBuffer` parameter. When the function returns, this variable contains the size of the data copied to `pBuffer` including the terminating null character.

  If the buffer specified by `pBuffer` parameter is not large enough to hold the data, the function returns the value `EAPI_STATUS_MORE_DATA` and stores the required buffer size, in bytes, into the variable pointed to by `pBufLen`.

  If `pBuffer` is NULL, and `pBufLen` is non-NULL, the function returns `EAPI_STATUS_MORE_DATA`, and stores the size of the data, in bytes, in the variable pointed to by `pBufLen`. This lets an application determine the best way to allocate a buffer for the value's data.

  Find more details refer to the platform specific header files. The Platform ID is defined by the specification and is “COMExpress” for COM Express.

<table>
<thead>
<tr>
<th>Id</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>EAPI_ID_BOARD_MANUFACTURER_STR</code></td>
<td>Board Manufacturer Name</td>
<td>PICMG</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_NAME_STR</code></td>
<td>Board Name</td>
<td>SAMPLE API</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_SERIAL_STR</code></td>
<td>Serial Number</td>
<td>Sample Serial Number</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_BIOS_REVISION_STR</code></td>
<td>Board BIOS Revision</td>
<td>PICMGR2.0</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_PLATFORM_TYPE_STR</code></td>
<td>Platform ID See 'Platform Specification' on page 22</td>
<td>COMExpress</td>
</tr>
</tbody>
</table>
4.1.3 Return Status Code

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><code>EAPI_STATUS_NOT_INITIALIZED</code></td>
</tr>
<tr>
<td>pBufLen==NULL</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>*pBufLen&amp;&amp;pBuffer==NULL</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>unknown Id</td>
<td><code>EAPI_STATUS_UNSUPPORTED</code></td>
</tr>
<tr>
<td>Id String Length +1&gt;*pBufLen</td>
<td><code>EAPI_STATUS_MORE_DATA</code></td>
</tr>
<tr>
<td>Success</td>
<td><code>EAPI_STATUS_SUCCESS</code></td>
</tr>
</tbody>
</table>

4.2 EApiBoardGetValue

```c
uint32_t
EAPI_CALLTYPE
EApiBoardGetValue(
    __IN uint32_t Id, /* Value Id */
    __OUT uint32_t *pValue /* Return Value */
);
```

4.2.1 Description

Information about the hardware platform in value format.

4.2.2 Parameters

**Id**

__IN Selects the Get Value Sub function Id.

<table>
<thead>
<tr>
<th>Id</th>
<th>Description</th>
<th>Units/Format</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>EAPI_ID_GET_EAPI_SPEC_VERSION</code></td>
<td>EAPI Specification Version used to implement API</td>
<td>'Specification Version Number Format' see page 77</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_BOOT_COUNTER_VAL</code></td>
<td>'Boot Counter' see page 9</td>
<td>boots</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_RUNNING_TIME_METER_VAL</code></td>
<td>'Running Time Meter' see page 11</td>
<td>minutes</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_PNPID_VAL</code></td>
<td>Board Vendor PNPID see page 11</td>
<td>'Compressed ASCII PNPID' page 77</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_PLATFORM_REV_VAL</code></td>
<td>Platform Specification Version used to create board. See 'Platform ID' on page 21</td>
<td>'Specification Version Number Format' see page 77</td>
</tr>
<tr>
<td><code>EAPI_ID_BOARD_DRIVER_VERSION_VAL</code></td>
<td>Vendor Specific Driver Version</td>
<td>'General Version number Format' page 78</td>
</tr>
</tbody>
</table>

1 may be supported
<table>
<thead>
<tr>
<th>Id</th>
<th>Description</th>
<th>Units/Format</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>EAPI_ID_BOARD_LIB_VERSION_VAL</code></td>
<td>Vendor Specific Library</td>
<td>'General Version number Format' page 78</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_CPU_TEMP</code></td>
<td>CPU Temperature</td>
<td>0.1 Kelvins</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_CHIPSET_TEMP</code></td>
<td>Chipset Temperature</td>
<td>0.1 Kelvins</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_SYSTEM_TEMP</code></td>
<td>System Temperature</td>
<td>0.1 Kelvins</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_VOLTAGE_VCORE</code></td>
<td>CPU Core Voltage</td>
<td>millivolts</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_VOLTAGE_2V5</code></td>
<td>2.5V Voltage</td>
<td>millivolts</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_VOLTAGE_3V3</code></td>
<td>3.3V Voltage</td>
<td>millivolts</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_VOLTAGE_VBAT</code></td>
<td>Battery Voltage</td>
<td>millivolts</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_VOLTAGE_5V</code></td>
<td>5V Voltage</td>
<td>millivolts</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_VOLTAGE_5VSB</code></td>
<td>5V Standby Voltage</td>
<td>millivolts</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_VOLTAGE_12V</code></td>
<td>12V Voltage</td>
<td>millivolts</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_FAN_CPU</code></td>
<td>CPU Fan</td>
<td>RPM</td>
</tr>
<tr>
<td><code>EAPI_ID_HWMON_FAN_SYSTEM</code></td>
<td>System Fan</td>
<td>RPM</td>
</tr>
</tbody>
</table>

pValue

__OUT__ Pointer to a buffer that receives the value's data.

### 4.2.3 Return Status Code

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><code>EAPI_STATUS_NOT_INITIALIZED</code></td>
</tr>
<tr>
<td>pValue==NULL</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>unknown Id</td>
<td><code>EAPI_STATUS_UNSUPPORTED</code></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td><code>EAPI_STATUS_SUCCESS</code></td>
</tr>
</tbody>
</table>
5 Backlight Functions

This function sub set facilitates backlight control for Integrated flat panel displays, typically LVDS.

5.1 Common Parameters for Backlight Functions

5.1.1 Backlight Ids

Selects the flat panel display.

<table>
<thead>
<tr>
<th>Id</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_ID_BACKLIGHT_1</td>
<td>Backlight Local Flat Panel 1</td>
</tr>
<tr>
<td>EAPI_ID_BACKLIGHT_2</td>
<td>Backlight Local Flat Panel 2</td>
</tr>
<tr>
<td>EAPI_ID_BACKLIGHT_3</td>
<td>Backlight Local Flat Panel 3</td>
</tr>
</tbody>
</table>

The IDs for the backlights are filled according to this fill order:
- Internal PWM
- EAPI_COM0_ID_I2C_LVDS_1 I2C Device
- SDVOB PWM (via SDVO to LVDS converter)
- SDVOB I2C Device (via SDVO to LVDS converter)
- SDVOC PWM (via SDVO to LVDS converter)
- SDVOC I2C Device (via SDVO to LVDS converter)
- DDI1 I2C Device eDP
- DDI2 I2C Device eDP
- DDI3 I2C Device eDP

The EAPI expects that the backlight control hardware for the SDVO ports is implemented according to the Intel SDVO specification.

5.1.2 Backlight Enable Values

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_BACKLIGHT_SET_ON</td>
<td>Requests/Signifies that the Backlight be Enabled</td>
</tr>
<tr>
<td>EAPI_BACKLIGHT_SET_OFF</td>
<td>Requests/Signifies that the Backlight be Disabled</td>
</tr>
</tbody>
</table>

5.1.3 Backlight Brightness Value Range

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_BACKLIGHT_SET_DIMMEST</td>
<td>Represents the lower range bound for the backlight brightness</td>
</tr>
<tr>
<td>EAPI_BACKLIGHT_SET_BRIGHTEST</td>
<td>Represents the upper range bound for the backlight brightness</td>
</tr>
</tbody>
</table>

5.2 EApiVgaGetBacklightEnable
5.2.1 Description
Returns current Backlight Enable state for specified Flat Panel.

5.2.2 Parameters

Id

__IN See '5.1.1 Backlight Ids' on page 24

pEnable

__OUT Pointer to a buffer that receives the the current backlight enable state.
See 5.1.2 Backlight Enable Values on page 24.

5.2.3 Return Status Code

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>pEnable==NULL</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>unknown Id</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td></td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

5.3 EApiVgaSetBacklightEnable

5.3.1 Description
Enables the backlight of the selected flat panel display.

5.3.2 Parameters

Id

__IN See '5.1.1 Backlight Ids' on page 24

Enable

__IN Backlight Enable options. See 5.1.2 Backlight Enable Values on page 24.
5.3.3 Return Status Code

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><strong>EAPI_STATUS_NOT_INITIALIZED</strong></td>
</tr>
<tr>
<td>Enable != EAPI_BACKLIGHT_SET_ON &amp; Enable != EAPI_BACKLIGHT_SET_OFF</td>
<td><strong>EAPI_STATUS_INVALID_PARAMETER</strong></td>
</tr>
<tr>
<td>unknown Id</td>
<td><strong>EAPI_STATUS_UNSUPPORTED</strong></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td><strong>EAPI_STATUS_SUCCESS</strong></td>
</tr>
</tbody>
</table>

5.4 **EApiVgaGetBacklightBrightness**

```c
uint32_t
EAPI_CALLTYPE
EApiVgaGetBacklightBrightness(
    __IN  uint32_t  Id       , /* Backlight Id */
    __OUT uint32_t  *pBright /* Backlight Brightness */
);
```

5.4.1 Description
Reads the current brightness of the selected flat panel display.

5.4.2 Parameters
- **Id**
  - __IN See '5.1.1 Backlight Ids' on page 24
- **pBright**
  - __OUT Pointer to a buffer that receives the current backlight brightness level.
  - See 5.1.3 Backlight Brightness Value Range on page 24.

5.4.3 Return Status Code

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><strong>EAPI_STATUS_NOT_INITIALIZED</strong></td>
</tr>
<tr>
<td>pBright == NULL</td>
<td><strong>EAPI_STATUS_INVALID_PARAMETER</strong></td>
</tr>
<tr>
<td>unknown Id</td>
<td><strong>EAPI_STATUS_UNSUPPORTED</strong></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td><strong>EAPI_STATUS_SUCCESS</strong></td>
</tr>
</tbody>
</table>

5.5 **EApiVgaSetBacklightBrightness**
5.5.1 Description
Sets the brightness of the selected flat panel display.

5.5.2 Parameters

Id
__IN See '5.1.1 Backlight Ids' on page 24

Bright
__IN Backlight Brightness level. See 5.1.3 Backlight Brightness Value Range on page 24.

5.5.3 Return Status Code

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>Bright&gt;EAPI_BACKLIGHT_SET_BRIGHTEST</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>unknown Id</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

```c
uint32_t
EAPI_CALLTYPE
EApiVgaSetBacklightBrightness(
    __IN  uint32_t Id ,  /* Backlight Id */
    __IN  uint32_t Bright /* Backlight Brightness */
);
```

**FUNC_DEF 8: EApiVgaSetBacklightBrightness**
6 Storage Functions

The EAPI defines one user storage area with a minimal size of 32 Byte.

6.1 Common Parameters

6.1.1 Storage Ids

The EAPI only defines one user storage area. Additional vendor specific IDs are possible (see section 11 'Vendor Specific IDs' on page 76)

<table>
<thead>
<tr>
<th>Id</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_ID_STORAGE_STD</td>
<td>Standard Storage Area &gt;=32Bytes for read/write access</td>
</tr>
</tbody>
</table>

6.2 EApiStorageCap

```
uint32_t
EAPI_CALLTYPE
EApiStorageCap(
    __IN  uint32_t  Id  ,  /* Storage Area Id */
    __OUT uint32_t  *pStorageSize  ,  /* Total */
    __OUT uint32_t  *pBlockLength   /* Write Block Length */
    * & Alignment */
);
```

6.2.1 Description

Get the capabilities of the selected storage area.

6.2.2 Parameters

Id

__IN See '6.1.1 Storage Ids' on page 28

pStorageSize

__OUTOPT Pointer to a buffer that receives storage area size. This parameter can be NULL if the data is not required.

pBlockLength

__OUTOPT Pointer to a buffer that receives the the storage areas alignment/Block size. This parameter can be NULL if the data is not required. The value must be used to calculate write block alignment and size.
6.2.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>((pStorageSize==NULL) &amp;&amp; (pBlockLength==NULL))</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>Unsupported Id</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

6.3 EApiStorageAreaRead

```c
uint32_t
EAPI_CALLTYPE
EApiStorageAreaRead(
    __IN uint32_t Id,  /* Storage Area Id */
    __IN uint32_t Offset,  /* Byte Offset */
    __OUT void *pBuffer,  /* Pointer to Data pBuffer */
    __IN uint32_t BufLen,  /* Data pBuffer Size in bytes */
    __IN uint32_t ByteCnt /* Number of bytes to read */
);
```

6.3.1 Description
Writes data to the selected user data area.

6.3.2 Parameters

Id
__IN See '6.1.1 Storage Ids' on page 28

Offset
__IN Storage area start address offset in bytes.

pBuffer
__OUT Pointer to a buffer that receives the read data.

BufLen
__IN Size, in bytes, of the buffer pointed to by the pBuffer parameter

ByteCnt
__IN Size, in bytes, of the information read to the buffer pointed to by the pBuffer parameter
6.3.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>pBuffer==NULL</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>ByteCnt==0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>BufLen==0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>unknown Id</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>Offset+ByteCnt&gt;pStorageSize</td>
<td>EAPI_STATUS_INVALID_BLOCK_LENGTH</td>
</tr>
<tr>
<td>Read Error</td>
<td>EAPI_STATUS_READ_ERROR</td>
</tr>
<tr>
<td>ByteCnt&gt;BufLen</td>
<td>EAPI_STATUS_MORE_DATA</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

6.4 EApiStorageAreaWrite

```c
uint32_t
EAPI_CALLTYPE
EApiStorageAreaWrite(
    __IN  uint32_t  Id       , /* Storage Area Id */
    __IN  uint32_t  Offset   , /* Byte Offset */
    __IN  void    *pBuffer  , /* Pointer to Data pBuffer */
    __IN  uint32_t  ByteCnt  /* Number of bytes to write*/
);
```

6.4.1 Description

Writes data to the selected user data area.

