



# PCI Express™ Form Factors: Card, Mini Card and ExpressCard\*

Chuck Stancil

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Chair, PCI Express Electromechanical WG



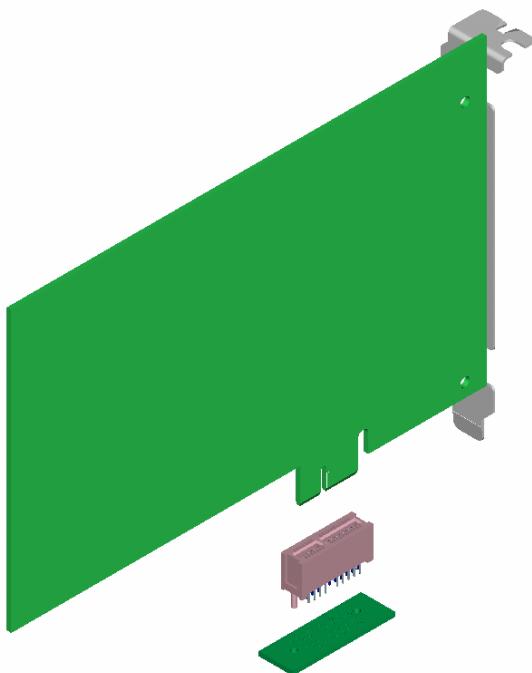
# Agenda

- Add-in Card
  - ✓ Review of add-in card basics
  - ✓ What's new since the CEM 1.0a spec was released?
- PCI Express Mini Card
  - ✓ Review of basics
  - ✓ What's new
- ExpressCard\*
- Summary
- Call to Action

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

# Add-in Card

# Simple Add-in Card Design



**Follows PCI Card form factors**

**Standard Height Cards, 4.20" (106.7mm)**

**Low Profile Cards, 2.536" (64.4mm)**

**Half Length Cards, 6.6" (167.65mm)**

**Full Length Cards, 12.283" (312mm)**

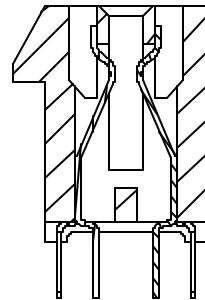
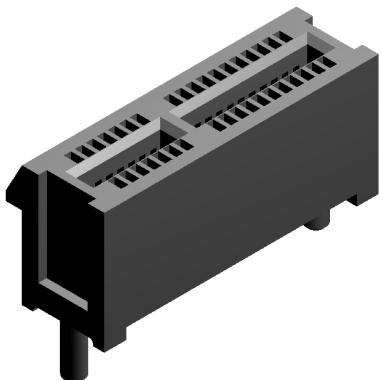
**Uses PCI I/O Bracket**

**PCI Express Is Optimized for Cost**

# Add-in Card Size Exceptions

- Standard height x1 cards are limited to half-length (6.6") for desktop applications
  - ✓ Push towards small form factor systems
  - ✓ 10W power limit
- For server I/O needs there is allowance for a 25W, standard height x1 card that MUST be greater or equal to 7.0" but less than or equal to full length

# Low Cost Edge Card Connector



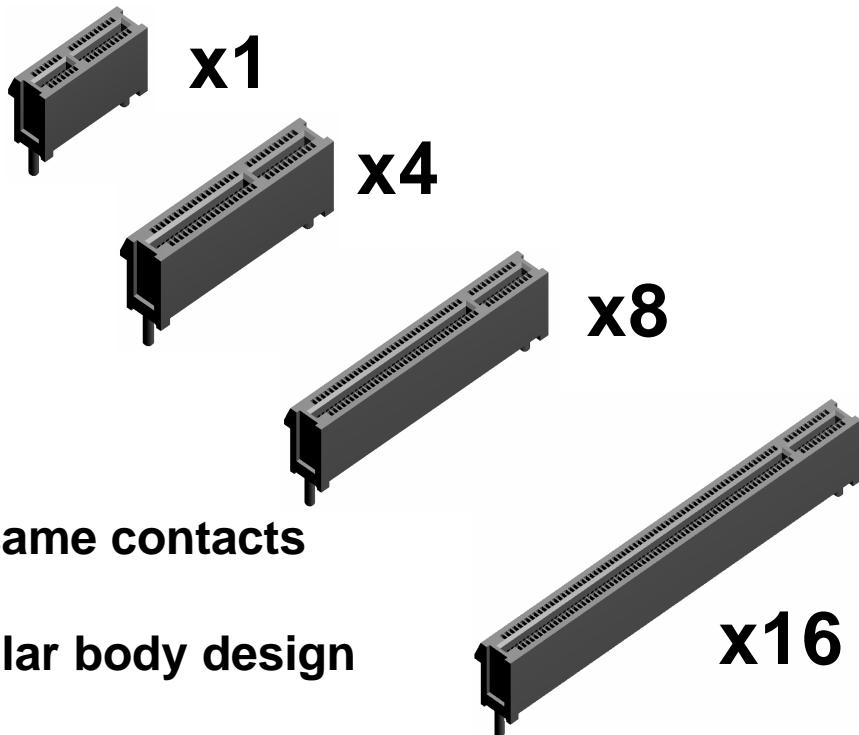
**x1 connector 36 pins vs.  
PCI 120 pins**

**Simple Single Level Contacts**

**1mm Contact Spacing**

**Low Cost Connector Assembly**

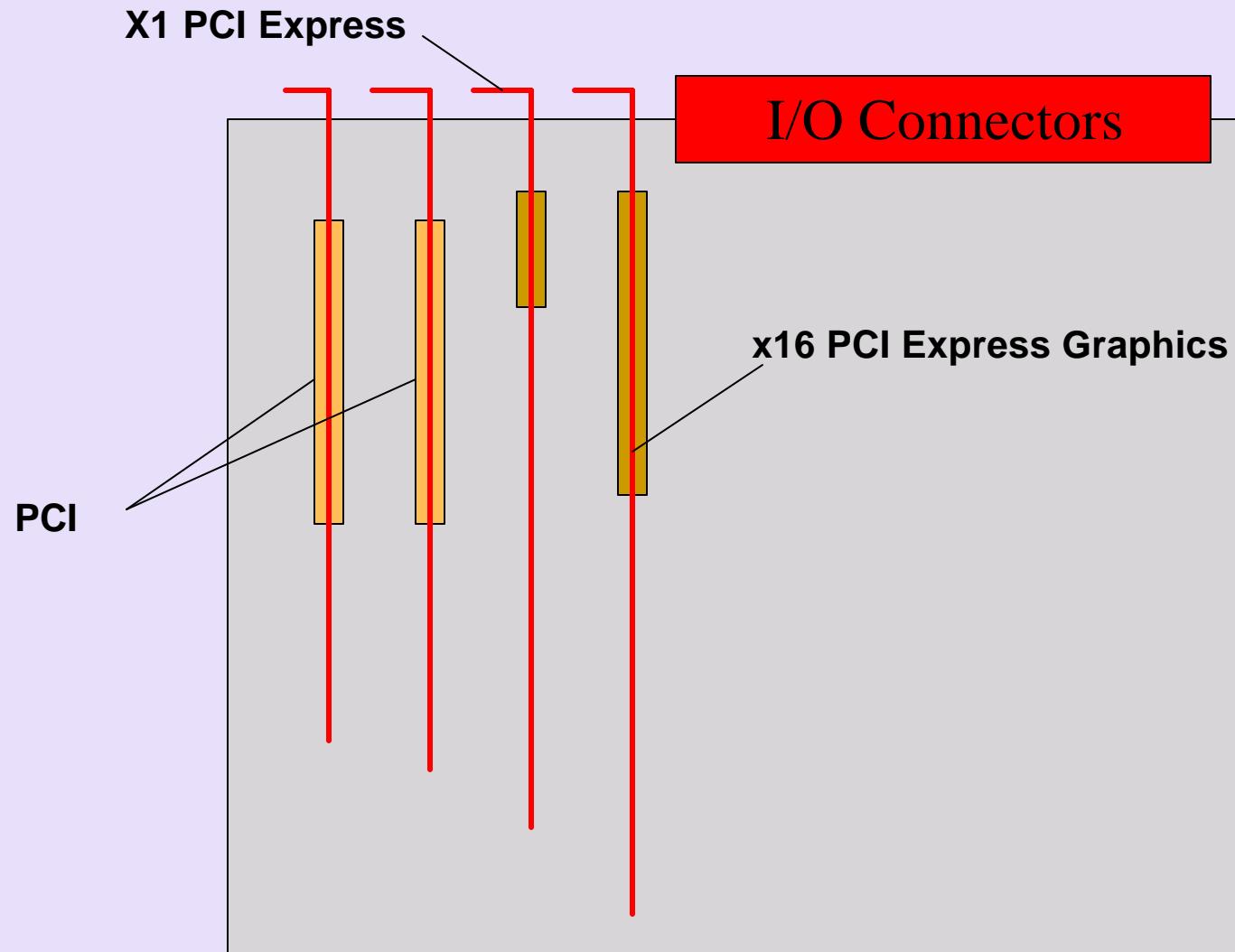
# Scalable Connector Design



**Scalable Design allows connectors from x1 to x16 to be easily designed**

**Smaller link-width cards can plug into larger link-width connectors**

# Slot Placement Strategy



# Routing in 4-Layer Motherboards

PCI  
Connectors

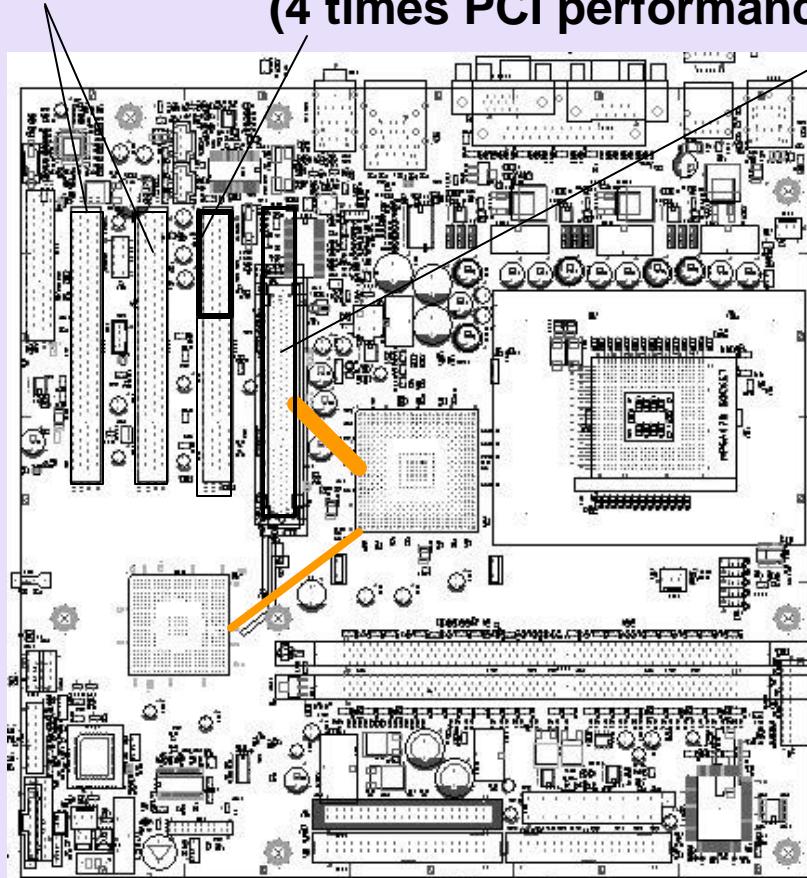
PCI Express x1 connector  
(4 times PCI performance)

PCI Express x16 connector  
(64 times PCI performance)

PCI Express layout and connectors can be routed in 4 Layers

Flexibility in routing PCI Express and PCI connectors on the same board

Smaller connectors provide more room for routing and components



μATX 4 Layer, P4 Motherboard

# Power Delivery

<b><i>Power Rail</i></b>	<b><i>10W slot</i></b>	<b><i>25W slot</i></b>	<b><i>75W slot</i></b>
+3.3V ±9%	3A max	3A max	3A max
+12V ±8%	0.5A max	2.1A max	5.5A max
+3.3Vaux ±9%	375mA max	375mA max	375mA max