6.4.2 Parameters

Id

__IN See '6.1.1 Storage Ids' on page 28

Offset

__IN Storage area start address offset in bytes. This value must be a multiple of *pBlockLength.

pBuffer

__IN Pointer to a buffer containing the data to be stored.

ByteCnt

__IN Size, in bytes, of the information pointed to by the pBuffer parameter
### 6.4.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><code>EAPI_STATUS_NOT_INITIALIZED</code></td>
</tr>
<tr>
<td>pBuffer==NULL</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>ByteCnt==0</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>unknown id</td>
<td><code>EAPI_STATUS_UNSUPPORTED</code></td>
</tr>
<tr>
<td>Offset%pBlockLength</td>
<td><code>EAPI_STATUS_INVALID_BLOCK_ALIGNMENT</code></td>
</tr>
<tr>
<td>ByteCnt%pBlockLength</td>
<td><code>EAPI_STATUS_INVALID_BLOCK_ALIGNMENT</code></td>
</tr>
<tr>
<td>Offset+ByteCnt&gt;pStorageSize</td>
<td><code>EAPI_STATUS_INVALID_BLOCK_LENGTH</code></td>
</tr>
<tr>
<td>Write Error</td>
<td><code>EAPI_STATUS_WRITE_ERROR</code></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td><code>EAPI_STATUS_SUCCESS</code></td>
</tr>
</tbody>
</table>
7 Functions for the I2C Bus

Set of function to access the I2C bus.

7.1 Common Parameters

7.1.1 I2C Bus IDs

The EAPI specification currently defines three I2C buses for COM Express. Additional vendor or platform specific IDs are possible (see section 11 'Vendor Specific IDs' on page 76)

<table>
<thead>
<tr>
<th>Id</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_ID_I2C_EXTERNAL</td>
<td>Baseboard I2C Interface</td>
</tr>
<tr>
<td>EAPI_ID_I2C_LVDS_1</td>
<td>LVDS/EDP 1 Interface</td>
</tr>
<tr>
<td>EAPI_ID_I2C_LVDS_2</td>
<td>LVDS/EDP 2 Interface</td>
</tr>
</tbody>
</table>

7.1.2 LVDS IDs Fill order.

Only required if multiple Local Flat panels present.

- Internal LFP
- SDVOB
- SDVOC
- DDI1
- DDI2
- DDI3
7.2 Address Format for the I2C Bus

The I2C specification defines a 7 bit and a 10 bit address format. Both formats can be used for the High level functions EapiI2CReadRegister and EapiI2CWriteRegister. Only 7 bit addresses are supported for the low level function EapiI2CWriteRead. This is because 10 Bit addresses are realized in the I2C Specification as an extended write read transfer and are not addressable as 7 Bit devices.

7 Bit and 10 Bit I2C Address format

/*
 *  L = Set to 0
 *  H = Set to 1
 *  X = Don't Care
 *  0-F Address Bit
 *  *
 *  Bits 31-16 are Reserved and should be set to 0
 *  *
 *  Bit Offset       F E D C B A 9 8 7 6 5 4 3 2 1 0
 *  7 Bit Address   L L L L L L L L 6 5 4 3 2 1 0 X
 *  10 Bit Address  H H H H L 9 8 X 7 6 5 4 3 2 1 0
 *  *
 *  Examples where Don't Care bits set to 0
 *  * Encoded Encoded
 *  Address     7Bit    10Bit
 *  0x01      0x02   0xF001
 *  0x58      0xA0   0xF058
 *  0x59      0xA2   0xF059
 *  0x77      0xEE   0xF077
 *  0x3FF            0xF6FF
 */

Macros for address decoding and encoding

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_I2C_ENC_7BIT_ADDR()</td>
<td>Encodes 7Bit I2C Address</td>
</tr>
<tr>
<td>EAPI_I2C_ENC_10BIT_ADDR()</td>
<td>Encodes 10Bit I2C Address</td>
</tr>
<tr>
<td>EAPI_I2C_DEC_7BIT_ADDR()</td>
<td>Decodes 7Bit I2C Address</td>
</tr>
<tr>
<td>EAPI_I2C_DEC_10BIT_ADDR()</td>
<td>Decodes 10Bit I2C Address</td>
</tr>
<tr>
<td>EAPI_I2C_IS_7BIT_ADDR()</td>
<td>Checks if 7Bit I2C Address</td>
</tr>
<tr>
<td>EAPI_I2C_IS_10BIT_ADDR()</td>
<td>Checks if 10Bit I2C Address</td>
</tr>
</tbody>
</table>
7.3 I2C Transfer Types

Transfer Type 1:
- Address Format: 7Bit
- Command Type: None
- Data Direction: Write
- Start<Addr Byte 1 LSB><W>Ack<Data Byte 1>Ack Stop

Transfer Type 2:
- Address Format: 7Bit
- Command Type: None
- Data Direction: Read
- Start<Addr Byte 1 LSB><R>Ack<Data Byte 1>Nak Stop

Transfer Type 3:
- Address Format: 7Bit
- Command Type: Standard
- Data Direction: Write
- Start<Addr Byte LSB><W>Ack<CMD Byte>Ack<Data Byte 1>Ack Stop

Transfer Type 4:
- Address Format: 7Bit
- Command Type: Standard
- Data Direction: Read
- Start<Addr Byte LSB><W>Ack<CMD Byte>Ack
- Start<Addr Byte LSB><R>Ack<Data Byte 1>Nak Stop

Transfer Type 5:
- Address Format: 7Bit
- Command Type: Extended
- Data Direction: Write
- Start<Addr Byte LSB><W>Ack<CMD Byte MSB>Ack<CMD Byte LSB>Ack<Data Byte 1>Ack Stop

Transfer Type 6:
- Address Format: 7Bit
- Command Type: Extended
- Data Direction: Read
- Start<Addr Byte LSB><W>Ack<CMD Byte MSB>Ack<CMD Byte LSB>Ack
- Start<Addr Byte LSB><R>Ack<Data Byte 1>Nak Stop

Transfer Type 7:
- Address Format: 10Bit
- Command Type: None
- Data Direction: Write
- Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<Data Byte 1>Ack Stop

Transfer Type 8:
- Address Format: 10Bit
- Command Type: None
- Data Direction: Read
- Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack
- Start<Addr Byte MSB><R>Ack<Data Byte 1>Nak Stop

Transfer Type 9:
- Address Format: 10Bit
- Command Type: Standard
- Data Direction: Write
- Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<CMD Byte>Ack<Data Byte 1>Ack Stop
Transfer Type 10:
Address Format : 10Bit
Command Type : Standard
Data Direction : Read
Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<CMD Byte >Ack
Start<Addr Byte MSB><R>Ack<Data Byte 1>Nak Stop

Transfer Type 11:
Address Format : 10Bit
Command Type : Extended
Data Direction : Write
Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<CMD Byte MSB>Ack<CMD Byte LSB>Ack<Data Byte 1>Ack Stop

Transfer Type 12:
Address Format : 10Bit
Command Type : Extended
Data Direction : Read
Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<CMD Byte MSB>Ack<CMD Byte LSB>Ack
Start<Addr Byte MSB><R>Ack<Data Byte 1>Nak Stop

Macros for Command/Index Encoding/Decoding

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_I2C_STD_CMD</td>
<td>Signifies Transfer using Standard Command</td>
</tr>
<tr>
<td>EAPI_I2C_EXT_CMD</td>
<td>Signifies Transfer using Extended Command</td>
</tr>
<tr>
<td>EAPI_I2C_NO_CMD</td>
<td>Signifies Transfer using No Command</td>
</tr>
<tr>
<td>EAPI_I2C_CMD_TYPE_MASK</td>
<td>Used to mask Command Request Bits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_I2C_ENC_STD_CMD()</td>
<td>Encodes Request for Standard Command</td>
</tr>
<tr>
<td>EAPI_I2C_ENC_EXT_CMD()</td>
<td>Encodes Request for Extended Command</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_I2C_IS_STD_CMD()</td>
<td>Tests if Transfer using Standard Command is requested</td>
</tr>
<tr>
<td>EAPI_I2C_IS_EXT_CMD()</td>
<td>Tests if Transfer using Extended Command is requested</td>
</tr>
<tr>
<td>EAPI_I2C_IS_NO_CMD()</td>
<td>Tests if Transfer using No Command is requested</td>
</tr>
</tbody>
</table>

7.4 I2C Device Probe Types

*Probe Type 1:*
Address Format : 7Bit
Start<Addr Byte LSB><W>Ack Stop

*Probe Type 2:*
Address Format : 10Bit
Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack Stop
7.5 EapiI2CGetBusCap

```
uint32_t
EAPI_CALLTYPE
EapiI2CGetBusCap(
    __IN  uint32_t Id,         /* I2C Bus Id */
    __OUT uint32_t *pMaxBlkLen /* Max Block Length */
    * Supported on this
    * interface */
);
```

7.5.1 Description
Returns the capabilities of the selected I2C bus.

7.5.2 Parameters
Id
    __IN See '7.1.1 I2C Bus Ids' on page 32

pMaxBlkLen
    __OUT size in bytes, Pointer to a buffer that receives the maximum transfer block length for the given
    interface. Please note care must be taken when using in combination with EapiI2CWriteTransfer as
    the maximum data payload length is then pMaxBlkLen-(write overhead). So for example a 10 Bit
    Addressed device with Extended command has a write overhead of 3 bytes. Address Byte 2 and 2
    byte command.

7.5.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>pMaxBlkLen==NULL</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>unknown Id</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

7.6 EapiI2CWriteReadRaw
7.6.1 Description
Universal function for read and write operations to the I2C bus.

7.6.2 Parameters

Id
__IN See '7.1.1 I2C Bus Ids' on page 32

Addr
__IN First Byte of I2C Device Address.

pWBuffer
__INOPT Pointer to a buffer containing the data to be transferred. This parameter can be NULL if the data is not required.

WriteBCnt
__IN Size, in bytes, of the information pointed to by the pWBuffer parameter plus 1 If pWBuffer is NULL this must be zero or one.

pRBuffer
__OUTOPT Pointer to a buffer that receives the read data. This parameter can be NULL if the data is not required.

RBufLen
__IN Size, in bytes, of the buffer pointed to by the pRBuffer parameter.
If the buffer specified by pRBuffer parameter is not large enough to hold the data, the function returns the value EAPI_STATUS_MORE_DATA
If pRBuffer is NULL this must be zero.

ReadBCnt
__IN Size, in bytes, to be read to pRBuffer plus 1 If pRBuffer is NULL this must be zero or one.
### 7.6.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>(WriteBCnt&gt;1) &amp;&amp; (pWBuffer==NULL)</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>(ReadBCnt&gt;1) &amp;&amp; (pRBuffer==NULL)</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>(ReadBCnt&gt;1) &amp;&amp; (RBufLen==0)</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>((WriteBCnt==0) &amp;&amp; (ReadBCnt==0))</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>unknown Id</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>WriteBCnt&gt;(pMaxBlkLen+1)</td>
<td>EAPI_STATUS_INVALID_BLOCK_LENGTH</td>
</tr>
<tr>
<td>ReadBCnt&gt;(pMaxBlkLen+1)</td>
<td>EAPI_STATUS_INVALID_BLOCK_LENGTH</td>
</tr>
<tr>
<td>Bus Busy SDA/SDC low</td>
<td>EAPI_STATUS_BUSY_COLLISION</td>
</tr>
<tr>
<td>Arbitration Error/Collision Error On Write 1 write cycle SDA Remains low</td>
<td></td>
</tr>
<tr>
<td>Timeout due to clock stretching</td>
<td>EAPI_STATUS_HW_TIMEOUT</td>
</tr>
<tr>
<td>start&lt;AddrByte1&gt;&lt;W&gt;Nak</td>
<td>EAPI_STATUS_NOT_FOUND</td>
</tr>
<tr>
<td>start&lt;AddrByte1&gt;&lt;R&gt;Nak</td>
<td>EAPI_STATUS_NOT_FOUND</td>
</tr>
<tr>
<td>start&lt;AddrByte1&gt;&lt;W&gt;Ack&lt;WriteByte1&gt;Nak</td>
<td>EAPI_STATUS_WRITE_ERROR</td>
</tr>
<tr>
<td>ReadBCnt&gt;(RBufLen+1)</td>
<td>EAPI_STATUS_MORE_DATA</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

### 7.7 EapiI2CReadTransfer

```c
uint32_t EAPI_CALLTYPE EapiI2CReadTransfer(
    __IN  uint32_t Id,  /* I2C Bus Id */
    __IN  uint32_t Addr,  /* Encoded 7/10Bit I2C */
    __IN  uint32_t Cmd,  /* Device Address */
    __OUT void *pBuffer,  /* Transfer Data pBuffer */
    __IN  uint32_t BufLen,  /* Data pBuffer Length */
    __IN  uint32_t ByteCnt  /* Byte Count to read */
);
```

#### 7.7.1 Description

Reads from a specific register in the selected I2C device.

Reads from I2C device at the I2C address `Addr` the amount of `ByteCnt` bytes to the buffer `pBuffer` while using the device specific command `Cmd`. Depending on the addressed I2C device `Cmd` can be a specific command or a byte offset.
7.7.2 Parameters

Id
__IN See '7.1.1 I2C Bus Ids' on page 32

Addr
__IN Encoded 7/10 Bit I2C Device Address.

Cmd
__IN Encoded I2C Device Command / Index.

pBuffer
__OUT Pointer to a buffer that receives the read data. This parameter can be NULL if the data is not required.

BufLen
__IN Size, in bytes, of the buffer pointed to by the pBuffer parameter.

If the buffer specified by pBuffer parameter is not large enough to hold the data, the function returns the value EAPI_STATUS_MORE_DATA

ByteCnt
__IN Size, in bytes, of data to be read

7.7.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>pBuffer==NULL</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>ByteCnt==0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>BufLen==0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>Unknown Id</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>ByteCnt&gt;pMaxBlkLen</td>
<td>EAPI_STATUS_INVALID_BLOCK_LENGTH</td>
</tr>
<tr>
<td>Bus Busy SDA/SDC low</td>
<td>EAPI_STATUS_BUSY_COLLISION</td>
</tr>
<tr>
<td>Arbitration Error/Collision Error</td>
<td>EAPI_STATUS_BUSY_COLLISION</td>
</tr>
<tr>
<td>On Write 1 write cycle</td>
<td></td>
</tr>
<tr>
<td>SDA Remains low</td>
<td></td>
</tr>
<tr>
<td>Timeout due to clock stretching</td>
<td>EAPI_STATUS_HW_TIMEOUT</td>
</tr>
<tr>
<td>start&lt;AddrByte1&gt;&lt;W&gt;Nak</td>
<td>EAPI_STATUS_NOT_FOUND</td>
</tr>
<tr>
<td>start&lt;AddrByte1&gt;&lt;R&gt;Nak</td>
<td>EAPI_STATUS_NOT_FOUND</td>
</tr>
<tr>
<td>start&lt;Addr Byte 2&gt;&lt;W&gt;Nak Ack&lt;Addr Byte 1&gt;Nak</td>
<td>EAPI_STATUS_WRITE_ERROR Or EAPI_STATUS_NOT_FOUND</td>
</tr>
<tr>
<td>start&lt;Addr Byte 1&gt;&lt;W&gt;Ack&lt;Cmd Byte 1&gt;Nak</td>
<td>EAPI_STATUS_WRITE_ERROR</td>
</tr>
<tr>
<td>start&lt;Addr Byte 1&gt;&lt;W&gt;Ack&lt;Data Byte 1&gt;Nak</td>
<td>EAPI_STATUS_WRITE_ERROR</td>
</tr>
<tr>
<td>ByteCnt&gt;BufLen</td>
<td>EAPI_STATUS_MORE_DATA</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>
7.8 EapiI2CWriteTransfer

```c
uint32_t EAPI_CALLTYPE EapiI2CWriteTransfer(
    __IN uint32_t Id, /* I2C Bus Id */
    __IN uint32_t Addr, /* Encoded 7/10Bit I2C */
    __IN uint32_t Cmd, /* I2C Command/Offset */
    __IN void *pBuffer, /* Transfer Data pBuffer */
    __IN uint32_t ByteCnt /* Byte Count to write */
);
```

7.8.1 Description

Write to a specific register in the selected I2C device.

Writes to an I2C device at the I2C address `Addr` the amount of `ByteCnt` bytes from the buffer `*pBuffer` while using the device specific command `Cmd`. Depending on the addressed I2C device `Cmd` can be a specific command or a byte offset.

7.8.2 Parameters

- **Id**
  - __IN__ See '7.1.1 I2C Bus Ids' on page 32

- **Addr**
  - __IN__ Encoded 7/10 Bit I2C Device Address.

- **Cmd**
  - __IN__ Encoded I2C Device Command / Index.

- **pBuffer**
  - __IN__ Pointer to a buffer containing the data to be transferred.

- **ByteCnt**
  - __IN__ Size, in bytes, of the information pointed to by the `pBuffer` parameter
### 7.8.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>pBuffer==NULL</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>ByteCnt=0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>unknown Id</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>ByteBuffer+(overhead)&gt;pMaxBlkLen</td>
<td>EAPI_STATUS_INVALID_BLOCK_LENGTH</td>
</tr>
<tr>
<td>Bus Busy SDA/SDC low</td>
<td>EAPI_STATUS_BUSY_COLLISION</td>
</tr>
<tr>
<td>Arbitration Error/Collision Error</td>
<td>EAPI_STATUS_BUSY_COLLISION</td>
</tr>
<tr>
<td>On Write 1 write cycle SDA Remains low</td>
<td>EAPI_STATUS_BUSY_COLLISION</td>
</tr>
<tr>
<td>Timeout due to clock stretching</td>
<td>EAPI_STATUS_HW_TIMEOUT</td>
</tr>
<tr>
<td>start&lt;AddrByte1&gt;&lt;W&gt;Nak</td>
<td>EAPI_STATUS_NOT_FOUND</td>
</tr>
<tr>
<td>start&lt;Addr Byte 1&gt;&lt;R&gt;Nak</td>
<td>EAPI_STATUS_NOT_FOUND</td>
</tr>
<tr>
<td>start&lt;Addr Byte 2&gt;&lt;W&gt;Ack&lt;Addr Byte 1&gt;Nak</td>
<td>EAPI_STATUS_WRITE_ERROR Or EAPI_STATUS_NOT_FOUND</td>
</tr>
<tr>
<td>start&lt;Addr Byte 1&gt;&lt;W&gt;Ack&lt;Addr Byte 1&gt;Nak</td>
<td>EAPI_STATUS_WRITE_ERROR</td>
</tr>
<tr>
<td>start&lt;Addr Byte 1&gt;&lt;W&gt;Ack&lt;Data Byte 1&gt;Nak</td>
<td>EAPI_STATUS_WRITE_ERROR</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

### 7.9 EApiI2CProbeDevice

```c
uint32_t
EAPI_CALLTYPE
EApiI2CProbeDevice(
   __IN  uint32_t  Id   , /* I2C Bus Id */
   __IN  uint32_t  Addr /* Encoded 7/10Bit I2C Device Address */
);

FUNC_DEF 16: EApiI2CProbeDevice
```

### 7.9.1 Description

Probes I2C address to test I2C Device present.

### 7.9.2 Parameters

**Id**

```c
__IN  See '7.1.1 I2C Bus Ids' on page 32
```

**Addr**

```c
__IN  Encoded 7/10 Bit I2C Device Address.
```
### 7.9.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><code>EAPI_STATUS_NOT_INITIALIZED</code></td>
</tr>
<tr>
<td>Bus Busy  SDA/SDC low</td>
<td><code>EAPI_STATUS_BUSY_COLLISION</code></td>
</tr>
<tr>
<td>Arbitration Error/Collision Error</td>
<td><code>EAPI_STATUS_BUSY_COLLISION</code></td>
</tr>
<tr>
<td>On Write 1 write cycle</td>
<td></td>
</tr>
<tr>
<td>SDA Remains low</td>
<td></td>
</tr>
<tr>
<td>Timeout due to clock stretching</td>
<td><code>EAPI_STATUS_HW_TIMEOUT</code></td>
</tr>
<tr>
<td><strong>7bit Address</strong></td>
<td></td>
</tr>
<tr>
<td>start&lt;AddrByte1&gt;&lt;W&gt;Nak</td>
<td><code>EAPI_STATUS_NOT_FOUND</code></td>
</tr>
<tr>
<td><strong>10bit Address</strong></td>
<td></td>
</tr>
<tr>
<td>start&lt;AddrByte1&gt;&lt;W&gt;Nak</td>
<td><code>EAPI_STATUS_NOT_FOUND</code></td>
</tr>
<tr>
<td>start&lt;Addr Byte 2&gt;&lt;W&gt;Ack&lt;Addr Byte 1&gt;Nak</td>
<td><code>EAPI_STATUS_NOT_FOUND</code></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td><strong>Success</strong></td>
<td><code>EAPI_STATUS_SUCCESS</code></td>
</tr>
</tbody>
</table>
After the watchdog timer has been set by the `EApiWDogStart` function it must be triggered by `EApiWDogTrigger` within \((\text{delay} + \text{EventTimeout})\) milliseconds as set with the `EApiWDogStart` function, following the initial trigger every subsequent trigger must occur within \((\text{EventTimeout})\) milliseconds. Should `EApiWDogTrigger` not be called within the relevant time limit a system reset will occur.

The EAPI watchdog timer *may* support two stages. If the watchdog is not triggered within the event timeout a NMI, IRQ, or hardware output will be generated. Then the reset timeout becomes active. If the watchdog timer is not triggered within the reset timeout a reset will be generated.

**Initial Timing**

- **Stage A**: Watchdog is started.
- **Stage B**: Initial Delay Period is exhausted.
- **Stage C/F**: Event is triggered, NMI, IRQ, or PIN is triggered. To allow for possible Software Recovery.
- **Stage D/G**: System is reset.

**Timing after EApiWDogTrigger**

- **Stage E**: Watchdog is triggered.  
  `EApiWDogTrigger/EApiWDogStop` must be called before Stage C/F to prevent event from being generated.
- **Stage F**: Event Timeout
- **Stage G**: Reset Timeout

`EApiWDogTrigger/EApiWDogStop` must be called before Stage D/G to prevent the system from being reset.
8.1 EApiWDogGetCap

```c
uint32_t EAPI_CALLTYPE EApiWDogGetCap(
    __OUTOPT uint32_t *pMaxDelay,  /* Max. supported delay in msec */
    __OUTOPT uint32_t *pMaxEventTimeout,  /* Max. supported event timeout in msec, 0 == Unsupported */
    __OUTOPT uint32_t *pMaxResetTimeout  /* Max. supported reset timeout in msec */
);
```

8.1.1 Description

Get the capabilities of the watchdog timer.

8.1.2 Parameters

- **pMaxDelay**
  
  __OUTOPT Pointer to a buffer that receives maximum supported initial delay time of the watchdog timer in milliseconds.

- **pMaxEventTimeout**
  
  __OUTOPT Pointer to a buffer that receives maximum supported event timeout of the watchdog timer in milliseconds.

- **pMaxResetTimeout**
  
  __OUTOPT Pointer to a buffer that receives maximum supported reset timeout of the watchdog timer in milliseconds.

8.1.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>Unsupported</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>pMaxDelay==NULL&amp;&amp; pMaxResetTimeout==NULL&amp;&amp; pMaxEventTimeout==NULL</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

8.2 EApiWDogStart
8.2.1 Description

Start the watchdog timer and set the parameters. To adjust the parameters, the watchdog must be stopped via `EApiWDogStop` and then `EApiWDogStart` must be called again with the new values.

If the hardware implementation of the watchdog timer does not allow to set exactly the selected timing, the EAPI shall select the next possible longer timing.

8.2.2 Parameters

delay
  __IN Initial delay for the watchdog timer in milliseconds.
  The first trigger must happen within \((delay + EventTimeout)\) milliseconds, of calling `EApiWDogStart`.

EventTimeout
  __IN Watchdog timeout interval in milliseconds to trigger an event.

ResetTimeout
  __IN Watchdog timeout interval in milliseconds to trigger a reset.

8.2.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><code>EAPI_STATUS NOT_INITIALIZED</code></td>
</tr>
<tr>
<td>Unsupported</td>
<td><code>EAPI_STATUS_UNSUPPORTED</code></td>
</tr>
<tr>
<td>Delay&gt;pMaxDelay</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>EventTimeout&gt;pMaxEventTimeout</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>ResetTimeout&gt;pMaxResetTimeout</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>Watchdog already started</td>
<td><code>EAPI_STATUS_RUNNING</code></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td><code>EAPI_STATUS_SUCCESS</code></td>
</tr>
</tbody>
</table>

8.3 EApiWDogTrigger

```
uint32_t
EAPI_CALLTYPE
EApiWDogTrigger(void);
```

8.3.1 Description

Trigger the watchdog timer.
8.3.2 Parameters
None.

8.3.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>Unsupported</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>Not Started</td>
<td>EAPI_STATUS_ERROR</td>
</tr>
<tr>
<td></td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

8.4 EApiWDogStop

```c
uint32_t
EAPI_CALLTYPE
EApiWDogStop(void);
```

8.4.1 Description
Stops the operation of the watchdog timer.

8.4.2 Parameters
None.

8.4.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>Unsupported</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td></td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>
# 9 GPIO Functions

COM Express specifies pins for general purpose I/Os. The EAPI provides a set of functions to control these hardware GPIO pins.

## 9.1 Common Parameters

### 9.1.1 GPIO Ids

The EAPI defines 4 general purpose inputs and 4 general purpose outputs. The possible configuration as GPIO is also supported. Additional vendor or platform specific IDs are possible (see section 11 'Vendor Specific IDs' on page 76)

The EAPI library defines two different mechanisms to address GPIO ports.

#### Single port addressing

**Example for GPIO single port addressing EApiGPIOGetLevel**

<table>
<thead>
<tr>
<th>EAPI_ID_GPIO_GPIO03</th>
<th>EAPI_ID_GPIO_GPIO02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware GPIO Levels 0 0 0 0 0 0 0 1 1</td>
<td>0 0 0 0 0 0 0 1 1</td>
</tr>
<tr>
<td>Bitmask</td>
<td>0 0 0 0 1</td>
</tr>
<tr>
<td>Resulting pLevel</td>
<td>0 0 0 0</td>
</tr>
</tbody>
</table>

**Example for GPIO single port addressing EApiGPIOSetLevel**

<table>
<thead>
<tr>
<th>EAPI_ID_GPIO_GPIO07</th>
<th>EAPI_ID_GPIO_GPIO05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial H/W GPIO Level</td>
<td>0 0 0 0 0 0 0 1 1</td>
</tr>
<tr>
<td>Bitmask</td>
<td>0 0 0 0 0 0 0 1</td>
</tr>
<tr>
<td>Level</td>
<td>0 0 0 0 0 0 0 1</td>
</tr>
<tr>
<td>Resulting H/W GPIO Level</td>
<td>0 0 0 0 0 0 0 1 1</td>
</tr>
</tbody>
</table>

#### Bank addressing

**Example for GPIO bit mask addressing EApiGPIOGetLevel**

Sample Logic:  
\[ p\text{Level} = \text{HardwareLevel} \& \text{Bitmask} \]

Truth tables:
- Parallel addressing (Bitmask)

<table>
<thead>
<tr>
<th>EAPI_ID_GPIO_BANK00</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware GPIO Level</td>
<td>0 0 0 0 0 0 0 1 1</td>
</tr>
<tr>
<td>Bitmask</td>
<td>0 0 0 0 0 0 0 1</td>
</tr>
<tr>
<td>Resulting pLevel</td>
<td>0 0 0 0 0 0 0 1</td>
</tr>
</tbody>
</table>

**Example for GPIO bit mask addressing EApiGPIOSetLevel**

Sample Logic:  
\[ \text{HardwareLevel} = (\text{HardwareLevel} \& \neg \text{Bitmask}) \mid (\text{Bitmask} \& \text{Level}) \]

Truth table:
- Parallel addressing (Bitmask)

<table>
<thead>
<tr>
<th>EAPI_ID_GPIO_BANK00</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial H/W GPIO Level</td>
<td>0 1 0 1 0 0 0 0</td>
</tr>
<tr>
<td>Bitmask</td>
<td>0 1 1 0 0 0 0 0</td>
</tr>
<tr>
<td>Level</td>
<td>0 1 1 0 0 0 0 0</td>
</tr>
<tr>
<td>Resulting H/W GPIO Level</td>
<td>0 1 0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

#### Single GPIO addressing

Each GPIO pin can be addressed individually. Please refer to the platform specific header file (COM Express: EApiCOM0.h) for the detailed pin assignment.