## Notes:

- 3.3Vaux max current is 375mA when the add-in card is Wake enabled and 20mA when Wake disabled.
- An ECR to the CEM 1.0 spec changed the maximum slot power from 60W to 75W

## Compared to PCI and AGP:

- Additional power from 12v rail
- +5V, -12V requirements are eliminated

# Power Rules

- System MUST provide +12V and +3.3V rails to ALL PCI Express slots in a chassis
- Systems may optionally provide +3.3Vaux but if supplied it MUST be provided to all PCI Express slots in a chassis
- If the platform supports the WAKE# signal then it MUST provide it and +3.3Vaux to all PCI Express slots in chassis
- Capacitive load rules:
  - ✓ +12V rail: 300 $\mu$ F @ 10W; 1000 $\mu$ F @ 25W; 2000 $\mu$ F @ 75W
  - ✓ +3.3V rail: 1000 $\mu$ F
  - ✓ +3.3Vaux rail: 150 $\mu$ F

# Power Rules (Continued)

- Current slew rate: 0.1A/ $\mu$ s
- All x1 add-in cards must power up at a maximum of 10W; once configured as a High Power device, if applicable, a card can consume up to 25W
- All x16 add-in cards must power up at a maximum of 25W; once configured as a High Power device, if applicable, a graphics card can consume up to 75W

# Power & Card Summary

- 10W: x1 cards (= 6.6" length)
- 25W: x1 cards (> 7.0" length), x4 cards, x8 cards, x16 low-profile graphics cards, x16 server I/O cards
- 75W: x16 full-height graphics cards

# Add-in Card Interoperability

Slot Card \ Card	x1	x4	x8	x16
x1	Required	Required	Required	Required
x4	No	Required	Allowed	Allowed
x8	No	No	Required	Allowed
x16	No	No	No	Required

- Up-plugging: Plugging a smaller link card into a larger link connector is fully allowed.
- Down-plugging: Plugging a larger link card into a smaller link connector is not allowed and is physically prevented.
- Down-shifting: Plugging a card into a connector that is not fully routed for all of the lanes. In general, this is not allowed. The exception is the x8 connector which the system designer may choose to route only the first four lanes. A x8 card functions as a x4 card in this scenario.

# Reference Clock (REFCLK+, REFCLK-)

- Differential pair
- Nominal frequency of 100MHz ( $\pm 300\text{ppm}$ )
- Point-to-point connection between each PCI Express connector and the clock source
- Within each differential pair the PCB trace lengths must be within 0.005"
- Spread Spectrum support is optional but likely needed to pass emissions testing!
- Termination resistors located at the clock source

# Lane Reversal, Polarity Inversion

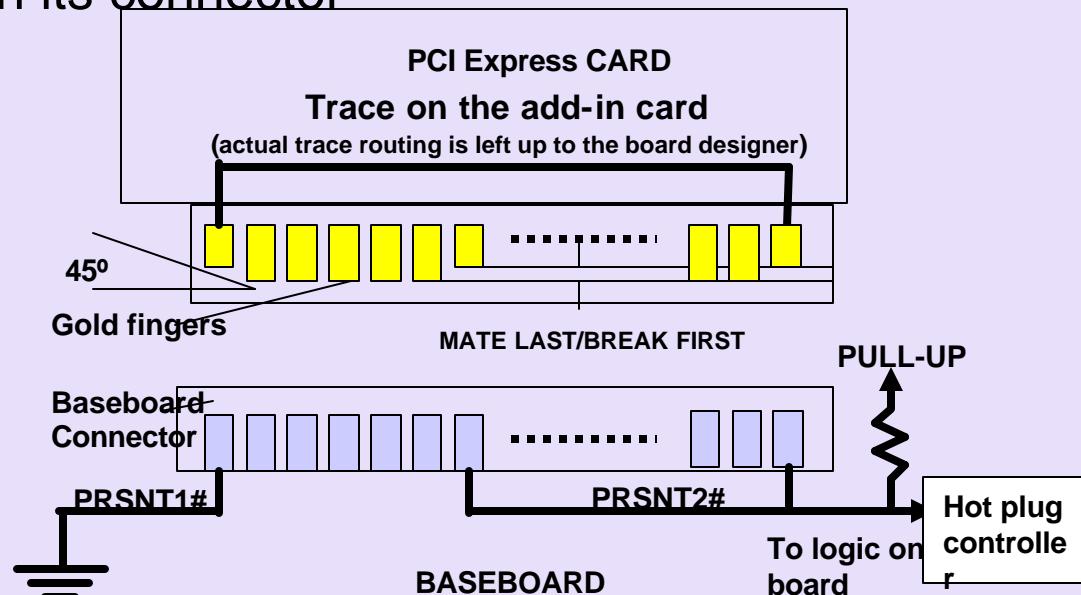
- The plus and minus connections from the system board's transmit differential pair (PETp/PETn) may be reversed
  - ✓ Simplification for board routing
  - ✓ Receiver is required to support Lane Polarity Inversion
- If a component does NOT support lane reversal then the board (system or add-in card) must adhere to strict connection ordering (i.e. Lane 0 to Lane 0, Lane 1 to Lane 1, etc) to the add-in card connector
- If a component DOES support lane reversal then the same lane ordering must be used for both the transmit and receive pair

# CEM spec updates since Revision 1.0a

- Card Presence Detect
- REFCLK clarification
- Slot Power Limit Implementation Note
- Connector color
- Card retention
- PERST# clarification

# Card Presence Detect

- Supports the hot plug solution; ALL add-in cards must implement both gold fingers, PRSNT1# and the “furthest” PRSNT2#
- System use is optional for non-hot plug solutions
- There are multiple PRSNT2# pins on the connector – this is needed to support up-plugging
  - ✓ System buses them together
  - ✓ Add-in card connects PRSNT1# to the FURTHEST PRSNT2# pin on its connector



# REFCLK clarification

- The timing budget allows for approximately 4" of add-in card trace length
- Termination resistors on the add-in card ARE allowed but...
  - ✓ Not covered by the CEM spec!
  - ✓ The nominal voltage swing, and rise & fall times will be reduced in half!
- Consider shutting off the clock to empty slots!
- Additional details on REFCLK measurement configurations and data are being provided in the CEM 1.0a Errata document

# Slot Power Implementation Note

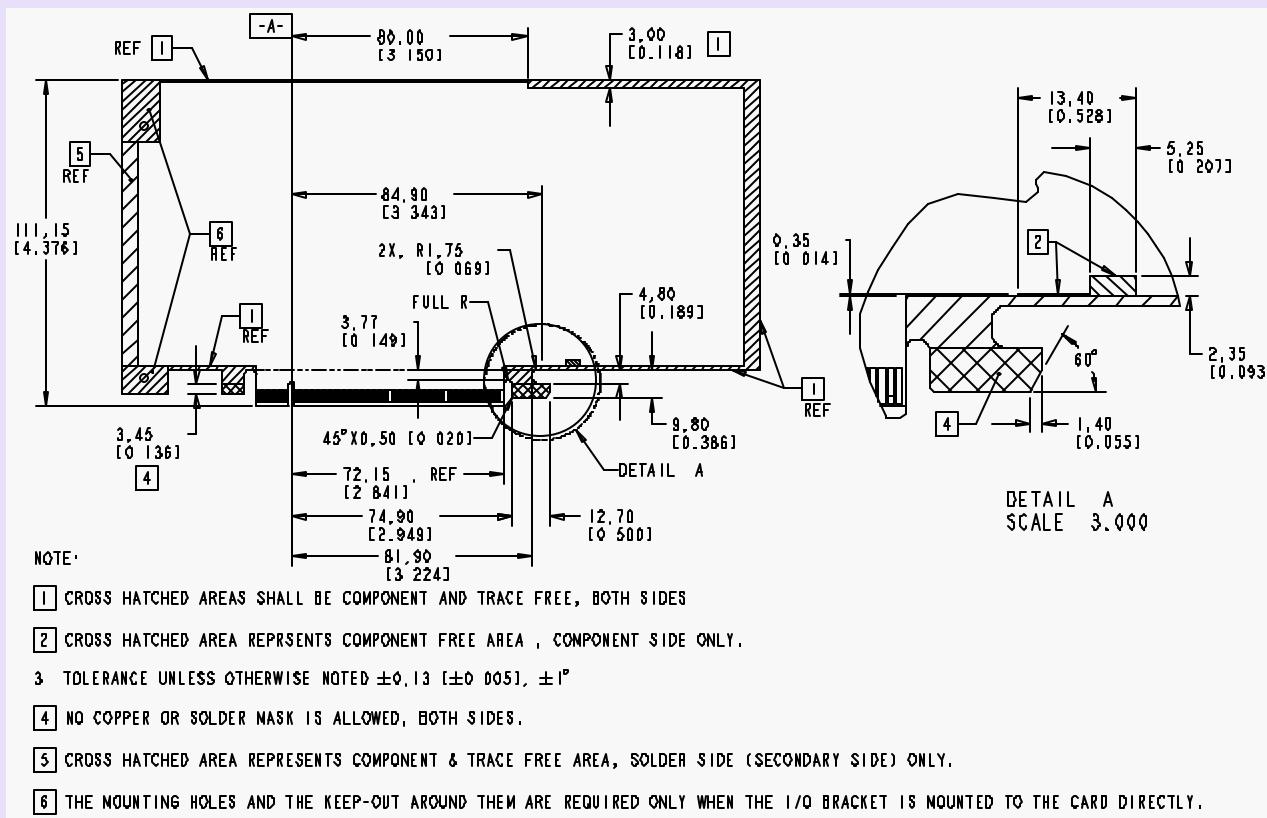
- Software Update of the Slot Power Limit -  
System firmware must update the slot power limit to the system's allocated value for the PCI Express add-in card (e.g. Graphics) and ensure the completion of this update prior to invoking the option ROM for that add-in card's PCI Express function. If the initial slot power limit value is set by hardware initialization then any attempt by software to change that value must be verified by that software prior to initializing the add-in card. Subsequent updates by the system firmware or operating system software, if any, may only increase the slot power limit value. However, after a card is reset the initial slot power limit value may be lower than the previous value. The maximum power level for an add-in card must be assigned by the system firmware during PCI Express bus configuration. For graphics the power level assigned will be dependent on the platforms support of the PCI Express Graphics High-End Specification (including the supplemental power cable).

# Connector Color

- CEM 1.0 did not suggest or specify a color for the add-in card connector
- Approved ECN addresses this
- By default the recommended color should be black
  - ✓ This color hasn't been used for an add-in card connector since ISA was around)
  - ✓ Avoids any confusion with PCI connectors even though PCI and PCI Express cards are mechanically incompatible
- Other colors ARE allowed if a system OEM requires a particular color coding scheme

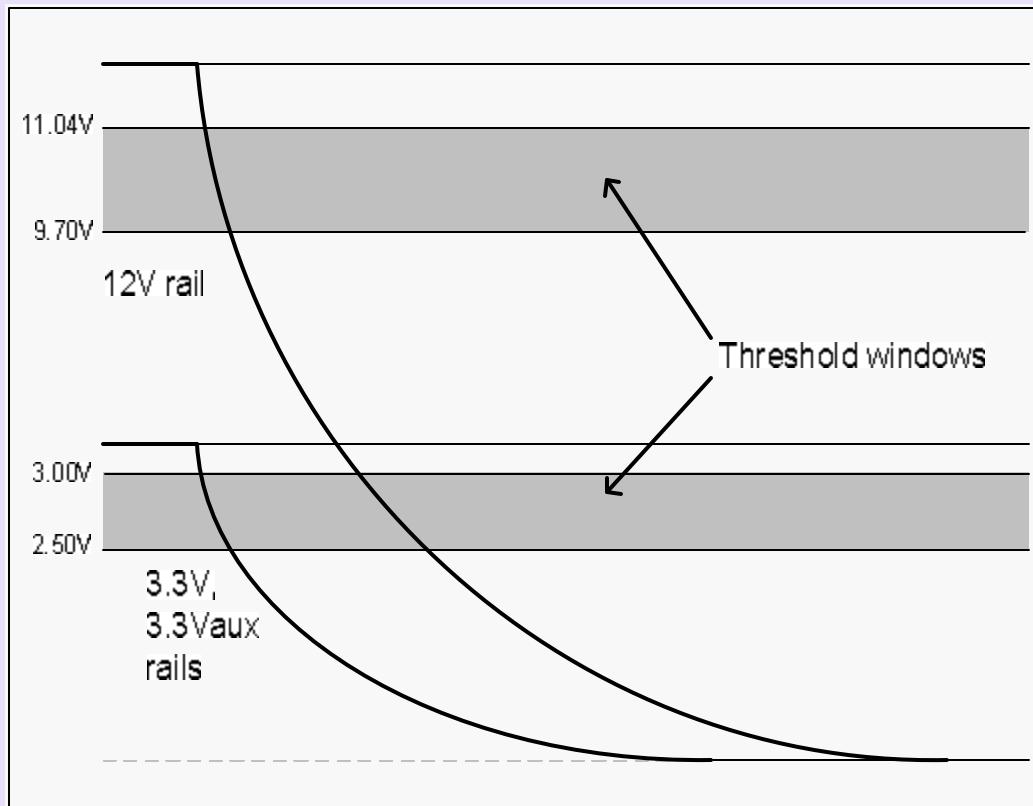
# Card Retention

- ECN defines additional component keepout areas on add-in cards to support system-level card retention
  - Focus is on full-height, x16 cards for Graphics