<table>
<thead>
<tr>
<th>Individual GPIO Ids</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_ID0</td>
<td>'GPIO 0' Bit mapped to Bit 0</td>
</tr>
</tbody>
</table>
### Individual GPIO Ids

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_ID1</td>
<td>'GPIO 1' Bit mapped to Bit 0</td>
</tr>
<tr>
<td>EAPI_GPIO_ID2</td>
<td>'GPIO 2' Bit mapped to Bit 0</td>
</tr>
<tr>
<td>EAPI_GPIO_ID3</td>
<td>'GPIO 3' Bit mapped to Bit 0</td>
</tr>
<tr>
<td>EAPI_GPIO_ID4</td>
<td>'GPIO 4' Bit mapped to Bit 0</td>
</tr>
<tr>
<td>EAPI_GPIO_ID5</td>
<td>'GPIO 5' Bit mapped to Bit 0</td>
</tr>
<tr>
<td>EAPI_GPIO_ID6</td>
<td>'GPIO 6' Bit mapped to Bit 0</td>
</tr>
<tr>
<td>EAPI_GPIO_ID7</td>
<td>'GPIO 7' Bit mapped to Bit 0</td>
</tr>
</tbody>
</table>

### Parallel GPIO addressing

A group of selected GPIO pins can be addressed simultaneously.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_ID_GPIO_BANK00</td>
<td>GPIO 0-31 Bit mapped to Bit 0-31</td>
</tr>
</tbody>
</table>

#### 9.1.2 Bit-mask Bit States

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_BITMASK_SELECT</td>
<td>Used to specify that the Specific GPIO is selected</td>
</tr>
<tr>
<td>EAPI_GPIO_BITMASK_NOSELECT</td>
<td>Used to specify that the Specific GPIO is not selected, and should be ignored.</td>
</tr>
</tbody>
</table>

#### 9.1.3 Level Bit States

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_LOW</td>
<td>Used to specify/signify that the Specific GPIO is low(not asserted).</td>
</tr>
<tr>
<td>EAPI_GPIO_HIGH</td>
<td>Used to specify/signify that the Specific GPIO is high(asserted).</td>
</tr>
</tbody>
</table>

#### 9.1.4 Direction Bit States

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_INPUT</td>
<td>Used to specify/signify that the Specific GPIO is in input mode.</td>
</tr>
<tr>
<td>EAPI_GPIO_OUTPUT</td>
<td>Used to specify/signify that the Specific GPIO is in output mode.</td>
</tr>
</tbody>
</table>

#### 9.2 EApiGPIOGetDirectionCaps
9.2.1 Description
Reads the capabilities of the current GPIO implementation from the selected GPIO interface.
The ports where both input and output bit masks are 1 are GPIOs. The direction of this ports can be configured by `EApiGPIOSetDirection`.

9.2.2 Parameters

Id
__IN See '9.1.1 GPIO Ids' on page 47

pInputs
__OUTOPT Pointer to a buffer that receives the bit mask of the supported inputs.

pOutputs
__OUTOPT Pointer to a buffer that receives the bit mask of the supported inputs.

9.2.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td><code>EAPI_STATUS_NOT_INITIALIZED</code></td>
</tr>
<tr>
<td>((pInputs==NULL)&amp;&amp;(pOutputs==NULL))</td>
<td><code>EAPI_STATUS_INVALID_PARAMETER</code></td>
</tr>
<tr>
<td>Unsupported ID</td>
<td><code>EAPI_STATUS_UNSUPPORTED</code></td>
</tr>
<tr>
<td>Not Started</td>
<td><code>EAPI_STATUS_ERROR</code></td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td><code>EAPI_STATUS_SUCCESS</code></td>
</tr>
</tbody>
</table>

9.3 EApiGPIOGetDirection

```c
uint32_t EAPI_CALLTYPE EApiGPIOGetDirectionCaps(
    __IN uint32_t Id        , /* GPIO Id */
    __OUTOPT uint32_t *pInputs , /* Supported GPIO Input * Bit Mask */
    __OUTOPT uint32_t *pOutputs /* Supported GPIO Output * Bit Mask */
);
```

FUNC_DEF 21: EApiGPIOGetDirectionCaps
9.3.1 Description

Reads the current configuration of the selected GPIO ports.

9.3.2 Parameters

Id

__IN See '9.1.1 GPIO Ids' on page 47

Bitmask

__IN Bit mask.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_BITMASK_NOSELECT</td>
<td>Do not use the selected GPIO port for this operation.</td>
</tr>
<tr>
<td>EAPI_GPIO_BITMASK_SELECT</td>
<td>Use the selected GPIO port for this operation.</td>
</tr>
</tbody>
</table>

See also 'Bitmask' on page 52.

pDirection

__OUT Pointer to a buffer that receives the direction of the selected GPIO ports.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_INPUT</td>
<td>Selected GPIO port is an input.</td>
</tr>
<tr>
<td>EAPI_GPIO_OUTPUT</td>
<td>Selected GPIO port is an output.</td>
</tr>
</tbody>
</table>

9.3.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>Bitmask==0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>Unsupported ID</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>(Bitmask&amp;~((pInputs</td>
<td>pOutputs))</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>

See also '2.3 Status Codes' on page 16.
9.4 EApiGPIOSetDirection

```c
uint32_t EApi_CALLTYPE EApiGPIOSetDirection(  
    __IN uint32_t Id , /* GPIO Id */    
    __IN uint32_t Bitmask , /* Bit mask of Affected * Bits */    
    __IN uint32_t Direction /* Direction */
);  
```

9.4.1 Description
Sets the configuration for the selected GPIO ports.

9.4.2 Parameters

Id

__IN See '9.1.1 GPIO Ids' on page 47

Bitmask

__IN Bit mask. Only the ports with the level EAPI_GPIO_HIGH are processed.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_BITMASK_NOSELECT</td>
<td>Do not use the selected GPIO port for this operation.</td>
</tr>
<tr>
<td>EAPI_GPIO_BITMASK_SELECT</td>
<td>Use the selected GPIO port for this operation.</td>
</tr>
</tbody>
</table>

See also 'Bitmask' on page 53.

Direction

__IN Sets the direction of the selected GPIO ports. Bits with the value EAPI_GPIO_INPUT are inputs, bits with EAPI_GPIO_OUTPUT are outputs.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_INPUT</td>
<td>Selected GPIO port is an input.</td>
</tr>
<tr>
<td>EAPI_GPIO_OUTPUT</td>
<td>Selected GPIO port is an output.</td>
</tr>
</tbody>
</table>

9.4.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>Bitmask==0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>Unsupported ID</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>(Bitmask&amp;~(pInputs</td>
<td>pOutputs))</td>
</tr>
<tr>
<td>(Bitmask&amp;Direction)&amp;~pInputs</td>
<td>EAPI_STATUS_INVALID_DIRECTION</td>
</tr>
<tr>
<td>(Bitmask&amp;~Direction)&amp;~pOutputs</td>
<td>EAPI_STATUS_INVALID_DIRECTION</td>
</tr>
<tr>
<td>Not Started</td>
<td>EAPI_STATUS_ERROR</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>
9.5 EApiGPIOGetLevel

```c
uint32_t
EAPI_CALLTYPE
EApiGPIOGetLevel(
    __IN  uint32_t  Id,  /* GPIO Id */
    __IN  uint32_t  Bitmask,  /* Bit mask of Affected Bits */
    __OUT uint32_t  *pLevel  /* Current Level */
);  
FUNC_DEF 24: EApiGPIOGetLevel
```

9.5.1 Description
Read the from GPIO ports.

9.5.2 Parameters

Id
__IN See '9.1.1 GPIO Ids' on page 47

Bitmask
__IN Bit mask. Only selected bits are returned. Unselected bits return EAPI_GPIO_LOW.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_BITMASK_NOSELECT</td>
<td>Do not use the selected GPIO port for this operation.</td>
</tr>
<tr>
<td>EAPI_GPIO_BITMASK_SELECT</td>
<td>Use the selected GPIO port for this operation.</td>
</tr>
</tbody>
</table>

See examples 'Single port addressing' and 'Bank addressing' on page 47.

pLevel
__OUT Pointer to a buffer that receives the GPIO level. Results can be read on a bit level.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_LOW</td>
<td>Selected GPIO port is low.</td>
</tr>
<tr>
<td>EAPI_GPIO_HIGH</td>
<td>Selected GPIO port is high.</td>
</tr>
</tbody>
</table>

9.5.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>Bitmask==0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>Unsupported ID</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>(Bitmask &amp; ~(pInputs</td>
<td>pOutputs))</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>
9.6 EApiGPIOSetLevel

```c
uint32_t
EAPI_CALLTYPE
EApiGPIOSetLevel(
    __IN  uint32_t Id,  /* GPIO Id */
    __IN  uint32_t Bitmask,  /* Bit mask of Affected */
    __IN  uint32_t Level     /* Level */
);

FUNC_DEF 25: EApiGPIOSetLevel
```

9.6.1 Description
Write to GPIO ports. Depending on the hardware implementation writing multiple GPIO ports with the bit mask option does not guarantee a time synchronous change of the output levels.

9.6.2 Parameters
Id
__IN See '9.1.1 GPIO Ids' on page 47

Bitmask
__IN Value for a bit mask. Only selected bits are changed. Unselected bits remain unchanged.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_BITMASK_NOSELECT</td>
<td>Do not use the selected GPIO port for this operation.</td>
</tr>
<tr>
<td>EAPI_GPIO_BITMASK_SELECT</td>
<td>Use the selected GPIO port for this operation.</td>
</tr>
</tbody>
</table>

See examples 'Single port addressing' and 'Bank addressing' on page 47.

Level
__IN Input level of the selected GPIO port. Output for single ports is on a bit level.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_GPIO_LOW</td>
<td>Set selected GPIO port to low.</td>
</tr>
<tr>
<td>EAPI_GPIO_HIGH</td>
<td>Set selected GPIO port to high.</td>
</tr>
</tbody>
</table>

9.6.3 Return Status Codes

<table>
<thead>
<tr>
<th>Condition</th>
<th>Return Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library Uninitialized</td>
<td>EAPI_STATUS_NOT_INITIALIZED</td>
</tr>
<tr>
<td>Bitmask==0</td>
<td>EAPI_STATUS_INVALID_PARAMETER</td>
</tr>
<tr>
<td>Unsupported ID</td>
<td>EAPI_STATUS_UNSUPPORTED</td>
</tr>
<tr>
<td>(Bitmask&amp;~((pInputs</td>
<td>pOutputs)))</td>
</tr>
<tr>
<td>...</td>
<td>see 2.3 Status Codes on page 16</td>
</tr>
<tr>
<td>Success</td>
<td>EAPI_STATUS_SUCCESS</td>
</tr>
</tbody>
</table>
10 Header Files

The documentation refers to the following header files.