# PERST# Clarification

- ECN defines threshold windows for PERST# activation
- Voltage monitoring circuitry will be able to reliably detect a power rail condition requiring the assertion of PERST#



# Add-in Card Summary

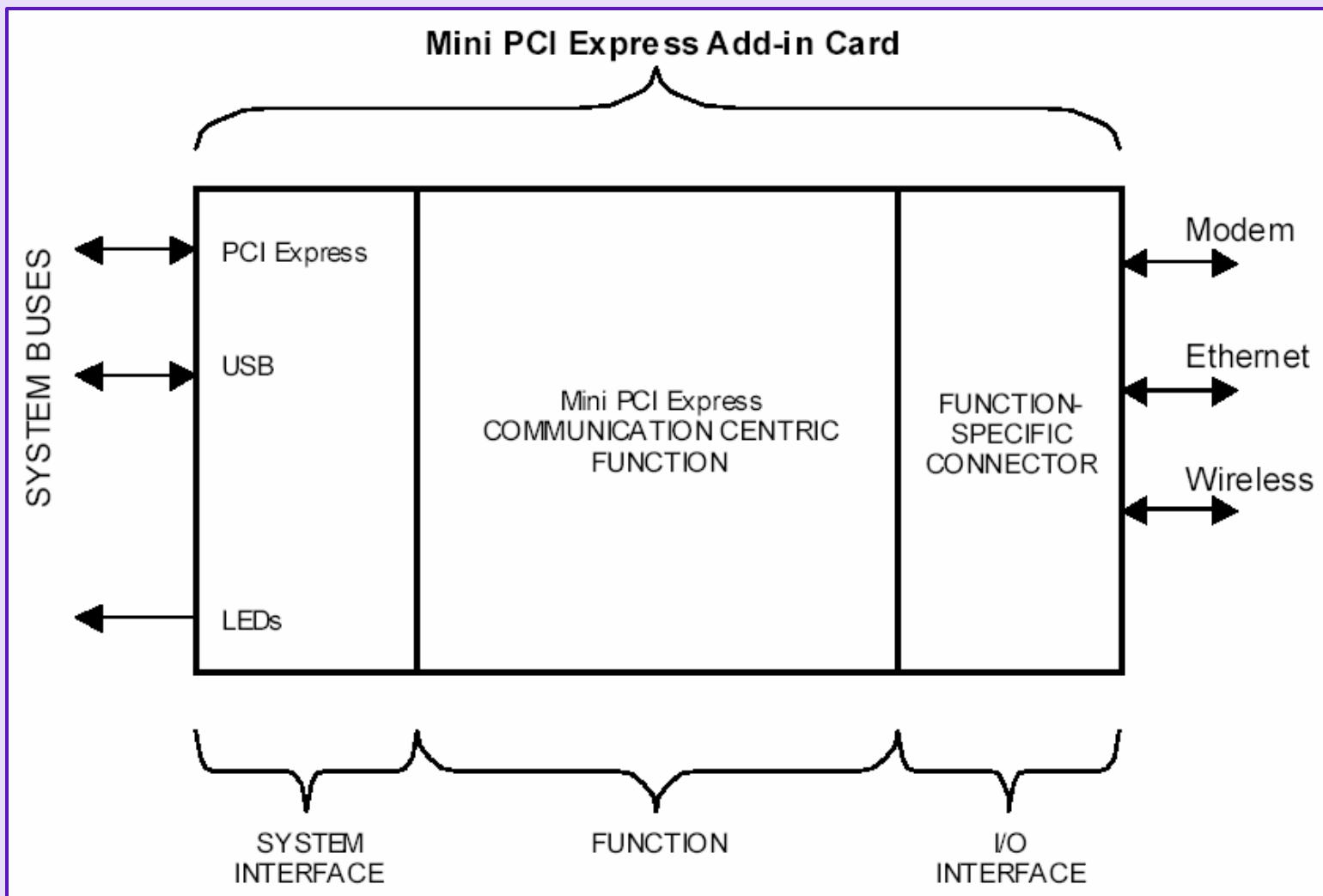
- PCI Express is Optimized for Cost
  - ✓ Cost-effective for migration into commodity infrastructure
  - ✓ Replaces PCI over time with 15+ years of life
- PCI Express is Easy to Implement
  - ✓ Leverages existing form factors and standards
  - ✓ Transition with existing PCI form factors

# PCI Express Mini Card

# What is PCI Express Mini Card

- Replacement for Mini PCI
  - ✓ Targeted for BTO/CTO solutions
- PCI Express and USB 2.0 enabled
  - ✓ Optimized for communication add-ins
- Card envelope: 30mm x 56mm x 5mm
  - ✓ Equal to  $\frac{1}{2}$  width of Mini PCI Type IIIa card

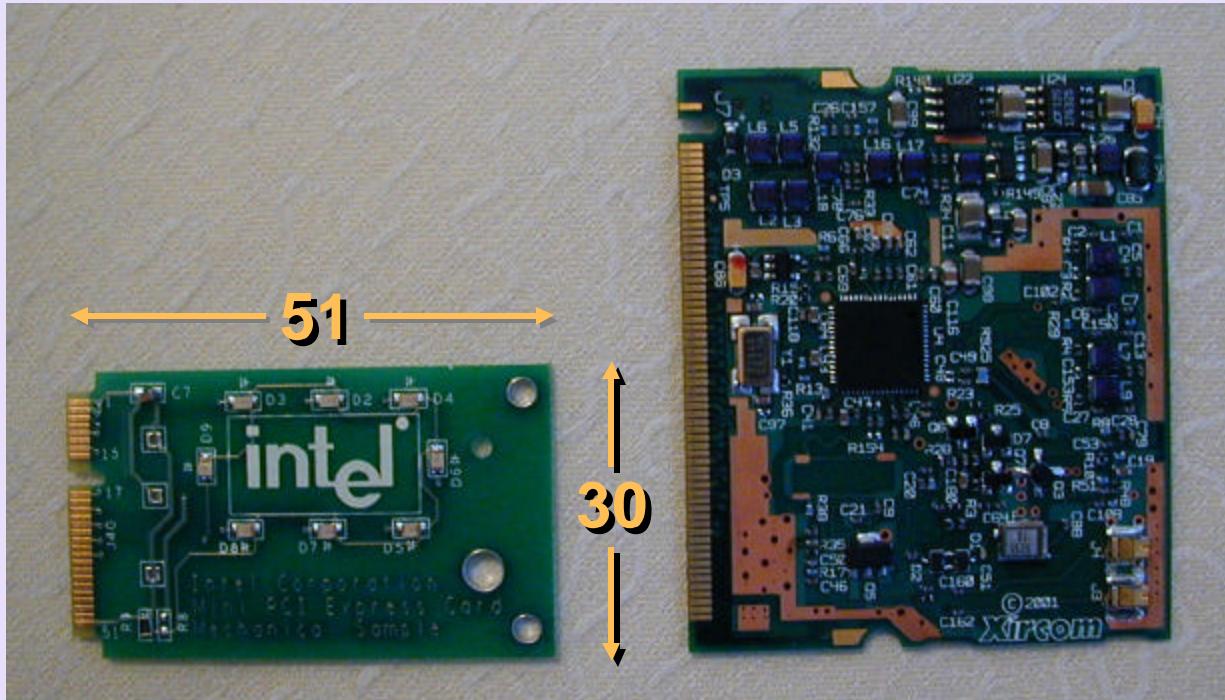
# Communications Centric



# Targeted Applications

- Wireless-Personal Area Network (W-PAN)
  - ✓ Bluetooth / Ultra wideband
- Local Area Network (LAN)
  - ✓ 10/100/1G/10G Ethernet
- Wireless-LAN (W-LAN)
  - ✓ 802.11b/g/a, etc.
- Wide Area Network (WAN)
  - ✓ V.90/V.92 modem / xDSL / cable modem
- Wireless-WAN (W-WAN)
  - ✓ GSM/GPRS / UMTS / CDMA

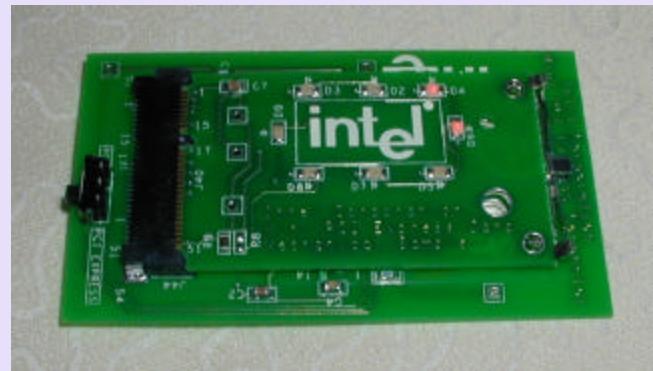
# Half the Size of Mini PCI



**PCI Express Mini PCI  
Mini Card (Type IIIa)**

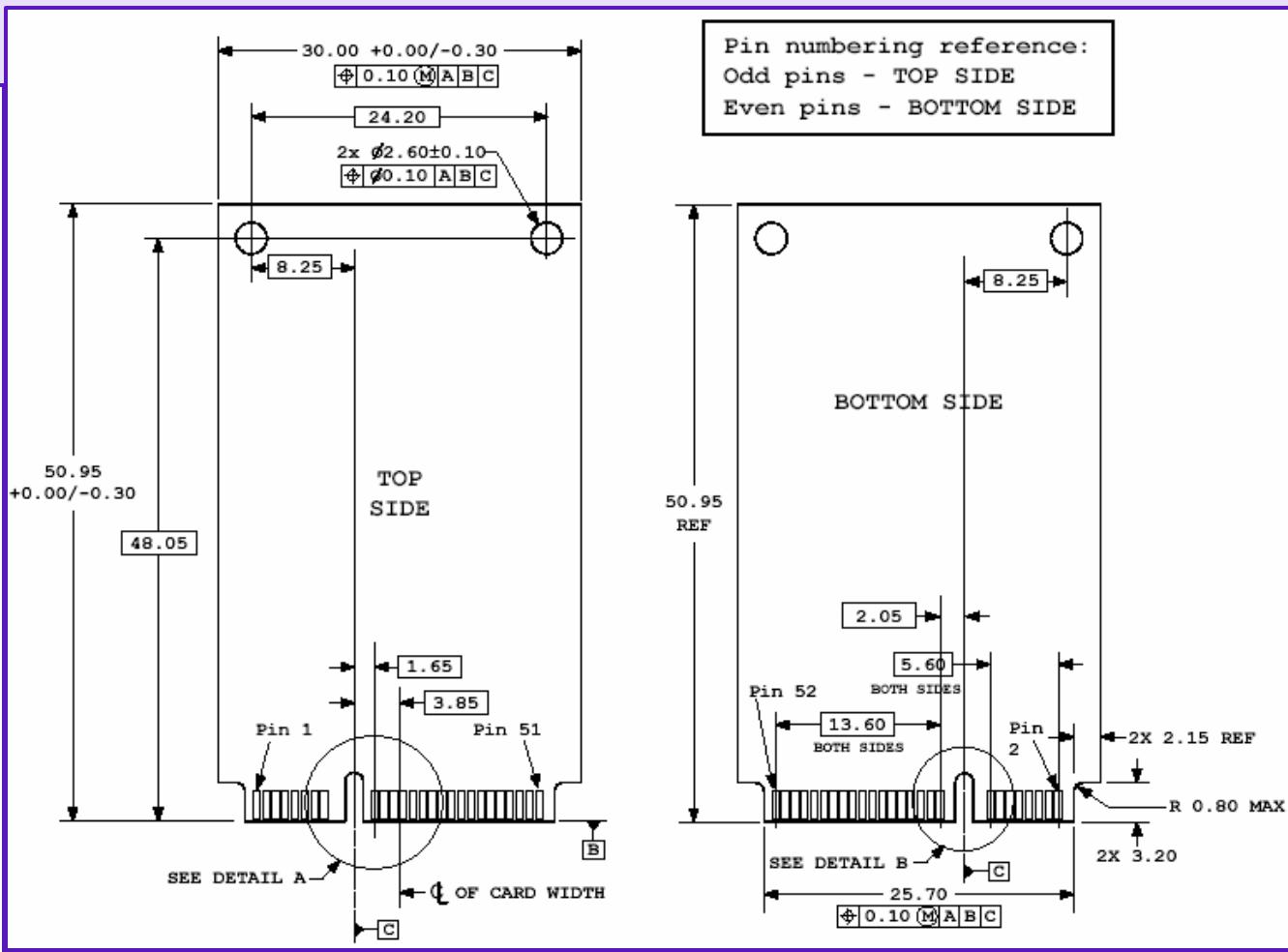
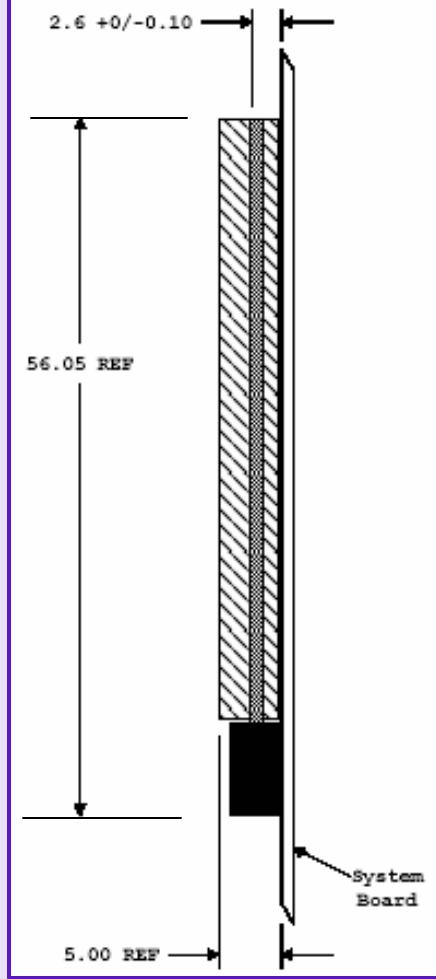
# Upgradeability / Serviceability

- Angled insertion and removal
- OEM optimized retention
  - ✓ Internal clips / screws / door attached clip
- BTO / CTO
  - ✓ Single connector
  - ✓ Multiple technologies
- Field replacement by service technicians
  - ✓ Reduce TCO / services costs



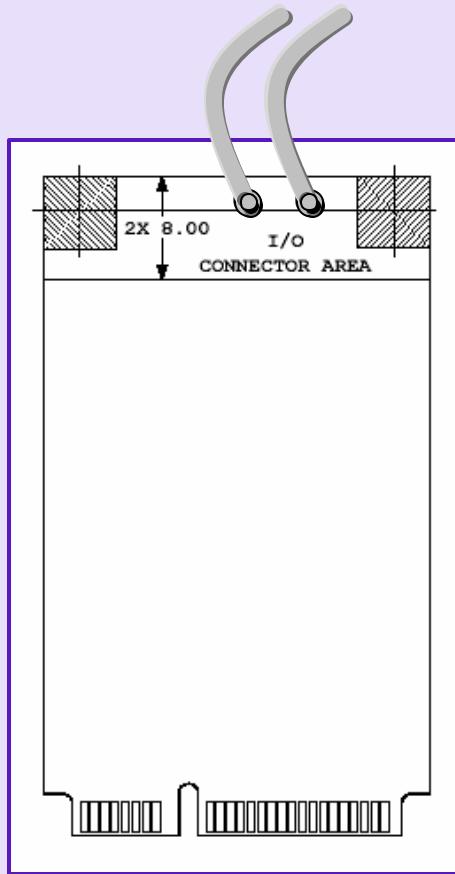
# Mechanical Summary (1)

## Cross-section



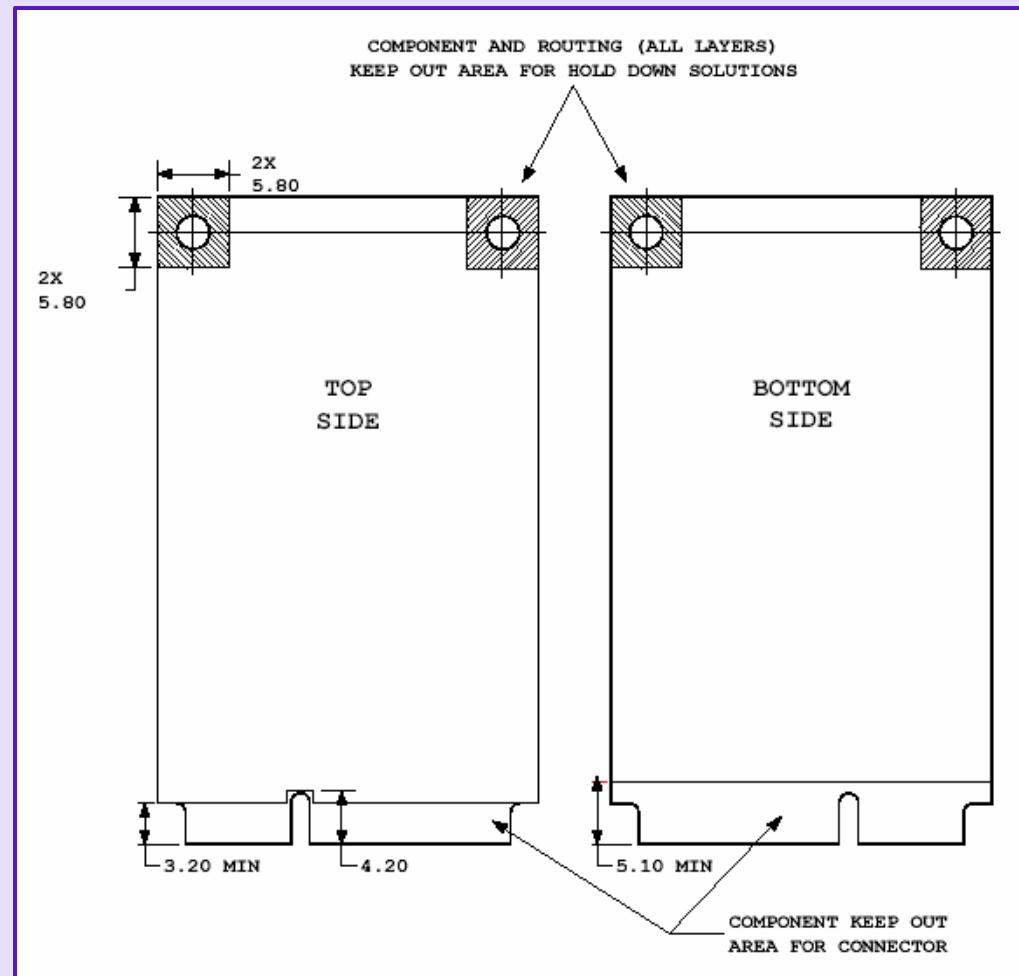
Card outline dimensioning

# Mechanical Summary (2)

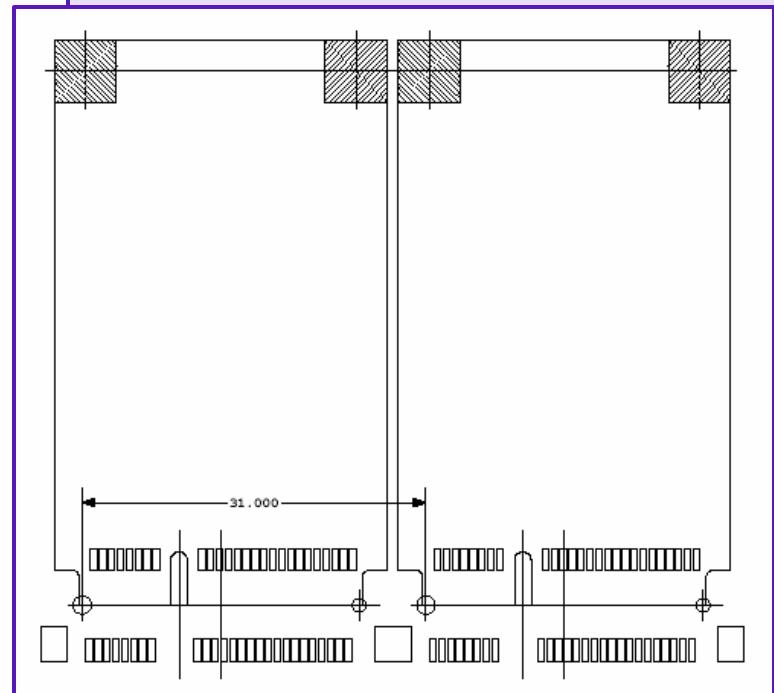
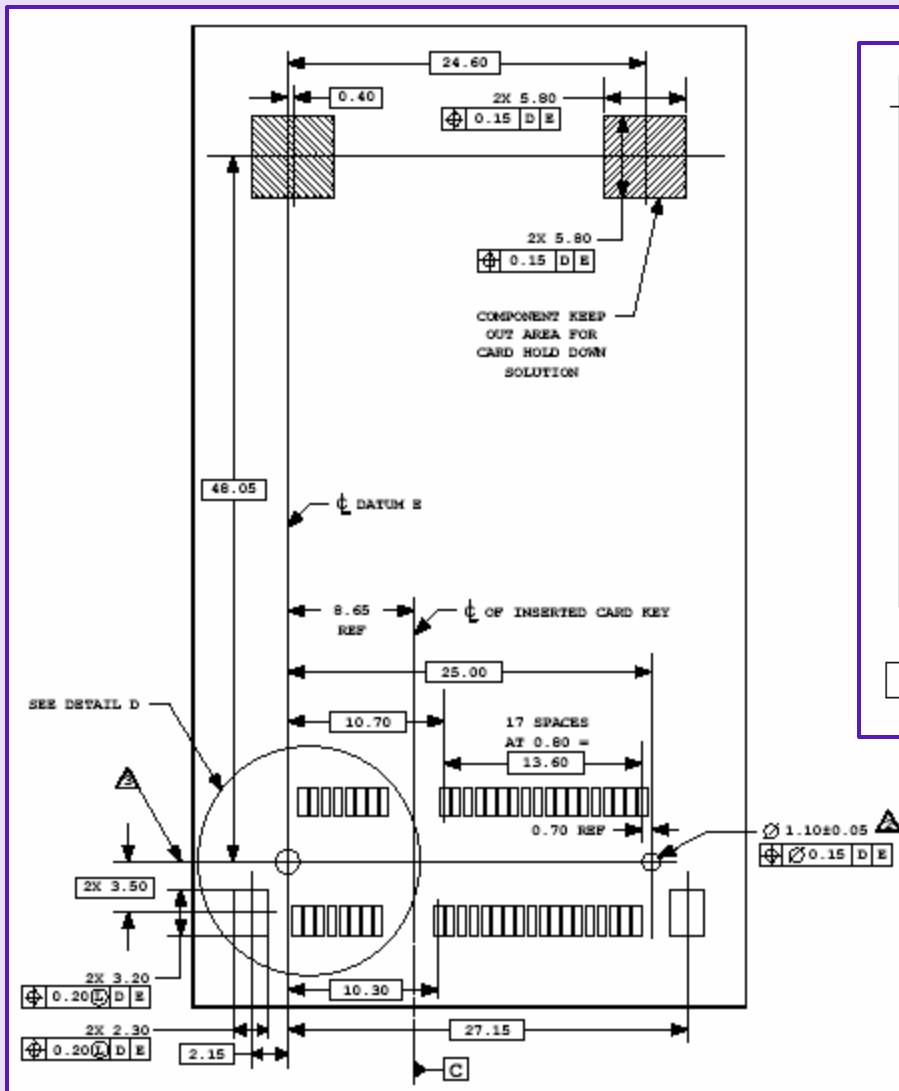