10.1 EApi.h

```c
/*
 *<KHeader>
 *+=========================================================================
 *I Project Name: EApiDK Embedded Application Development Kit
 *+=========================================================================
 *I $HeadURL: https://eapidk.svn.sourceforge.net/svnroot/eapidk/trunk/include/EApi.h $ 
 *+=========================================================================
 *I Copyright: Copyright (c) 2009-2010, PICMG
 *I Author: John Kearney, John.Kearney@kontron.com
 *I License: All rights reserved. This program and the accompanying materials are licensed and made available under the terms and conditions of the BSD License which accompanies this distribution. The full text of the license may be found at http://opensource.org/licenses/bsd-license.php
 *I THE PROGRAM IS DISTRIBUTED UNDER THE BSD LICENSE ON AN "AS IS" BASIS, WITHOUT WARRANTIES OR REPRESENTATIONS OF ANY KIND, EITHER EXPRESS OR IMPLIED.
 *I Description: Auto Created for EApi.h
 */

#ifndef _EAPI_H_
#define _EAPI_H_
#ifdef __cplusplus
extern "C" {
#endif

/******************************************************/
#ifndef __IN
#define __IN
/*
__IN
* Arg Type | Characteristics
* ----------------+-----------------------------------------------------
* Immediate value | Input value that must be specified and is essential to function operation.
* | | Valid pointer to initialized buffer/variable.
* | |
*/
#endif
#endif

/******************************************************/
#endif
#endif
#endif
```
#ifndef __OUT
#define __OUT
/

* Arg Type: Pointer
  * Characteristics: Valid pointer to destination buffer/variable
/
#endif

#ifndef __OUTOPT
#define __OUTOPT
/

* Arg Type: Pointer
  * Characteristics: Valid pointer to destination buffer/variable, or NULL Pointer.
  * Note: refer to function specification for specifics.
/
#endif

#ifndef __INOUT
#define __INOUT
/

* Arg Type: Pointer
  * Characteristics: Valid pointer to initialized buffer/variable
* Contents of buffer/variable updated before return.
/
#endif

#ifndef EAPI_CALLTYPE
#define EAPI_CALLTYPE
#endif

#ifndef EAPI_UINT32_C
#define EAPI_UINT8_C(x) ((uint8_t)(x))
#define EAPI_UINT16_C(x) ((uint16_t)(x))
#define EAPI_UINT32_C(x) ((uint32_t)(x))
#endif

/************************************************************************
* All version numbers
* +-------------------+-----------------------------------------------+
* | Bits | Descriptions |                                |
* +-------------------+-----------------------------------------------+
* | 24 - 31 | Version Number |
* +-------------------+-----------------------------------------------+
* | 16 - 23 | Revision Number |
* +-------------------+-----------------------------------------------+
* | 0 - 15 | Build Number |
* +-------------------+-----------------------------------------------+
*/
#define EAPI_VER_MASK_VER EAPI_UINT32_C(0xFF000000)
#define EAPI_VER_MASK_REV EAPI_UINT32_C(0x00FF0000)
#define EAPI_VER_MASK_BUILD EAPI_UINT32_C(0x0000FFFF)
#define EAPI_VER_GET_VER(x) EAPI_UINT8_C (((x)>>24)&UINT8_MAX)
#define EAPI_VER_GET_REV(x) EAPI_UINT8_C (((x)>>16)&UINT8_MAX)
#define EAPI_VER_GET_BUILD(x) EAPI_UINT16_C(((x)>>0)&UINT16_MAX)
#define EAPI_VER_CREATE(Version,Revision,Build) (\
    EAPI_UINT32_C(\
    (((Version)&UINT8_MAX)<<(24))|\
    (((Revision)&UINT8_MAX)<<(16))|\
    (((Build )&UINT16_MAX)<<0) \\)
    )

/************************************************************************
* Embedded API Standard Revision */
#define EAPI_VER 1
#define EAPI_REVISION 0
#define EAPI_VERSION EAPI_VER_CREATE(EAPI_VER, EAPI_REVISION, 0)

/************************************************************************
* Embedded Application System Interface */
/ *
  * EApi Types
  */
typedef uint32_t EApiStatus_t;
typedef uint32_t EApiId_t;

/*
 * S T A T U S C O D E S
 */
/* Description
 * The EAPI library is not yet or unsuccessfully initialized.
 * EApiLibInitialize needs to be called prior to the first access of any
 * other EAPI function.
 * Actions
 * Call EApiLibInitialize..
 */
#define EAPI_STATUS_NOT_INITIALIZED EAPI_UINT32_C(0xFFFFFFFF)

/* Description
 * Library is initialized.
 * Actions
 * none.
 */
#define EAPI_STATUS_INITIALIZED EAPI_UINT32_C(0xFFFFFFFE)

/* Description
 * Memory Allocation Error.
 * Actions
 * Free memory and try again..
 */
#define EAPI_STATUS_ALLOC_ERROR EAPI_UINT32_C(0xFFFFFFFD)

/* Description
 * Time out in driver. This is Normally caused by hardware/software
 * semaphore timeout.
 * Actions
 * Retry.
 */
#define EAPI_STATUS_DRIVER_TIMEOUT EAPI_UINT32_C(0xFFFFFFFC)

/* Description
 * One or more of the EAPI function call parameters are out of the
 * defined range.
 * Possible Reasons include be
 * NULL Pointer
 * Invalid Offset
 * Invalid Length
 * Undefined Value
 * Storage Write
 * Incorrectly Aligned Offset
 * Invalid Write Length
 * Actions
 * Verify Function Parameters.
 */
#define EAPI_STATUS_INVALID_PARAMETER EAPI_UINT32_C(0xFFFFFEFF)

/* Description
 * The Block Alignment is incorrect.
 * Actions
 * Use pInputs and pOutputs to correctly select input and outputs.
 */
#define EAPI_STATUS_INVALID_BLOCK_ALIGNMENT EAPI_UINT32_C(0xFFFFFEFE)

/* Description
 * This means that the Block length is too long.
 * Actions
 * Use Alignment Capabilities information to correctly align write access.
 */
#define EAPI_STATUS_INVALID_BLOCK_LENGTH EAPI_UINT32_C(0xFFFFFEFD)

/* Description
 * The current Direction Argument attempts to set GPIOs to a unsupported
 * directions. I.E. Setting GPI to Output.
 */
* Use pInputs and pOutputs to correctly select input and outputs.
*/
#define EAPI_STATUS_INVALID_DIRECTION EAPI_UINT32_C(0xFFFFFEFC)

/* Description
* The Bitmask Selects bits/GPIOs which are not supported for the current ID.
* Actions
* Use pInputs and pOutputs to probe supported bits.
*/
#define EAPI_STATUS_INVALID_BITMASK EAPI_UINT32_C(0xFFFFFEFB)

/* Description
* Watchdog timer already started.
* Actions
* Call EApiWDogStop, before retrying.
*/
#define EAPI_STATUS_RUNNING EAPI_UINT32_C(0xFFFFFEFA)

/* Description
* This function or ID is not supported at the actual hardware environment.
* Actions
* none.
*/
#define EAPI_STATUS_UNSUPPORTED EAPI_UINT32_C(0xFFFFFCFF)

/* Description
* I2C Device Error
* No Acknowledge For Device Address, 7Bit Address Only
* 10Bit Address may cause Write error if 2 10Bit addressed devices
* present on the bus.
* Actions
* none.
*/
#define EAPI_STATUS_NOT_FOUND EAPI_UINT32_C(0xFFFFFBFF)

/* Description
* I2C Time-out
* Device Clock stretching time-out, Clock pulled low by device
* for too long
* Actions
* none.
*/
#define EAPI_STATUS_TIMEOUT EAPI_UINT32_C(0xFFFFFBFE)

/* Description
* EApi I2C functions specific. The addressed I2C bus is busy or there
* is a bus collision.
* The I2C bus is in use. Either CLK or DAT are low.
* Arbitration loss or bus Collision, data remains low when writing a 1
* Actions
* Retry.
*/
#define EAPI_STATUS_BUSY_COLLISION EAPI_UINT32_C(0xFFFFFBFD)

/* Description
* I2C Read Error
* Not Possible to detect.
* Storage Read Error
* ....
* Actions
* Retry.
*/
#define EAPI_STATUS_READ_ERROR EAPI_UINT32_C(0xFFFFFAFf)

/* Description
* I2C Write Error
* No Acknowledge received after writing any Byte after the First Address
* Byte.
* Can be caused by
* unsupported Device Command/Index
* Eat Command/Index used on Standard Command/Index Device
* 10Bit Address Device Not Present
* Storage Write Error
* ....
* Actions
* Retry.
*/
#define EAPI_STATUS_WRITE_ERROR EAPI_UINT32_C(0xFFFFFAFE)

/* Description
 * The amount of available data exceeds the buffer size.
 * Storage buffer overflow was prevented. Read count was larger then
 * the defined buffer length.
 * Read Count > Buffer Length
 * Actions
 * Either increase the buffer size or reduce the block length.
 */
#define EAPI_STATUS_MORE_DATA EAPI_UINT32_C(0xFFFFF9FF)

/* Description
 * Generic error message. No further error details are available.
 * Actions
 * none.
 */
#define EAPI_STATUS_ERROR EAPI_UINT32_C(0xFFFFF0FF)

/* Description
 * The operation was successful.
 * Actions
 * none.
 */
#define EAPI_STATUS_SUCCESS EAPI_UINT32_C(0)
#define EAPI_TEST_SUCCESS(x) (!(x))

#include "EAPI.h"

EApiStatus_t EAPI_CALLTYPE EApiLibInitialize(void);
EApiStatus_t EAPI_CALLTYPE EApiLibUnInitialize(void);

#define EAPI_BYTE_SWAP_W(a) EAPI_UINT16_C(((a)<<8)&0xFF00|((a)>>8)&0x00FF)

#define EAPI_CREATE_PNPID(a, b, c) \  EAPI_BYTE_SWAP_W(((a - 'A' + 1) & 0x1F) << 10)\  (((b - 'A' + 1) & 0x1F) << 5)\  (((c - 'A' + 1) & 0x1F) << 0) \
#define EAPI_CREATE_CUST_ID(a, b, c, Id) \  EAPI_UINT32_C((0xF << 28) | (EAPI_CREATE_PNPID(a, b, c) << 12) | (Id & 0xFFF))
#endif

#define EAPI_PNPID_PICMG EAPI_CREATE_PNPID('P', 'M', 'G') /* PICMG Should register this. */

#define EAPI_ID_BOARD_MANUFACTURER_STR EAPI_UINT32_C(0) /* Board Manufacturer Name String */
#define EAPI_ID_BOARD_NAME_STR EAPI_UINT32_C(1) /* Board Name String */
#define EAPI_ID_BOARD_REVISION_STR EAPI_UINT32_C(2) /* Board Serial Number String */
#define EAPI_ID_BOARD_SERIAL_STR EAPI_UINT32_C(3) /* Board Serial Number String */
#define EAPI_ID_BOARD_BIOS_REVISION_STR EAPI_UINT32_C(4) /* Board Bios Revision String */
#define EAPI_ID_BOARD_HW_REVISION_STR EAPI_UINT32_C(5) /* Board Hardware Revision String */
#define EAPI_ID_BOARD_PLATFORM_TYPE_STR EAPI_UINT32_C(6) /* Platform ID (ETX, COM Express, etc...) */

EApiStatus_t EAPI_CALLTYPE EApiBoardGetStringA(  
  __IN  EApiId_t Id,  /* Name Id */  
  __OUT char *pBuffer,  /* Destination pBuffer */  
  __INOUT uint32_t *pBufLen  /* pBuffer Length */  );

#define EAPI_ID_GET_EAPI_SPEC_VERSION EAPI_UINT32_C(0) /* EAPI Specification Revision I.E. The EAPI Spec Version Bits 31-24, Revision 23-16, 15-0 always 0  Used to implement this interface */
#define EAPI_ID_BOARD_BOOT_COUNTER_VAL EAPI_UINT32_C(1) /* Units = Boots */
#define EAPI_ID_BOARD_RUNNING_TIME_METER_VAL EAPI_UINT32_C(2) /* Units = Minutes */
#define EAPI_ID_BOARD_ENPID_VAL EAPI_UINT32_C(3) /* Encoded PHP ID */
  * Format
  * (Compressed ASCII)
/
#define EAPI_ID_BOARD_PLATFORM_REV_VAL EAPI_UINT32_C(4) /* Platform Revision */
  * I.E. The PICMG Spec
  * Version Bits 31-24,
  * Revision 23-16,
  * 15-0 always 0
/
#define EAPI_ID_BOARD_DRIVER_VERSION_VAL EAPI_UINT32_C(0x10000) /* Vendor Specific */
  * (Optional)
/
#define EAPI_ID_BOARD_LIB_VERSION_VAL EAPI_UINT32_C(0x10001) /* Vendor Specific */
  * (Optional)
/
#define EAPI_ID_HWMON_CPU_TEMP EAPI_UINT32_C(0x20000) /* 0.1 Kelvins */
#define EAPI_ID_HWMON_CHIPSET_TEMP EAPI_UINT32_C(0x20001) /* 0.1 Kelvins */
#define EAPI_ID_HWMON_SYSTEM_TEMP EAPI_UINT32_C(0x20002) /* 0.1 Kelvins */
#define EAPI_KELVINS_OFFSET 2731
#define EAPI_ENCODE_CELCIUS(Celsius) EAPI_UINT32_C((((Celsius)*10)+(EAPI_KELVINS_OFFSET))
#define EAPI_DECODE_CELCIUS(Celsius) ((Celsius)-(EAPI_KELVINS_OFFSET))/10
#define EAPI_ID_HWMON_VOLTAGE_VCORE EAPI_UINT32_C(0x21004) /* millivolts */
#define EAPI_ID_HWMON_VOLTAGE_2V5 EAPI_UINT32_C(0x21008) /* millivolts */
#define EAPI_ID_HWMON_VOLTAGE_3V3 EAPI_UINT32_C(0x2100C) /* millivolts */
#define EAPI_ID_HWMON_VOLTAGE_VBAT EAPI_UINT32_C(0x21010) /* millivolts */
#define EAPI_ID_HWMON_VOLTAGE_5V EAPI_UINT32_C(0x21014) /* millivolts */
#define EAPI_ID_HWMON_VOLTAGE_5VSB EAPI_UINT32_C(0x21018) /* millivolts */
#define EAPI_ID_HWMON_VOLTAGE_12V EAPI_UINT32_C(0x2101C) /* millivolts */
#define EAPI_ID_HWMON_FAN_CPU EAPI_UINT32_C(0x22000) /* RPM */
#define EAPI_ID_HWMON_FAN_SYSTEM EAPI_UINT32_C(0x22001) /* RPM */

/*
 * Condition | Return Values
 *-------------------------------+---------------------
 * Library Uninitialized         | EAPI_STATUS_NOT_INITIALIZED
 * pValue==NULL                  | EAPI_STATUS_INVALID_PARAMETER
 * unknown Id                    | EAPI_STATUS_UNSUPPORTED
 * Common Error                  | Common Error Code
 * Else                           | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiBoardGetValue(
  __IN  EApiId_t Id,    /* Value Id */
  __OUT uint32_t *pValue /* Return Value */
);

/*
 * B A C K L I G H T
 * /
/*
 * IDS */
#define EAPI_ID_BACKLIGHT_1 EAPI_UINT32_C(0)
#define EAPI_ID_BACKLIGHT_2 EAPI_UINT32_C(1)
#define EAPI_ID_BACKLIGHT_3 EAPI_UINT32_C(2)