I/O connector zone

Keep out zones



# Mechanical Summary (3)



Two socket arrangement defined  
System board footprint

# Signal Summary

Signal Group	Signal	Direction	Description
Power	+3.3V (2 pins)		Primary 3.3V source
	+3.3VAUX (1 pin)		Auxiliary 3.3V source
	+1.5V (3 pins)		Primary 1.5V source
	GND (12 pins)		Return current path
PCI Express	PETp0, PETn0 PERp0, PERn0	Input/Output	PCI Express x1 data interface: 1 differential transmit pair and 1 differential receive pair
	REFCLK+, REFCLK-	Input	PCI Express differential reference clock (100 MHz)
	CLKREQ#	Output	Reference clock request
Universal Serial Bus	USB_D+, USB_D-	Input/Output	USB serial data interface – USB2.0 Specifications
Auxiliary Signals	PERST#	Input	Functional reset to the card
	WAKE#	Output	Open Drain active Low signal
	SMB_DATA	Input/Output	SMBus data signal – SMBUS 2.0 Specifications
	SMB_CLK	Input	SMBus clock signal – SMBUS 2.0 Specifications
Communications Specific Signals	LED_WPAN#, LED_WLAN#, LED_WWAN#	Output	Active Low signals – connection status indicators

# Pin Arrangement

52 pin solution  
Arranged to  
assure isolation

PCI  
Express

REF  
Clock

USB

Table 3-4: System Connector Pin-Out

Pin #	Name	Pin #	Name
51	Reserved*	52	+3.3V
49	Reserved*	50	GND
47	Reserved*	48	+1.5V
45	Reserved*	46	LED_WPAN#
43	Reserved*	44	LED_WLAN#
41	Reserved*	42	LED_WWAN#
39	Reserved*	40	GND
37	Reserved*	38	USB_D+
35	GND	36	USB_D-
33	PETp0	34	GND
31	PETn0	32	SMB_DATA
29	GND	30	SMB_CLK
27	GND	28	+1.5V
25	PERp0	26	GND
23	PERn0	24	+3.3VAUX
21	GND	22	PERST#
19	Reserved	20	Reserved***
17	Reserved	18	GND

Mechanical Key

15	GND	16	Reserved**
13	REFCLK-	14	Reserved**
11	REFCLK+	12	Reserved**
9	GND	10	Reserved**
7	CLKREQ#	8	Reserved**
5	Reserved****	6	1.5V
3	Reserved****	4	GND
1	WAKE#	2	3.3V

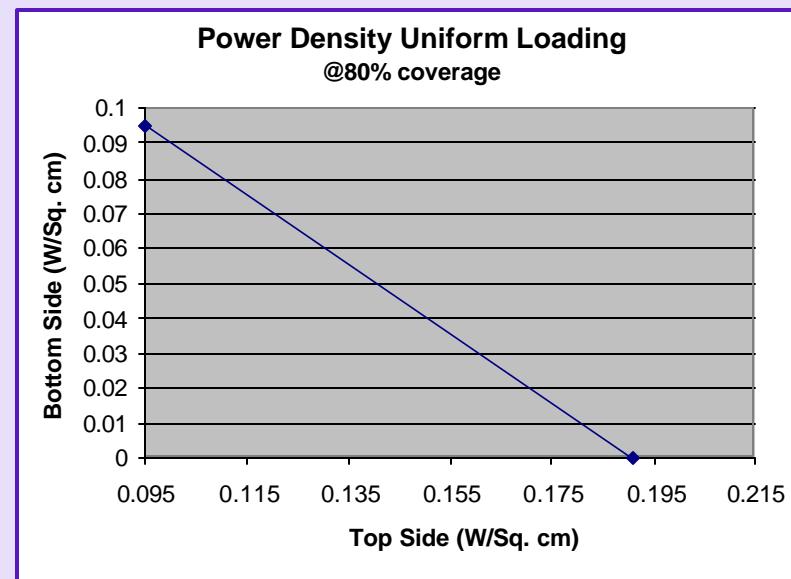
# Power and Thermals

Table 3-6: Power Ratings

	Primary power		Auxiliary power*
	Voltage Tolerance	Peak (max) mA	Normal (max) mA
+3.3V (AUX)	±9%	1,000	750
+1.5V	±5%	500	N/A

**3W MAX power consumption**

**2.3W MAX thermal dissipation**



# Designed for Power Efficiency

- Robust power management features
  - ✓ ACPI and PCI PM supported
  - ✓ In-band wake mechanisms supported
  - ✓ Wake# – *enables lowest system power solution*
  - ✓ SMBus – *available for advanced features*
- Dual power planes
  - ✓ 3.3V – *nominal voltage required for I/O drive requirements*
  - ✓ 1.5V – *reduces need for on-card regulation*
- Two power states
  - ✓ PRIMARY – 3.3V and 1.5V fully ON
  - ✓ AUXILIARY – 3.3VAUX available in D3<sub>HOT</sub>

# Status Indicators

Table 3-2: Defined LED states

State	Definition	Characteristics
OFF	The LED is emitting no light.	
ON	The LED is emitting light in a stable non-flashing state.	
Slow Blink	The LED is flashing at a steady but slow rate.	$250 \pm 25\%$ milliseconds ON period $0.2 \pm 25\%$ Hz blink rate
Intermittent Blink	The LED is flashing intermittently proportional to activity on the interface.	50% duty cycle 3 Hz minimum blink rate 20 Hz maximum blink rate

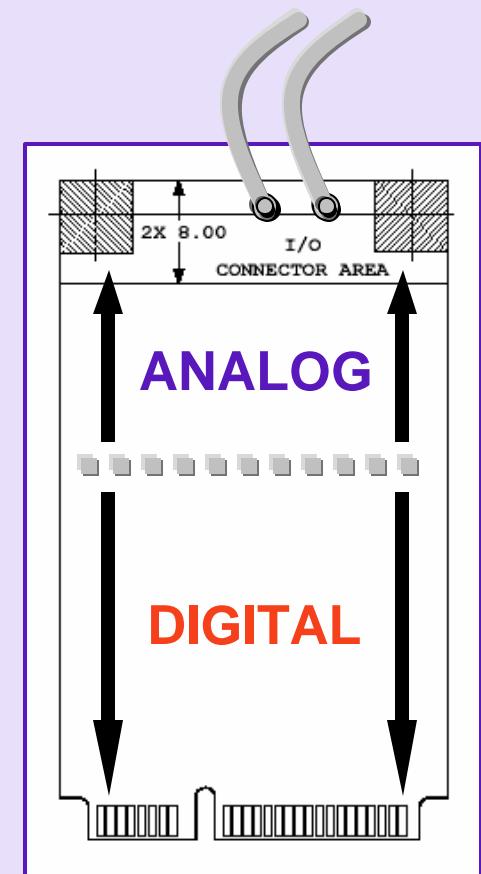
Table 3-3: Recommended use for LED indicators by wireless classes

State	W-PAN	W-LAN	W-WAN
OFF	Not powered	Not powered	Not powered
ON	Powered; ready to transmit or receive	Powered, associated and authenticated but not transmitting or receiving	Powered, associated and authenticated but not transmitting or receiving
Slow Blink	N/A	Powered but not associated or authenticated; searching	Powered but not associated or authenticated; searching
Intermittent Blink	Activity proportional to transmitting & receiving speed	Activity proportional to transmitting & receiving speed	Activity proportional to transmitting & receiving speed For voice applications, turning off and on the intermittent blink based on the ring pulse cycle can indicate a ring event.

- Three LEDs
  - ✓ W-PAN
  - ✓ W-LAN
  - ✓ W-WAN
- Single-ended, 9 mA sink capable
- LED support via I/O connector
  - ✓ Still an option

# Ease of Design

- Digital / Analog physical separation
  - ✓ RF is not as near to digital
    - High speed digital on host connector
    - Analog on I/O connectors
- Spread Spectrum Reference clock supports
  - ✓ Reduced EMI emissions
- Software compatibility
  - ✓ Per native bus definitions
    - PCI Express
    - USB 2.0
    - SMBus 2.0



# Mini Card Summary

- Higher performance and smaller F/F replacement for Mini PCI
- Optimized for communications applications
  - ✓ IHVs can select the serial interface appropriate for their device
  - ✓ Support for LED status indicators
- Outstanding power management features

# ExpressCard\*

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

# Agenda

- The motivation behind *ExpressCard* technology
- Key characteristic details of *ExpressCard* technology
- Key design considerations
- *ExpressCard* applications opportunities

# The ExpressCard® Standard

PCMCIA's next generation PC Card technology specification

- ✓ Major step to align with platform trends
- ✓ Retains the best characteristics of CardBus
- ✓ Leverages advanced serial bus technologies



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# Platform shifts present opportunities, drive requirements

I/O interconnect

*fast serial links*

*native hot-plug*

**smaller yet higher performance  
lower cost by design**

Notebook PCs

*thinner and lighter*

**smaller yet flexible**

Desktop PCs

*smaller, modular  
form factors*

**technology reuse  
lower cost by volume  
address growing SFF market**

Establishing module product compatibility across desktop & mobile

# Desktop View on ExpressCard

- Significant ease-of-use benefit over traditional add-in cards
  - ✓ Closed box I/O expansion without clutter and complexity
  - ✓ Lower support costs compared to traditional add-in cards
- Uses native interfaces
  - ✓ I/O plumbing is “standard feature” of the base platform
  - ✓ No external I/O controller or bridge is required
- Advanced serial interfaces vs. existing parallel interfaces
  - ✓ Fewer pins and more bandwidth
  - ✓ Lower cost interconnects (connector, cables, silicon)
    - Leverage a larger combined desktop / mobile market
    - ✓ Draw on mobile platform proven usage model

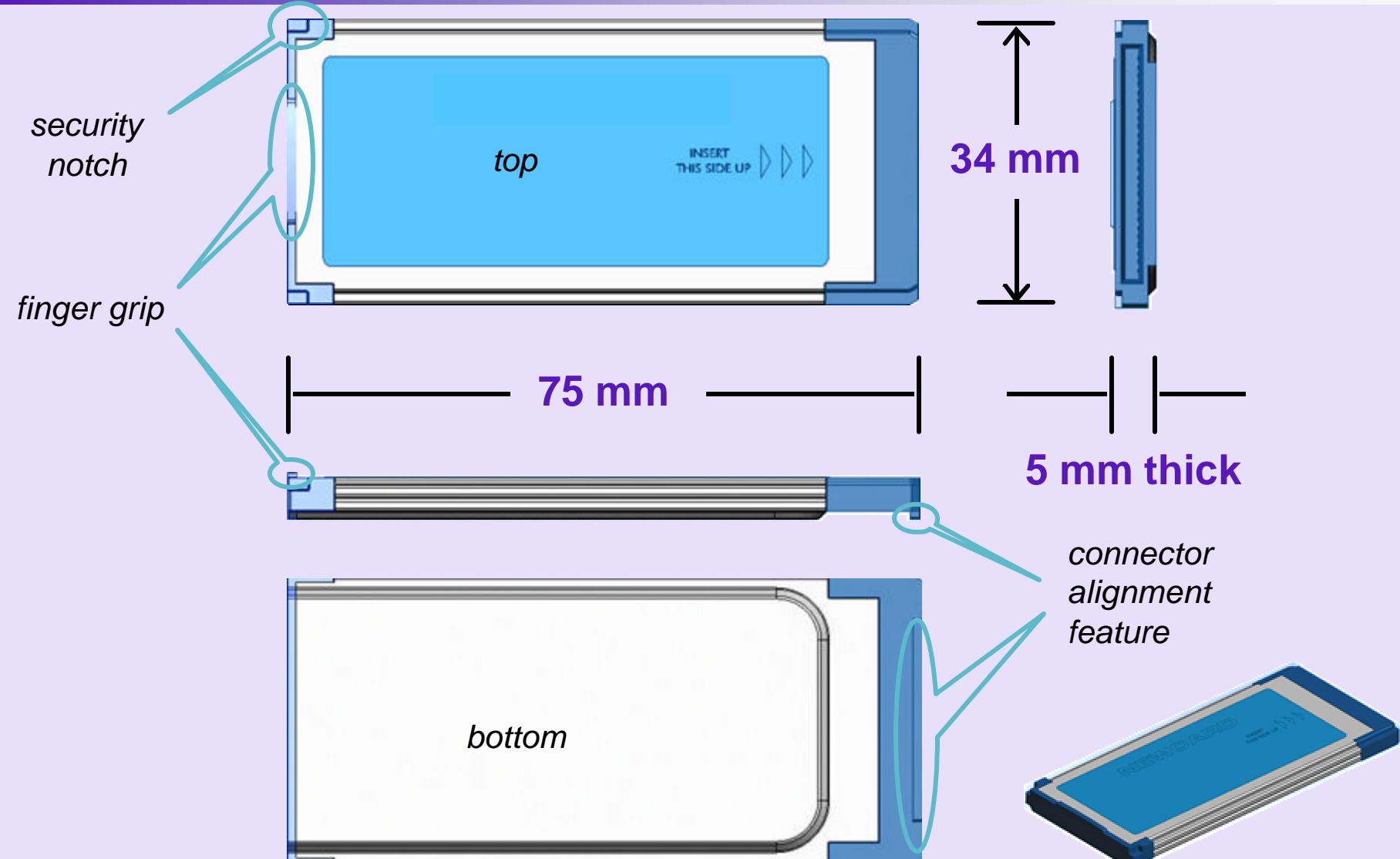


*SFF desktop market growing – estimates range from 20% - 40% market share by 2005*

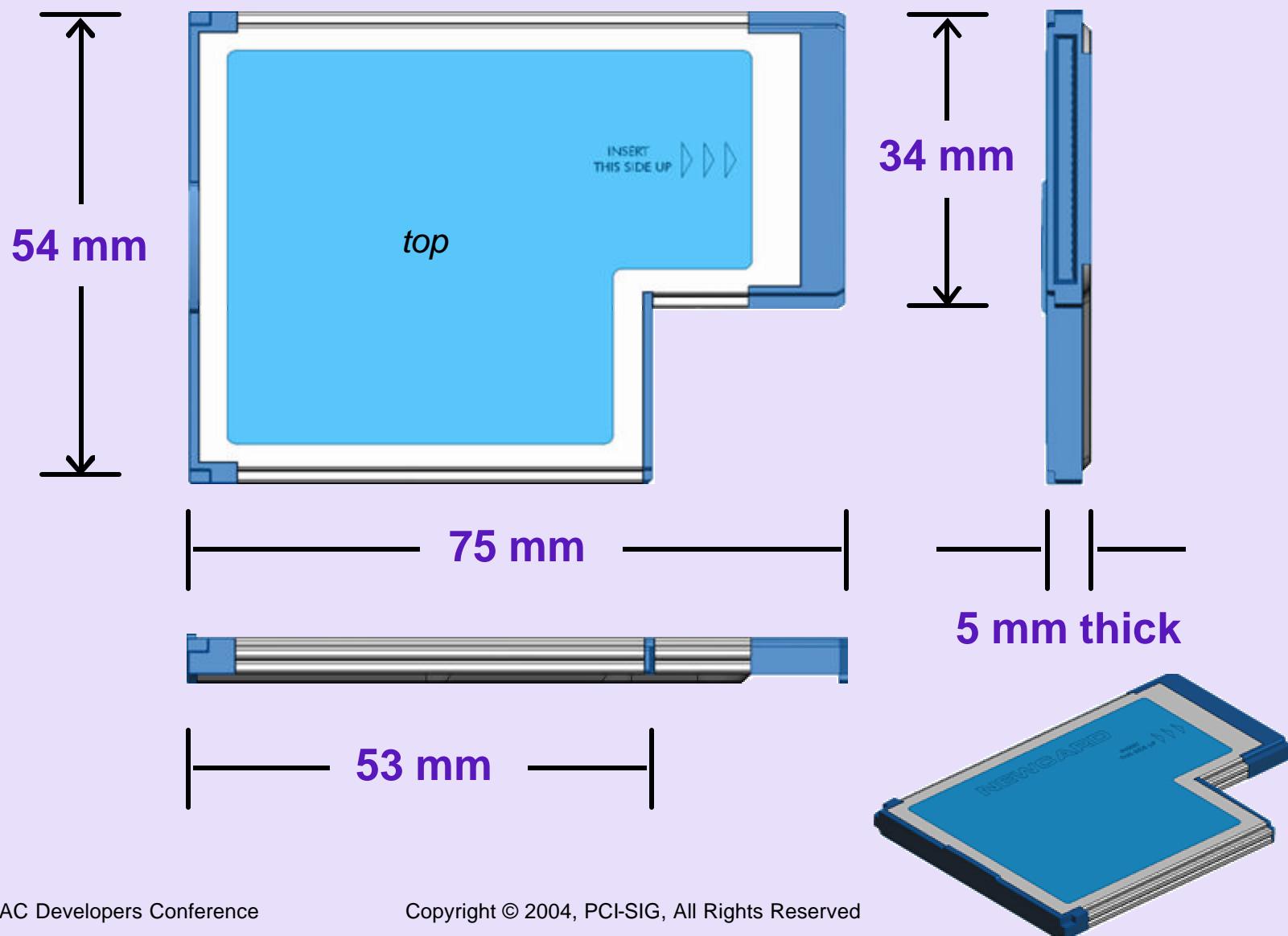
# Architectural Overview

- System design based on a modular, extensible slot model
  - ✓ Assumes multiple slot solutions, single slots allowed
- Relies on native bus operation
  - ✓ *PCI Express Base Specification 1.0a*
  - ✓ *USB 2.0 (low / full / high speeds)*
- *Compliant systems must support both in slots*
- Compatible with existing operating system
  - ✓ Future OS may offer non-essential enhancements

# ExpressCard/34 Module Form-Factor



# ExpressCard/54 Module Form-Factor



# Building a Slot

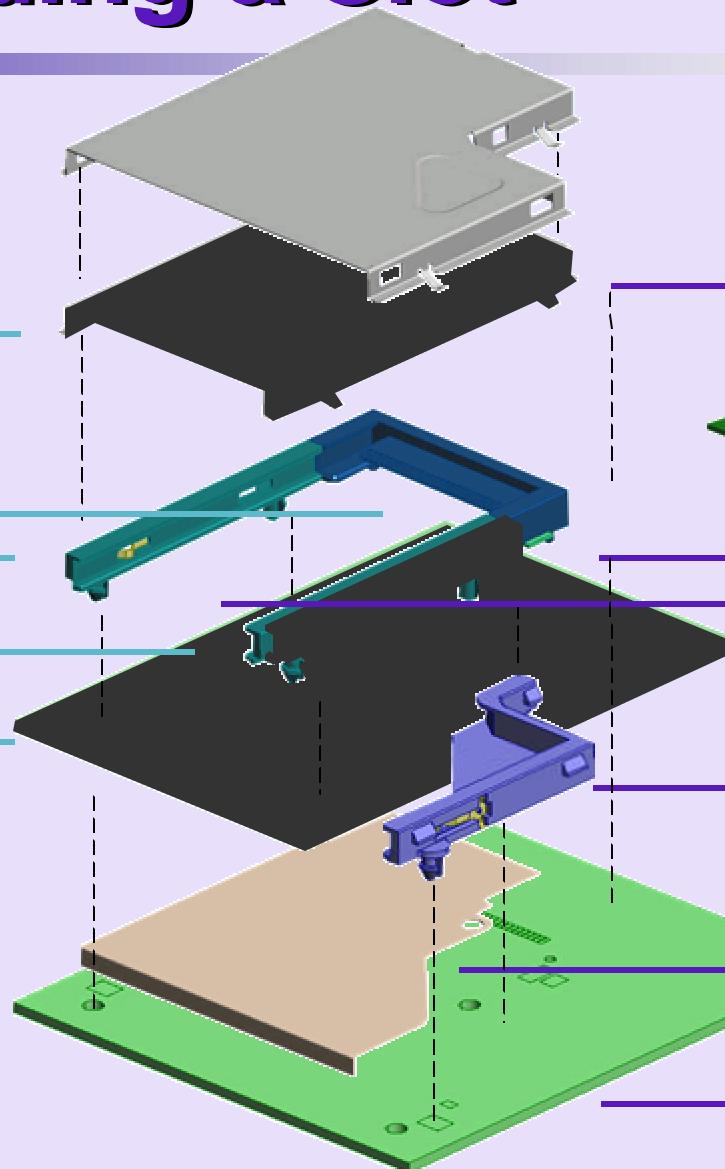
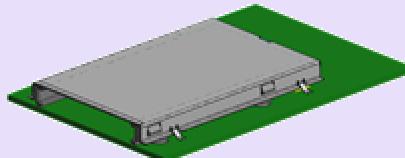
Slot for 34mm modules only

Top Cover

Host Connector  
Left Guide Rail

Right Guide Rail

Host/Daughter Card



Universal slot for both modules

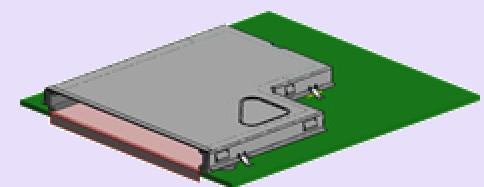
Top Cover

Host Connector  
Left Guide Rail

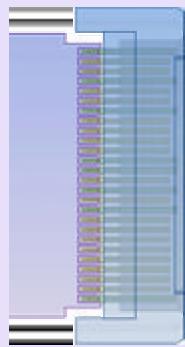
Right Guide Rail

PCB Insulator

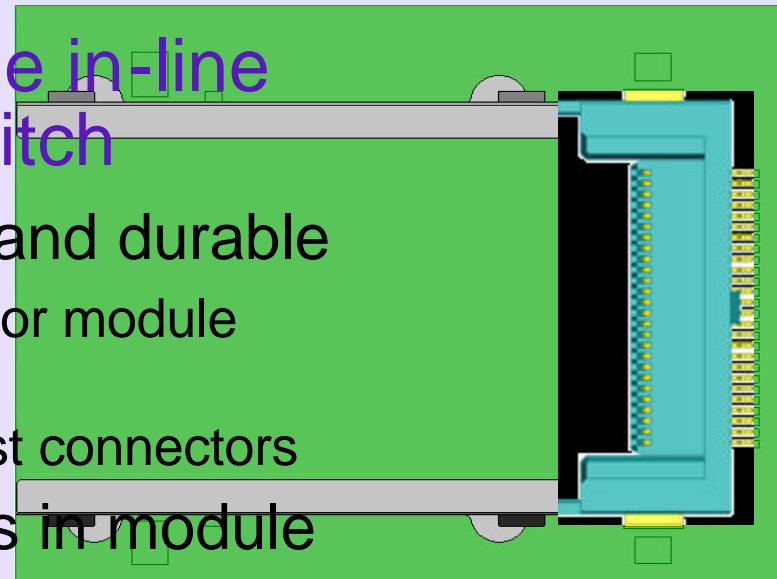
Host/Daughter Card



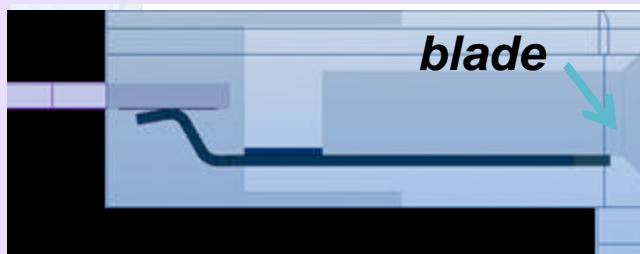
# ExpressCard Connectors



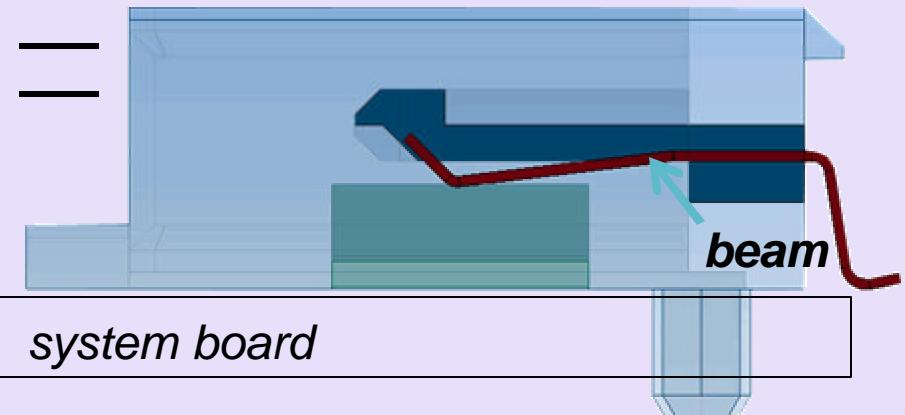
- Beam-on-blade, single in-line configuration, 1mm pitch
  - ✓ Low-cost yet reliable and durable
    - 5K / 10K cycle rating for module connectors
    - 5K cycle rating for host connectors
  - ✓ Two-levels of contacts in module