/* Backlight Values */
#define EAPI_BACKLIGHT_SET_ON EAPI_UINT32_C(0)
#define EAPI_BACKLIGHT_SET_OFF EAPI_UINT32_C(0xFFFFFFFF)
#define EAPI_BACKLIGHT_SET_DIMEST EAPI_UINT32_C(0x0)
#define EAPI_BACKLIGHT_SET_BRIGHTTEST EAPI_UINT32_C(255)

*/
EApiVgaGetBacklightEnable
*/
* Condition | Return Values
* ---------------------------------------+------------------------------
* Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
* pEnable==NULL | EAPI_STATUS_INVALID_PARAMETER
* unknown Id | EAPI_STATUS_UNSUPPORTED
* Common Error | Common Error Code
* Else | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiVgaGetBacklightEnable(
    __IN EApiId_t Id, /* Backlight Id */
    __OUT uint32_t *pEnable /* Backlight Enable */
);
/*
* EApiVgaSetBacklightEnable
*
* Condition | Return Values
* ---------------------------------------+------------------------------
* Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
* Enable!=EAPI_BACKLIGHT_SET_ON&&
* Enable!=EAPI_BACKLIGHT_SET_OFF | EAPI_STATUS_INVALID_PARAMETER
* unknown Id | EAPI_STATUS_UNSUPPORTED
* Common Error | Common Error Code
* Else | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiVgaSetBacklightEnable(
    __IN EApiId_t Id, /* Backlight Id */
    __IN uint32_t Enable /* Backlight Enable */
);
/*
* EApiVgaGetBacklightBrightness
*
* Condition | Return Values
* ---------------------------------------+------------------------------
* Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
* pBright==NULL | EAPI_STATUS_INVALID_PARAMETER
* unknown Id | EAPI_STATUS_UNSUPPORTED
* Common Error | Common Error Code
* Else | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiVgaGetBacklightBrightness(
    __IN EApiId_t Id, /* Backlight Id */
    __OUT uint32_t *pBright /* Backlight Brightness */
);
/*
* EApiVgaSetBacklightBrightness
*
* Condition | Return Values
* ---------------------------------------+------------------------------
* Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
* Bright>EAPI_BACKLIGHT_SET_BRIGHTEST | EAPI_STATUS_INVALID_PARAMETER
* unknown Id | EAPI_STATUS_UNSUPPORTED
* Common Error | Common Error Code
* Else | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiVgaSetBacklightBrightness(
    __IN EApiId_t Id, /* Backlight Id */
    __IN uint32_t Bright /* Backlight Brightness */
);

*/
*/

STORAGE
*/
/* IDs */
#define EAPI_ID_STORAGE_STD EAPI_UINT32_C(0)
/* Dummy Example */
#define EAPI_PMG_ID_STORAGE_SAMPLE EAPI_CREATE_CUST_ID('P', 'M', 'G', 0)
```c
EApiStatus_t
EAPI_CALLTYPE
EApiStorageCap(  
  __IN  EApiId_t  Id,  /* Storage Area Id */  
  __OUT  uint32_t  *pStorageSize,  /* Total */  
  __OUT  uint32_t  *pBlockLength  /* Write Block Length */  
);  

EApiStatus_t
EAPI_CALLTYPE
EApiStorageAreaRead(  
  __IN  EApiId_t  Id,  /* Storage Area Id */  
  __IN  uint32_t  Offset,  /* Byte Offset */  
  __IN  void  *pBuffer,  /* Pointer to Data pBuffer */  
  __IN  uint32_t  BufLen,  /* Data pBuffer Size in bytes */  
  __IN  uint32_t  ByteCnt  /* Number of bytes to read */  
);  

EApiStatus_t
EAPI_CALLTYPE
EApiStorageAreaWrite(  
  __IN  EApiId_t  Id,  /* Storage Area Id */  
  __IN  uint32_t  Offset,  /* Byte Offset */  
  __IN  void  *pBuffer,  /* Pointer to Data pBuffer */  
  __IN  uint32_t  ByteCnt  /* Number of bytes to write */  
);  
```
/*
 /* IDs */
 #define EAPI_ID_I2C_EXTERNAL EAPI_UINT32_C(0)  /* Baseboard I2C Interface
   * required */
 #define EAPI_ID_I2C_LVDS_1 EAPI_UINT32_C(1)  /* LVDS/EDP 1 Interface
   * (optional) */
 #define EAPI_ID_I2C_LVDS_2 EAPI_UINT32_C(2)  /* LVDS/EDP 2 Interface
   * (optional) */

/*
 * I2C Address Format
 *  
 *  L = Set to 0
 *  H = Set to 1
 *  X = Don't Care(Direction Bit)
 *  0-F Address Bit
 *  
 *  Bits 31-16 are Reserved and should be set to 0
 *  
 *  Bit Offset   F E D C B A 9 8 7 6 5 4 3 2 1 0
 *  -----------------------------------------------------
 *  7 Bit Address | L L L L L L L 6 5 4 3 2 1 0 X
 *  10 Bit Address | H H H H L 9 8 X 7 6 5 4 3 2 1 0
 *  
 *  Examples where Don't Care bits set to 0
 *  
 *  Address     Encoded     Encoded
 *  0x01        0x02        0xF001
 *  0x58        0xA0        0xF058
 *  0x59        0xA2        0xF059
 *  0x77        0xEE        0xF077
 *  0x3FF       0xF6FF      
 * /

#define EAPI_I2C_ENC_7BIT_ADDR(x) EAPI_UINT8_C(((x)&0x07F)<<1)
#define EAPI_I2C_DEC_7BIT_ADDR(x) EAPI_UINT8_C(((x)>>1)&0x07F)

/*
 * EApiI2CGetBusCap
 *  
 * Condition     | Return Values
 * ----------------+----------------------------------
 * Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
 * pMaxBlkLen==NULL | EAPI_STATUS_INVALID_PARAMETER
 * unknown Id     | EAPI_STATUS_UNSUPPORTED
 * Common Error   | Common Error Code
 * Else           | EAPI_STATUS_SUCCESS
 */

EApiStatus_t
EAPI_CALLTYPE
EApiI2CGetBusCap(
   __IN   EApiId_t Id,
   __OUT  uint32_t *pMaxBlkLen
); /* I2C Bus Id */

/*
 * EApiI2CWriteRead
 *  
 * Condition     | Return Values
 * ----------------+--------------------------------------------------
 * Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
 * (WriteBCnt>1) && (pWBuffer==NULL) | EAPI_STATUS_INVALID_BLOCK_LENGTH
 * (ReadBCnt>1) && (pRBuffer==NULL) | EAPI_STATUS_INVALID_BLOCK_LENGTH
 * (WriteBCnt>0) && (ReadBCnt==0) | EAPI_STATUS_UNSUPPORTED
 * unknown Id     | EAPI_STATUS_UNSUPPORTED
 * WriteBCnt>(pMaxBlkLen+1) | EAPI_STATUS_INVALID_BLOCK_LENGTH
 * ReadBCnt>(pMaxBlkLen+1) | EAPI_STATUS_INVALID_BLOCK_LENGTH
 * Bus Busy SDA/SDC low | EAPI_STATUS_BUSY_COLLISION
 * Arbitration Error/Collision Error | EAPI_STATUS_BUSY_COLLISION
 * On Write 1 write cycle | 
 * SDA Remains low | 
 */
* Timeout due to clock stretching | EAPI_STATUS_TIMEOUT
* start<Addr Byte><W>Nak | EAPI_STATUS_NOT_FOUND
* start<Addr Byte><R>Nak | EAPI_STATUS_NOT_FOUND
* start<Addr Byte><W>Ack<Data Byte 1>Nak | EAPI_STATUS_WRITE_ERROR
* ReadBCnt>(RBufLen+1) | EAPI_STATUS_MORE_DATA
* Common Error | Common Error Code
* Else | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiI2CWriteReadRaw(
    __IN    EApiId_t Id , /* I2C Bus Id */
    __IN    uint8_t Addr , /* Encoded 7Bit I2C */
    __INOPT void *pWBuffer , /* Write Data pBuffer */
    __IN    uint32_t WriteBCnt , /* write plus 1 */
    __OUTOPT void *pRBuffer , /* Read Data pBuffer */
    __IN    uint32_t RBufLen , /* Read pBuffer Length */
    __IN    uint32_t ReadBCnt /* Read plus 1 */
);
#define EApiI2CWriteRaw(Id, Addr, pBuffer, ByteCnt) \
    EApiI2CWriteReadRaw(Id, Addr, pBuffer, ByteCnt, \ 
    NULL, NULL, NULL, 0, 0)
#define EApiI2CReadRaw(Id, Addr, pBuffer, BufLen, ByteCnt) \
    EApiI2CWriteReadRaw(Id, Addr, NULL, 0, pBuffer, BufLen, ByteCnt)
#define EAPI_I2C_ENC_10BIT_ADDR(x) EAPI_UINT32_C(((x)&0xFF)|(((x)&0x0300)<<1)|0xF000)
#define EAPI_I2C_DEC_10BIT_ADDR(x) EAPI_UINT32_C(((x)>>1)&0x300)
#define EAPI_I2C_IS_10BIT_ADDR(x) (((x)&0xF800)==0xF000)
#define EAPI_I2C_IS_7BIT_ADDR(x) (!EAPI_I2C_IS_10BIT_ADDR(x))
/*
* I2C Transfer Types
* Bits 31 & 30 Selects Command Type
* Transfer Type 1:
* Address Format : 7Bit
* Command Type : None
* Data Direction : Write
* Start<Addr Byte><W>Nak Ack<Data Byte 1>Ack Stop
* Transfer Type 2:
* Address Format : 7Bit
* Command Type : None
* Data Direction : Read
* Start<Addr Byte><R>Nak Ack<Data Byte 1>Nak Stop
* Transfer Type 3:
* Address Format : 7Bit
* Command Type : Standard
* Data Direction : Write
* Start<Addr Byte><W>Nak Ack<CMD Byte>Ack<Data Byte 1>Ack Stop
* Transfer Type 4:
* Address Format : 7Bit
* Command Type : Standard
* Data Direction : Read
* Start<Addr Byte><W>Nak Ack<CMD Byte>Ack
* Start<Addr Byte><R>Nak Ack<Data Byte 1>Nak Stop
* Transfer Type 5:
* Address Format : 7Bit
* Command Type : Extended
* Data Direction : Write
* Start<Addr Byte><W>Nak Ack<CMD Byte MSB>Ack<CMD Byte LSB>ACK<Data Byte 1>Ack Stop
* Transfer Type 6:
* Address Format : 7Bit
* Command Type : Extended
* Data Direction : Read
* Start<Addr Byte><W>Nak Ack<CMD Byte MSB>Ack<CMD Byte LSB>Ack
* Transfer Type 7:
  * Address Format : 10Bit
  * Command Type : None
  * Data Direction : Write
  * Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<Data Byte 1>Ack Stop

* Transfer Type 8:
  * Address Format : 10Bit
  * Command Type : None
  * Data Direction : Read
  * Start<Addr Byte MSB><R>Ack<Data Byte 1>Nak Stop

* Transfer Type 9:
  * Address Format : 10Bit
  * Command Type : Standard
  * Data Direction : Write
  * Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<Data Byte 1>Ack Stop

* Transfer Type 10:
  * Address Format : 10Bit
  * Command Type : Standard
  * Data Direction : Read
  * Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<CMD Byte>Ack<Data Byte 1>Ack Stop

* Transfer Type 11:
  * Address Format : 10Bit
  * Command Type : Extended
  * Data Direction : Write
  * Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Ack<CMD Byte MSB>Ack<CMD Byte LSB>Ack<Data Byte 1>Ack Stop

*/
#define EAPI_I2C_STD_CMD EAPI_UINT32_C((0)<<30)
#define EAPI_I2C_EXT_CMD EAPI_UINT32_C((2)<<30)
#define EAPI_I2C_NO_CMD EAPI_UINT32_C((1)<<30)
#define EAPI_I2C_CMD_TYPE_MASK EAPI_UINT32_C((3)<<30)
#define EAPI_I2C_ENC_STD_CMD(x) EAPI_UINT32_C(((x)&0xFF)|EAPI_I2C_STD_CMD)
#define EAPI_I2C_ENC_EXT_CMD(x) EAPI_UINT32_C(((x)&0xFFFF)|EAPI_I2C_EXT_CMD)
#define EAPI_I2C_IS_EXT_CMD(x) (EAPI_UINT32_C((x)&(EAPI_I2C_CMD_TYPE_MASK))==EAPI_I2C_EXT_CMD)
#define EAPI_I2C_IS_STD_CMD(x) (EAPI_UINT32_C((x)&(EAPI_I2C_CMD_TYPE_MASK))==EAPI_I2C_STD_CMD)
#define EAPI_I2C_IS_NO_CMD(x) (EAPI_UINT32_C((x)&(EAPI_I2C_CMD_TYPE_MASK))==EAPI_I2C_NO_CMD)

* EApiI2CReadTransfer
  * Addr Byte 1 Below Designates Addr MSB in a 10bit address transfer and
  * the complete address in an 7bit address transfer.
  * /*
  * Condition | Return Values
  *-----------------------------------------|-----------------------------
  * Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
  * pBuffer==NULL | EAPI_STATUS_INVALID_PARAMETER
  * BufLen==0 | EAPI_STATUS_INVALID_PARAMETER
  * ByteCnt==0 | EAPI_STATUS_INVALID_PARAMETER
  * unknown Id | EAPI_STATUS_UNSUPPORTED
  * ByteCnt>pMaxBlkLen | EAPI_STATUS_INVALID_BLOCK_LENGTH
  * Bus Busy SDA/SDC low | EAPI_STATUS_BUSY_COLLISION
  * Arbitration Error/Collision Error | EAPI_STATUS_BUSY_COLLISION
  * On Write 1 write cycle | EAPI_STATUS_WRITE_ERROR
  * SDA Remains low | EAPI_STATUS_WRITE_ERROR
  * Time-out due to clock stretching | EAPI_STATUS_TIMEOUT
  * start<Addr Byte 1><W>Nak | EAPI_STATUS_NOT_FOUND
  * start<Addr Byte 1><R>Nak | EAPI_STATUS_NOT_FOUND
  * start<Addr Byte 1><W>Ack<Addr Byte 2>Nak | EAPI_STATUS_WRITE_ERROR