module connector

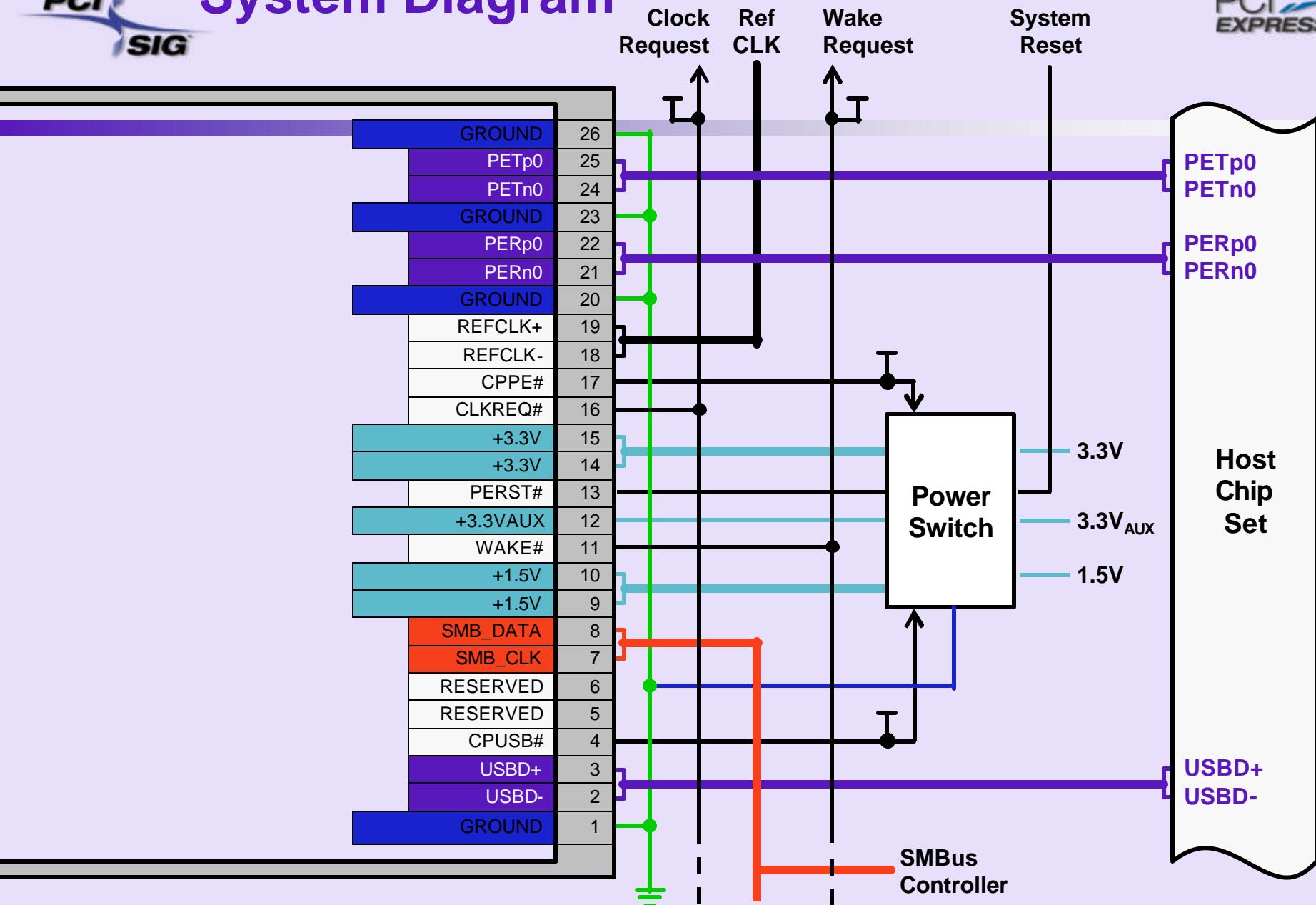


host connector



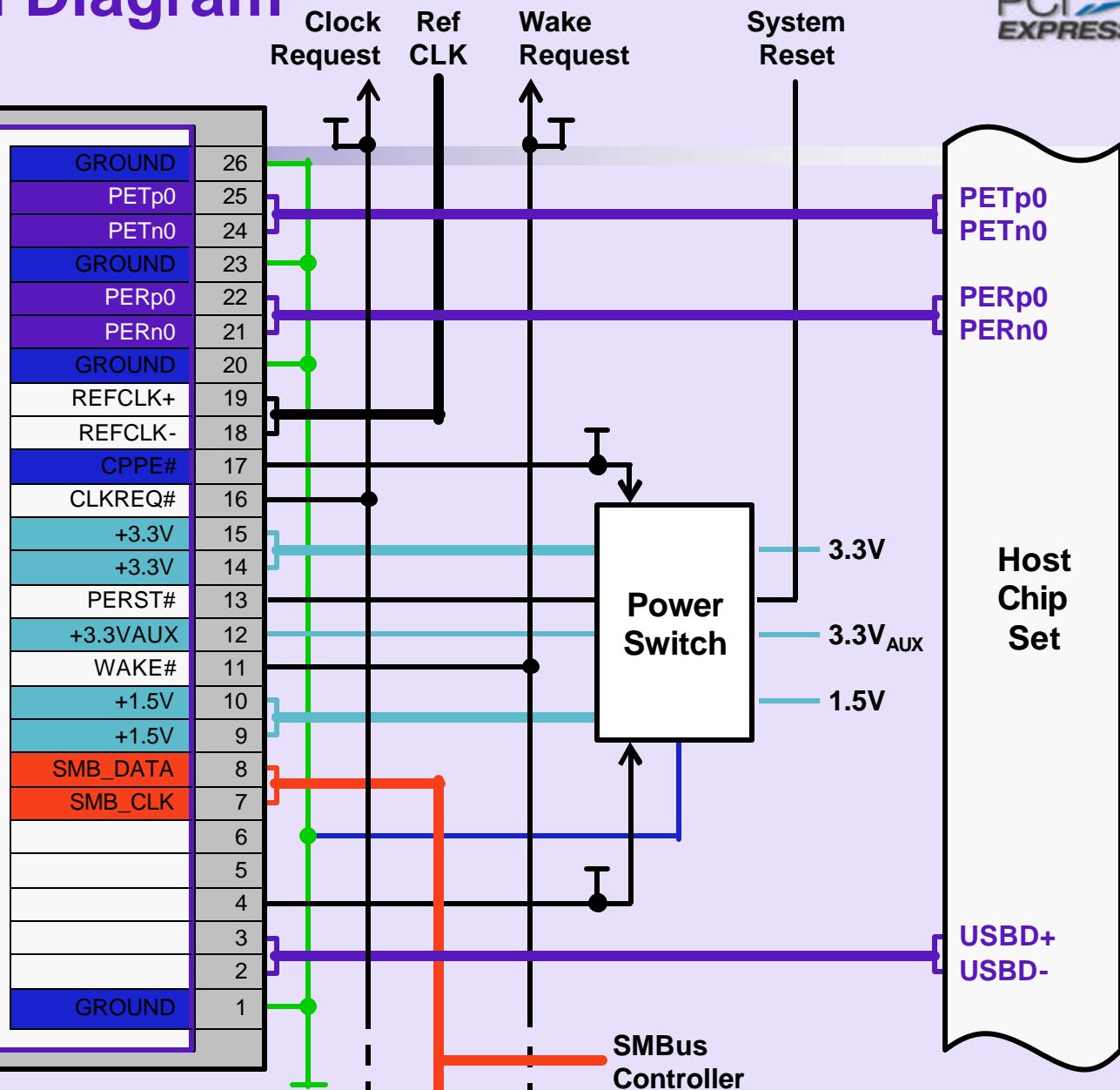
system board

# System Diagram



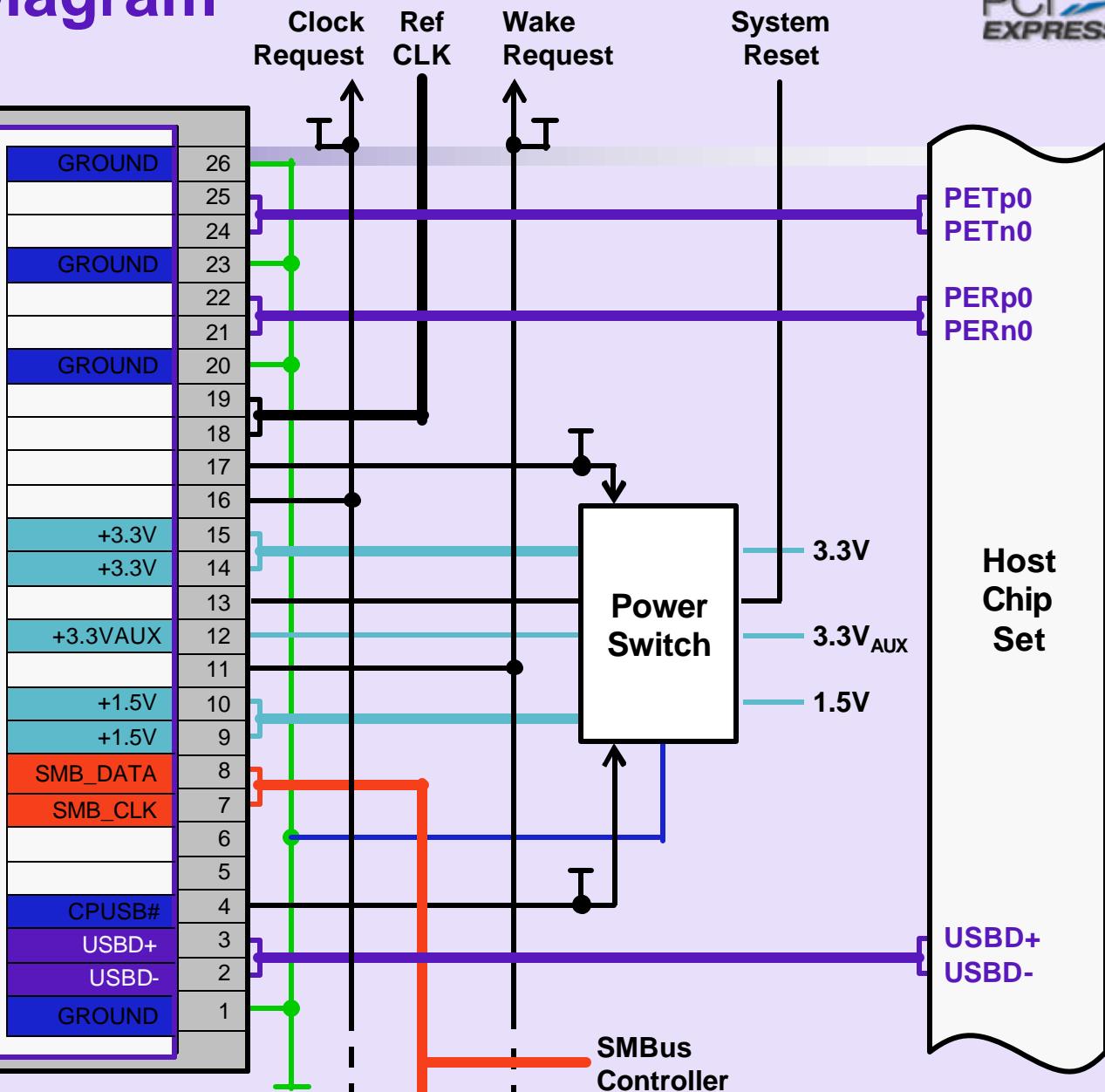
# System Diagram

ExpressCard  
module  
using PCI Express



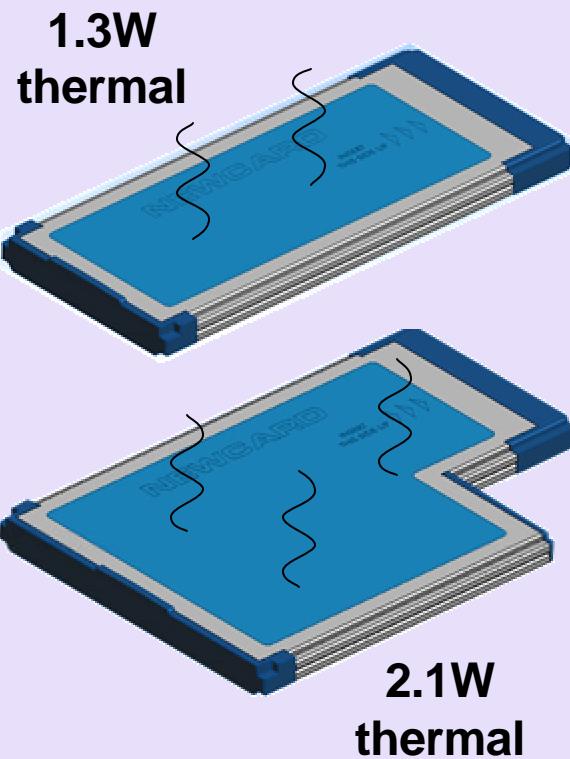
# System Diagram

ExpressCard  
module  
using USB



# Power & Thermal Requirements

- Solution balances the needs of applications with thermal constraints of size
  - ✓ Thermal limits defined for “inside the slot” dissipation



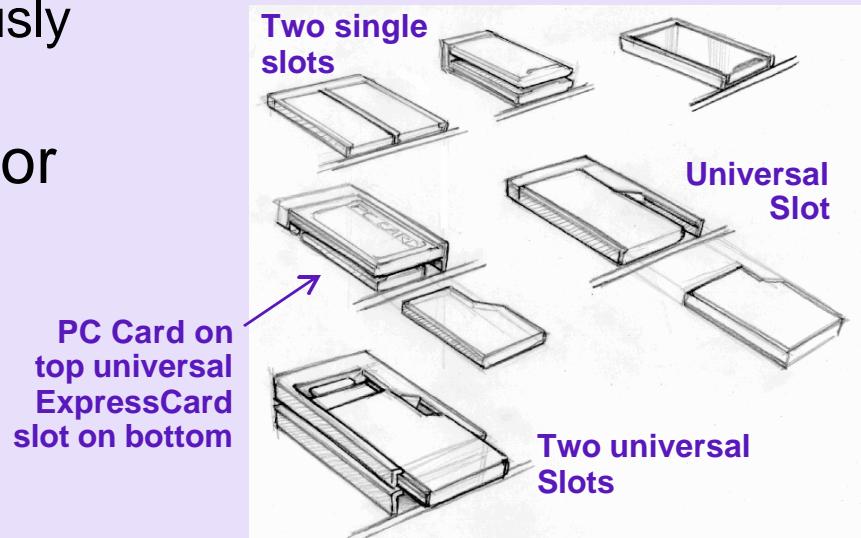
## Slot power ratings

Supply	Limits	Notes
+3.3V	1000 mA – Average <sup>1</sup> 1300 mA – Max <sup>2</sup>	OFF in D3
+3.3VAUX	250 mA – Average <sup>1</sup> 325 mA – Max <sup>2</sup>	ON in D0 – D3 (with wake enabled)
	5 mA – Average	D3 limit when wake disabled