PICMG® EAPI R1.0, August 8, 2010 page 65 of 83
/*
 * start<Addr Byte 1><W>Ack<CMD Byte 1>Nak | EAPI_STATUS_WRITE_ERROR
 * start<Addr Byte 1><W>Ack<Data Byte 1>Nak | EAPI_STATUS_WRITE_ERROR
 * ByteCnt>BufLen | EAPI_STATUS_MORE_DATA
 * Common Error | Common Error Code
 * Else | EAPI_STATUS_SUCCESS
 */

EApiStatus_t
EAPI_CALLTYPE
EApiI2CReadTransfer(
  __IN EApiId_t Id , /* I2C Bus Id */
  __IN uint32_t Addr , /* Encoded 7/10Bit I2C */
  __IN uint32_t Cmd , /* I2C Command/Offset */
  __IN uint32_t BufLen , /* Data pBuffer Length */
  __IN uint32_t ByteCnt /* Byte Count to read */);

/*
 * EApiI2CWriteTransfer
 * Addr Byte 1 Below Designates Addr MSB in a 10bit address transfer and
 * the complete address in a 7bit address transfer.
 *
 * Condition | Return Values
 *---------------------------------------|-------------------------------
 * Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
 * pBuffer==NULL | EAPI_STATUS_INVALID_PARAMETER
 * ByteCnt=0 | EAPI_STATUS_INVALID_PARAMETER
 * unknown Id | EAPI_STATUS_UNSUPPORTED
 * ByteCnt+(overhead)>pMaxBlkLen | EAPI_STATUS_INVALID_BLOCK_LENGTH
 * Bus Busy SDA/SDC low | EAPI_STATUS_BUSY_COLLISION
 * Arbitration Error/Collision Error | EAPI_STATUS_BUSY_COLLISION
 * On Write 1 write cycle | | EAPI_STATUS_SUCCESS
 * SDA Remains low | EAPI_STATUS_TIMEOUT
 * Time-out due to clock stretching | EAPI_STATUS_TIMEOUT
 * start<Addr Byte 1><R>Ack | EAPI_STATUS_WRITE_ERROR or
 */

EApiStatus_t
EAPI_CALLTYPE
EApiI2CWriteTransfer(
  __IN EApiId_t Id , /* I2C Bus Id */
  __IN uint32_t Addr , /* Encoded 7/10Bit I2C */
  __IN uint32_t Cmd , /* I2C Command/Offset */
  __IN void *pBuffer , /* Transfer Data pBuffer */
  __IN uint32_t BufLen , /* Data pBuffer Length */
  __IN uint32_t ByteCnt /* Byte Count to read */);

/*
 * EApiI2CProbeDevice
 * I2C Probe Types
 *
 * Probe Type 1:
 * Address Format : 7Bit
 * Start<Addr Byte>W>Ack Stop
 *
 * Probe Type 2:
 * Address Format : 10Bit
 * Start<Addr Byte_MSB>W>Ack<Addr Byte_LSB>Ack Stop
 *
 */

EApiStatus_t
EAPI_CALLTYPE
EApiI2CProbeDevice(  __IN EApiId_t Id , /* I2C Bus Id */  __IN uint32_t Addr , /* Device Address */  __IN uint32_t Cmd , /* I2C Command */  __IN void */ pBuffer , /* Transfer Data pBuffer */  __IN uint32_t ByteCnt /* Byte Count to write */ );

/* I2C Probe Types */

/* Probe Type 1: */

/* Probe Type 2: */

/* EApiI2CProbeDevice */

/* Condition | Return Values */

/* Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED */

/* Bus Busy SDA/SDC low | EAPI_STATUS_BUSY_COLLISION */
* Arbitration Error/Collision Error | EAPI_STATUS_BUSY_COLLISION
* On Write 1 write cycle |
* SDA Remains low |
* Time-out due to clock stretching | EAPI_STATUS_TIMEOUT
* |
* 7Bit Address |
| Start<Addr Byte><W>Nak | EAPI_STATUS_NOT_FOUND
* |
| 10Bit Address |
| Start<Addr Byte MSB><W>Nak | EAPI_STATUS_NOT_FOUND
| Start<Addr Byte MSB><W>Ack<Addr Byte LSB>Nak | EAPI_STATUS_NOT_FOUND
| |
* Common Error | Common Error Code
| Else | EAPI_STATUS_SUCCESS
*/

EApiStatus_t
EAPI_CALLTYPE
EApiI2CProbeDevice(
    __IN  EApiId_t Id , /* I2C Bus Id */
    __IN  uint32_t Addr /* Encoded 7/10Bit */
); /*
 */

WATCHDOG
*/
*/
* After EApiWDogStart*/
* |
| <- Delay -> | <- Event Timeout -> | <- Reset Timeout -> |
| A--------------B-------------------C-------------------D |
* *
* After EApiWDogTrigger*/
* |
| <- Event Timeout -> | <- Reset Timeout -> |
| E-------------------F-------------------G |
* *
* Stage A*/
| Watchdog is started.
* |
* Stage B*/
| Initial Delay Period is exhausted.
* |
| Stage C/F*/
| Event is triggered, NMI, IRQ, or PIN is Triggered.
| To Allow for possible Software Recovery.
* |
| Stage D/G*/
| System is reset.
* *
| Stage E*/
| Watchdog is Triggered.
* |
| EApiWDogTrigger/EApiWDogStop Must be called before Stage C/F*/
| to prevent event from being generated.
* |
| EApiWDogTrigger/EApiWDogStop Must be called before Stage D/G*/
| to prevent The system from being reset.
* */
*/
* EApiWDogGetCap*/
* *
| Condition | Return Values
| -----------------------------------+------------------------------|
| Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
| Unsupported | EAPI_STATUS_UNSUPPORTED
| pMaxDelay==NULL | |
| pMaxResetTimeout==NULL | |
EApiStatus_t EAPI_CALLTYPE EApiWDogGetCap(
    __OUTOPT uint32_t *pMaxDelay, /* Maximum Supported * Delay in milliseconds */
    __OUTOPT uint32_t *pMaxEventTimeout, /* Maximum Supported * Event Timeout in * milliseconds */
    __OUTOPT uint32_t *pMaxResetTimeout /* Maximum Supported * Reset Timeout in * milliseconds */
);

EApiStatus_t EAPI_CALLTYPE EApiWDogStart(
    __IN uint32_t Delay /* Delay in milliseconds */
    __IN uint32_t EventTimeout, /* Event Timeout in * milliseconds */
    __IN uint32_t ResetTimeout /* Reset Timeout in * milliseconds */
);

EApiStatus_t EAPI_CALLTYPE EApiWDogTrigger(void);

EApiStatus_t EAPI_CALLTYPE EApiWDogStop(void);
```c
*  GPIO
*/
/
* +-----+-----+-----+-----+-----+-----+-----+-----+
| Bit | Bit | Bit | Bit | Bit | Bit | Bit | Bit |
| 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
| 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    |
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
* +-----+-----+-----+-----+-----+-----+-----+-----+
*/

#define EAPI_ID_GPIO_GPIO00
0 0 0 0 0 0 0 0
#define EAPI_ID_GPIO_GPIO01
0 0 0 0 0 0 0 0
#define EAPI_ID_GPIO_GPIO02
0 0 0 0 0 0 0 0
#define EAPI_ID_GPIO_GPIO03
0 0 0 0 0 0 0 0
#define EAPI_ID_GPIO_GPIO04
0 0 0 0 0 0 0 0
#define EAPI_ID_GPIO_GPIO05
0 0 0 0 0 0 0 0
#define EAPI_ID_GPIO_GPIO06
0 0 0 0 0 0 0 0
#define EAPI_ID_GPIO_GPIO07
0 0 0 0 0 0 0 0
```
PICMG® EAPI R1.0, August 8, 2010  page 70 of 83

* Multiple GPIOs Per ID Mapping *
* (Optional) */
#define EAPI_GPIO_BANK_ID(GPIO_NUM) EAPI_UINT32_C(0x10000|((GPIO_NUM)>>5))
#define EAPI_GPIO_BANK_TEST_STATE(GPIO_NUM, TState, TValue) {
    (TValue>>(GPIO_NUM)&0x1F))&1==(TState))
#define EAPI_GPIO_BANK_ID( 0) /* GPIOs  0 - 31 */
#define EAPI_GPIO_BANK_ID(32) /* GPIOs 32 - 63 */
#define EAPI_GPIO_BANK_ID(64) /* GPIOs 64 - 95 */

/* Bit mask Bit States */
#define EAPI_GPIO_BITMASK_SELECT 1
#define EAPI_GPIO_BITMASK_NOSELECT 0

/* Levels */
#define EAPI_GPIO_LOW 0
#define EAPI_GPIO_HIGH 1

/* Directions */
#define EAPI_GPIO_INPUT 1
#define EAPI_GPIO_OUTPUT 0

/* EApiGPIOGetDirectionCaps */
*/
* Condition | Return Values
* -----------------------------------+------------------------------
* Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
* Unsupported Id | EAPI_STATUS_UNSUPPORTED
* Common Error | Common Error Code
* Else | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiGPIOGetDirectionCaps(
  __IN EApiId_t Id , /* GPIO Id */
  __OUTOPT uint32_t *pInputs , /* Supported GPIO Input */
  * Bit Mask
  /*
  __OUTOPT uint32_t *pOutputs /* Supported GPIO Output */
  * Bit Mask
  */
);
/* EApiGPIOGetDirection */
*/
* Condition | Return Values
* -----------------------------------+------------------------------
* Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
* Bitmask==0 | EAPI_STATUS_INVALID_PARAMETER
* Unsupported Id | EAPI_STATUS_UNSUPPORTED
* (Bitmask&(pInputs|pOutputs)) | EAPI_STATUS_INVALID_BITMASK
* Common Error | Common Error Code
* Else | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiGPIOGetDirection(
  __IN EApiId_t Id , /* GPIO Id */
  __IN uint32_t Bitmask , /* Bit mask of Affected */
  * Bits
  /*
  __OUT uint32_t *pDirection /* Current Direction */
  */
);
/* EApiGPIOSetDirection */
*/
* Condition | Return Values
* -----------------------------------+------------------------------
* Library Uninitialized | EAPI_STATUS_NOT_INITIALIZED
* Bitmask==0 | EAPI_STATUS_INVALID_PARAMETER
* Unsupported Id | EAPI_STATUS_UNSUPPORTED
* (Bitmask&(pInputs|pOutputs)) | EAPI_STATUS_INVALID_BITMASK
* (Bitmask&Direction)&~pInputs | EAPI_STATUS_INVALID_DIRECTION
* (Bitmask&~pDirection)&~pOutputs | EAPI_STATUS_INVALID_DIRECTION
* Common Error | Common Error Code
* Else | EAPI_STATUS_SUCCESS
*/
EApiStatus_t
EAPI_CALLTYPE
EApiGPIOSetDirection(
  __IN EApiId_t Id , /* GPIO Id */
  __IN uint32_t Bitmask , /* Bit mask of Affected */
  * Bits
  /*
  __IN uint32_t Direction /* Direction */
  */
);
```c
EApiStatus_t EAPI_CALLTYPE EApiGPIOGetLevel(
    __IN EApiId_t Id,  /* GPIO Id */
    __IN uint32_t Bitmask,  /* Bit mask of Affected Bits */
    __OUT uint32_t *pLevel /* Current Level */
);

EApiStatus_t EAPI_CALLTYPE EApiGPIOSetLevel(
    __IN EApiId_t Id,  /* GPIO Id */
    __IN uint32_t Bitmask,  /* Bit mask of Affected Bits */
    __IN uint32_t Level /* Level */
);

#include "EApiCOM0.h"  /* COMExpress Platform Specific ID Mappings */
#include "EApiTCA.h"  /* TCA Platform Specific ID Mappings */
#include "EApiETX.h"  /* ETX Platform Specific ID Mappings */
#include "EApiQ7.h"  /* Q Seven Platform Specific ID Mappings */
#include "EApiMOPS.h"  /* MOPS Platform Specific ID Mappings */
#include "EApiPISA.h"  /* PISA Platform Specific ID Mappings */
#include "EApiEPIC.h"  /* EPIC Platform Specific ID Mappings */

#ifndef __cplusplus
}
#endif
#include "_EAPI_H_"
```

PICMG® EAPI R1.0, August 8, 2010  page 72 of 83
10.2 EApiCOM0.h

/ *
 * <KHeader>
 * +=========================================================================
 * |Project Name: EApiDK Embedded Application Development Kit
 * +=========================================================================
 * |$HeadURL: https://eapidk.svn.sourceforge.net/svnroot/eapidk/trunk/include/EApiCOM0.h$
 * +=========================================================================
 * |Copyright: Copyright (c) 2009-2010, PICMG
 * +=========================================================================
 * |Author: John Kearney, John.Kearney@kontron.com
 * +-------------------------------------------------------------------------
 * |Description: Auto Created for EApiCOM0.h
 * +=========================================================================
 * |File Name: EApiCOM0.h
 * +File Location: include
 * +Last committed: $Revision: 74 $
 * +Last changed by: $Author: dethrophes $
 * +Last changed date: $Date: 2010-06-23 21:26:50 +0200 (Mi, 23 Jun 2010) $
 * +ID: $Id: EApiCOM0.h 74 2010-06-23 19:26:50Z dethrophes $
 * +=========================================================================
 * </KHeader>
 */

#ifndef _EAPICOM0_H_
#define _EAPICOM0_H_

/*
* BOARD INFORMATION STRINGS
*/

/* IDS */
#define EAPI_COM0_ID_BOARD_MANUFACTURER_STR EAPI_ID_BOARD_MANUFACTURER_STR
#define EAPI_COM0_ID_BOARD_NAME_STR EAPI_ID_BOARD_NAME_STR
#define EAPI_COM0_ID_BOARD_SERIAL_STR EAPI_ID_BOARD_SERIAL_STR
#define EAPI_COM0_ID_BOARD_BIOS_REVISION_STR EAPI_ID_BOARD_BIOS_REVISION_STR
#define EAPI_COM0_ID_BOARD_PLATFORM_TYPE_STR EAPI_ID_BOARD_PLATFORM_TYPE_STR

#define EAPI_COM0_PLATFORM_STR "COMExpress"

/*
* BOARD INFORMATION VALUES
*/

/* IDS */
#define EAPI_COM0_ID_BOARD_BOOT_COUNTER_VAL EAPI_ID_BOARD_BOOT_COUNTER_VAL
#define EAPI_COM0_ID_BOARD_RUNNING_TIME_METER_VAL EAPI_ID_BOARD_RUNNING_TIME_METER_VAL
#define EAPI_COM0_ID_BOARD_PNPID_VAL EAPI_ID_BOARD_PNPID_VAL
#define EAPI_COM0_ID_BOARD_PLATFORM_REV_VAL EAPI_ID_BOARD_PLATFORM_REV_VAL
#define EAPI_COM0_ID_BOARD_DRIVER_VERSION_VAL EAPI_ID_BOARD_DRIVER_VERSION_VAL
#define EAPI_COM0_ID_BOARD_LIB_VERSION_VAL EAPI_ID_BOARD_LIB_VERSION_VAL
#define EAPI_COM0_REV_1_0 EAPI_VER_CREATE(1, 0, 0)
#define EAPI_COM0_REV_2_0  EAPI_VER_CREATE(2, 0, 0)

#define EAPI_COM0_ID_HWMON_CPU_TEMP  EAPI_ID_HWMON_CPU_TEMP
#define EAPI_COM0_ID_HWMON_CHIPSET_TEMP  EAPI_ID_HWMON_CHIPSET_TEMP
#define EAPI_COM0_ID_HWMON_SYSTEM_TEMP  EAPI_ID_HWMON_SYSTEM_TEMP

#define EAPI_COM0_ID_HWMON_VOLTAGE_VCORE  EAPI_ID_HWMON_VOLTAGE_VCORE
#define EAPI_COM0_ID_HWMON_VOLTAGE_2V5  EAPI_ID_HWMON_VOLTAGE_2V5
#define EAPI_COM0_ID_HWMON_VOLTAGE_3V3  EAPI_ID_HWMON_VOLTAGE_3V3
#define EAPI_COM0_ID_HWMON_VOLTAGE_VBAT  EAPI_ID_HWMON_VOLTAGE_VBAT
#define EAPI_COM0_ID_HWMON_VOLTAGE_5V  EAPI_ID_HWMON_VOLTAGE_5V
#define EAPI_COM0_ID_HWMON_VOLTAGE_5VSB  EAPI_ID_HWMON_VOLTAGE_5VSB
#define EAPI_COM0_ID_HWMON_VOLTAGE_12V  EAPI_ID_HWMON_VOLTAGE_12V

#define EAPI_COM0_ID_HWMON_FAN_CPU  EAPI_ID_HWMON_FAN_CPU
#define EAPI_COM0_ID_HWMON_FAN_SYSTEM  EAPI_ID_HWMON_FAN_SYSTEM

/*
 *  B A C K L I G H T
 */

/*
 * COM Express Backlight Fill Order
 *  
 * Internal PWM
 * EAPI_COM0_ID_I2C_LVDS_1 I2C Device
 * SDVOB PWM
 * SDVOB I2C Device
 * SDVOC PWM
 * SDVOC I2C Device
 * DDI1 I2C Device
 * DDI2 I2C Device
 * DDI3 I2C Device
 */

/*
 * IDS */
#define EAPI_COM0_ID_BACKLIGHT_1  EAPI_ID_BACKLIGHT_1
#define EAPI_COM0_ID_BACKLIGHT_2  EAPI_ID_BACKLIGHT_2

/*
 *  S T O R A G E
 */

/*
 * IDS */
#define EAPI_COM0_ID_STORAGE_STD  EAPI_ID_STORAGE_STD

/*
 *  I 2 C
 */

/*
 * IDS */
#define EAPI_COM0_ID_I2C_EXTERNAL  EAPI_ID_I2C_EXTERNAL
#define EAPI_COM0_ID_I2C_LVDS_1  EAPI_ID_I2C_LVDS_1
#define EAPI_COM0_ID_I2C_LVDS_2  EAPI_ID_I2C_LVDS_2

/*
 *  G P I O
 */

/*
 * IDS */
#define EAPI_COM0_ID_GPIO_BANK  EAPI_ID_GPIO_BANK00
#define EAPI_COM0_ID_GPIO_GPIO0  EAPI_GPIO_GPIO_ID(0)
#define EAPI_COM0_ID_GPIO_GPIO1  EAPI_GPIO_GPIO_ID(1)
#define EAPI_COM0_ID_GPIO_GPIO2  EAPI_GPIO_GPIO_ID(2)
#define EAPI_COM0_ID_GPIO_GPIO3  EAPI_GPIO_GPIO_ID(3)
#define EAPI_COM0_ID_GPIO_GPIO4  EAPI_GPIO_GPIO_ID(4)
#define EAPI_COM0_ID_GPIO_GPIO5  EAPI_GPIO_GPIO_ID(5)
#define EAPI_COM0_ID_GPIO_GPIO6  EAPI_GPIO_GPIO_ID(6)
#define EAPI_COM0_ID_GPIO_GPO3 EAPI_GPIO_GPIO_ID(7)

#endif /* EAPICOM0_H */
11 Vendor Specific IDs

In order to allow vendor specific device IDs for the EAPI without overlapping definition PNPID\(^2\) are used.

11.1.1 Vendor Id breakdown

To allow for Vendor unique Ids the following Id Range is reserved 0xF0000000 – 0xFFFFFFFF.

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[31:28]</td>
<td>0xF</td>
</tr>
<tr>
<td>[27:12]</td>
<td>Compressed ASCII PNPID (see chapter 12.1 page 77)</td>
</tr>
<tr>
<td>[11:0]</td>
<td>12Bit Vendor Specific ID</td>
</tr>
</tbody>
</table>

11.1.2 Support MACROS

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_CREATE_CUST_ID</td>
<td>Allows creation of Custom Ids</td>
</tr>
</tbody>
</table>

11.1.3 Example

<table>
<thead>
<tr>
<th>Id</th>
<th>Hex</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAPI_CREATE_CUST_ID('P', 'M', 'G', 0x123)</td>
<td>0xFA741123</td>
</tr>
</tbody>
</table>

---

\(^2\) For PNPID see Chapter 1.6 page 11
12 Standard Data Formats

12.1 Compressed ASCII PNPID

12.1.1 Definition

Compressed ASCII is defined as 5 bits per character, "00001b" = "A" ... "11010b" = "Z".

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>[7]</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>[6:2]</td>
<td>First character in compressed ASCII</td>
</tr>
<tr>
<td>0</td>
<td>[1:0]</td>
<td>Second character in compressed ASCII</td>
</tr>
<tr>
<td>1</td>
<td>[7:5]</td>
<td>Second character in compressed ASCII</td>
</tr>
<tr>
<td>1</td>
<td>[4:0]</td>
<td>Third character in compressed ASCII</td>
</tr>
</tbody>
</table>

12.1.2 Example

<table>
<thead>
<tr>
<th>Hex</th>
<th>Interpreted</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xA741</td>
<td>'PMG'</td>
</tr>
</tbody>
</table>

12.2 Specification Version Number Format

12.2.1 Definition

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[31:24]</td>
<td>Version</td>
</tr>
<tr>
<td>[23:16]</td>
<td>Revision</td>
</tr>
<tr>
<td>[15:0]</td>
<td>0</td>
</tr>
</tbody>
</table>

12.2.2 Example

<table>
<thead>
<tr>
<th>Hex</th>
<th>Interpreted</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x03040000</td>
<td>3.4</td>
</tr>
<tr>
<td>0x01100000</td>
<td>1.16</td>
</tr>
<tr>
<td>0x02010000</td>
<td>2.1</td>
</tr>
</tbody>
</table>
12.3 General Version number Format

12.3.1 Definition

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[31:24]</td>
<td>Major Version</td>
</tr>
<tr>
<td>[15:0]</td>
<td>Build Number</td>
</tr>
</tbody>
</table>

12.3.2 Example

<table>
<thead>
<tr>
<th>Hex</th>
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</tr>
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<tbody>
<tr>
<td>0x03040010</td>
<td>3.4.16</td>
</tr>
<tr>
<td>0x01100100</td>
<td>1.16.256</td>
</tr>
<tr>
<td>0x02010001</td>
<td>2.1.1</td>
</tr>
</tbody>
</table>
13 OS Specific Requirements

13.1 Windows

13.1.1 DLL Naming Convention

   EAPI_X.dll
   X represents the EAPI Specification Version Number

   **Example**
   EAPI_1.dll

13.1.2 Version Resource Information

   **Problem**
   Due to the nature of the EAPI DLLs in Microsoft Windows it may not be possible to distinguish one manufacturers DLL from another. Although it would possible to do this using a tool that uses the API, It may not be possible to load the DLL, due to missing dependencies.

   **Solution**
   The solution is to require that Version Resource Information be present for every EAPI DLL. It is then easily possible to check Manufacturer and versions in Windows Explorer Properties window.

   ![EApi.dll Properties](image)

   **Sample**
   For an example implementation see EApi.rc in the EApiDK.
13.2 Linux/Unix Shared Library Naming Convention

**Problem**
Due to the nature of ELF Shared Libraries in Linux/UNIX/... it may not be possible to distinguish one manufacturer's DLL from another. Although it would possible to do this using a tool that uses the API, It may not be possible to load the shared library, due to missing dependencies.

**Solution**

**Filename Convention**

`libEApiYYY.so.W.Z`

<table>
<thead>
<tr>
<th>Part</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>YYY</td>
<td>PMG</td>
<td>Vendor PN PID</td>
</tr>
<tr>
<td>W</td>
<td>1</td>
<td>EAPI Specification Version number</td>
</tr>
<tr>
<td>X</td>
<td>0</td>
<td>EAPI Specification Revision number</td>
</tr>
</tbody>
</table>

**Soname Convention**

`libEApi.so.W`

<table>
<thead>
<tr>
<th>Part</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>1</td>
<td>EAPI Specification Version number</td>
</tr>
</tbody>
</table>

**Example**

Shared Library
Filename = `libEapiPMG.so.1.0`
soname = `libEApi.so.1`
in file system.
`/usr/lib/libEApi.so.1` → `/usr/lib/libEapiPMG.so.1.0`
`/usr/lib/libEapiPMG.so.1.0`
see EApiDK for sample implementation.

13.3 ELF/a.out Format Shared Libraries

13.3.1 Library Output Format

**Problem**
Due to the nature of ELF Dynamic Link Libraries in Linux/UNIX/... it may not be possible to distinguish one manufacturer's DLL from another. Although it would possible to do this using a tool that uses the API, It may not be possible to load the DLL, due to missing dependencies.

**Solution**
The solution is to require the shared libraries be executable. Upon Execution the library should then print out the following information.

```
The Output format is
<Variable name>=Value
and should be matched by this regular expression. m/\s+(\w+)\s*=\s+(.+)(\s+$)/
where
$1=Variable name
$2=Value/Data.
```
<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVersion</td>
<td>EApi Standard Version used to create Library</td>
</tr>
<tr>
<td>LVersion</td>
<td>Vendor Specific Library Version</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Library Manufacturer</td>
</tr>
<tr>
<td>MPNPID</td>
<td>Manufacturer PN_PID</td>
</tr>
<tr>
<td>OFilename</td>
<td>Original File name</td>
</tr>
<tr>
<td>Description</td>
<td>Library Description</td>
</tr>
</tbody>
</table>

**Sample**

For an example implementation see [Message.c](#) in EApiDK.

```c
#!/usr/bin/env python
#---------------------------------------------
# Copyright (C) PICMG 2009
#---------------------------------------------
SVersion=0.5
LVersion=0.5.721
Manufacturer=PICMG
MPNPID=PMG
OFilename=libEApiPMG.so.0.5
Description=Embedded Application Programming Interface
```
14 Example Code

Example code and test software is available here http://eapidk.sourceforge.net/.

To Check out the EApiDK use

svn co https://eapidk.svn.sourceforge.net/svnroot/eapidk/trunk
<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>Jun 25, 09</td>
<td>Initial Version</td>
</tr>
<tr>
<td>0.01</td>
<td>Jun 30, 09</td>
<td>multiple updates</td>
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<tr>
<td>0.02</td>
<td></td>
<td></td>
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<tr>
<td>0.03</td>
<td>Jul 10, 09</td>
<td>Changed Format</td>
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<tr>
<td>0.04</td>
<td>Jul 14, 09</td>
<td>Minor changes</td>
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<tr>
<td>0.05</td>
<td>Jul 22, 09</td>
<td>Subcommittee review version</td>
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<tr>
<td>0.06</td>
<td>Sept 10, 09</td>
<td>Some CR and cleanup</td>
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<tr>
<td>D0.81</td>
<td>Sept 29, 09</td>
<td>closed most open CRs. Added PICMG boilerplate. Merged double glossary sections. Only open item is the multi stage feature for the watchdog timer.</td>
</tr>
<tr>
<td>D082</td>
<td>Oct 12, 09</td>
<td>Added 8.1 EApiWDogGetCap and second stage for watchdog timer Better explanation and examples for 9_GPIO Functions</td>
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