+1.5V	500 mA – Average 650 mA – Max	OFF in D3

1. Sum of +3.3V & +3.3VAUX averages may not exceed 1A
2. Sum of +3.3V & +3.3VAUX maximums may not exceed 1.75A

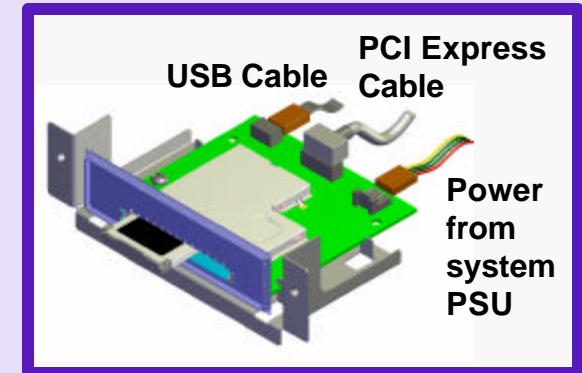
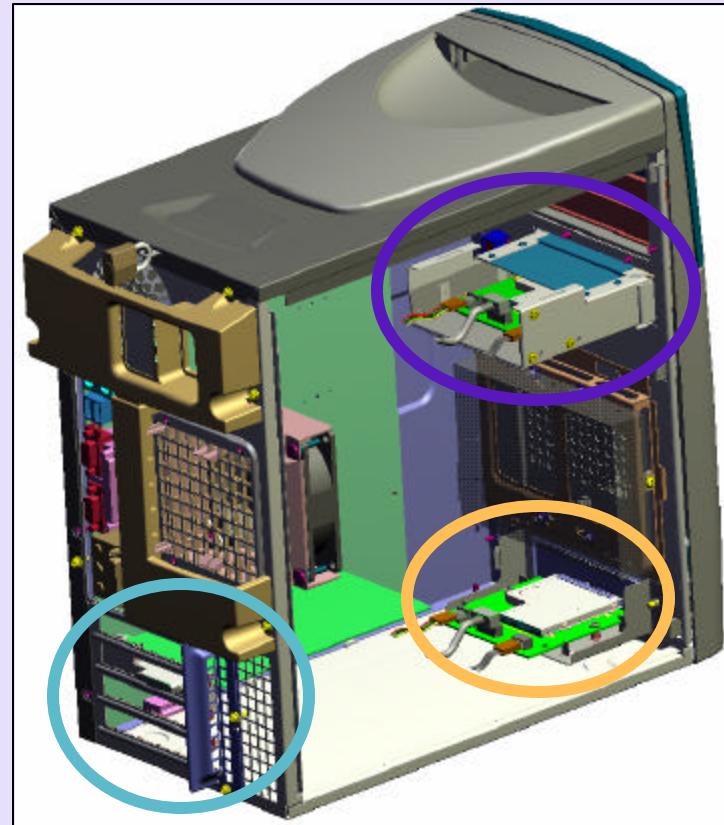
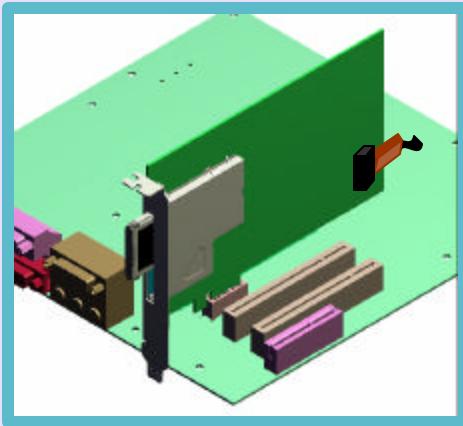
# System Configurations

- Location of slots vary for desktop & mobile
  - ✓ Based on application and accessibility needs
- Platform-independent recommendations
  - ✓ Support multiple slots in a platform
    - Single slot solutions seriously limit usage flexibility
  - ✓ Provide at least one slot for ExpressCard/54 modules
    - Supports CF adapters, Smart Card adapters, larger rotating-media drives

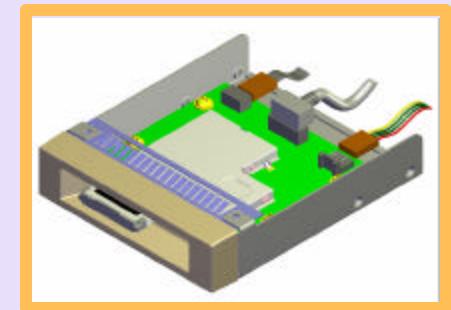


# System Desktop Concepts

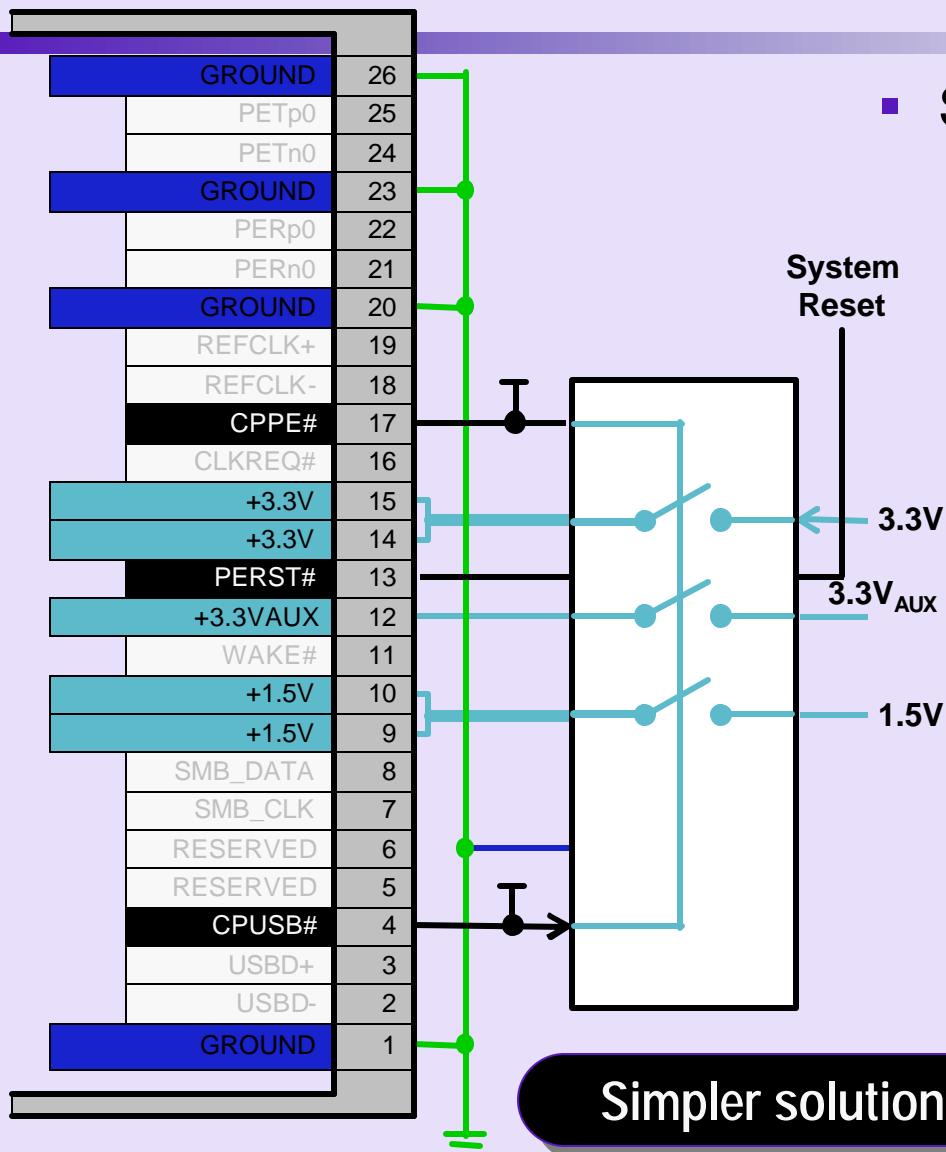
OEM-specific  
riser card



Cabled  
daughter cards



# Power to the Slot

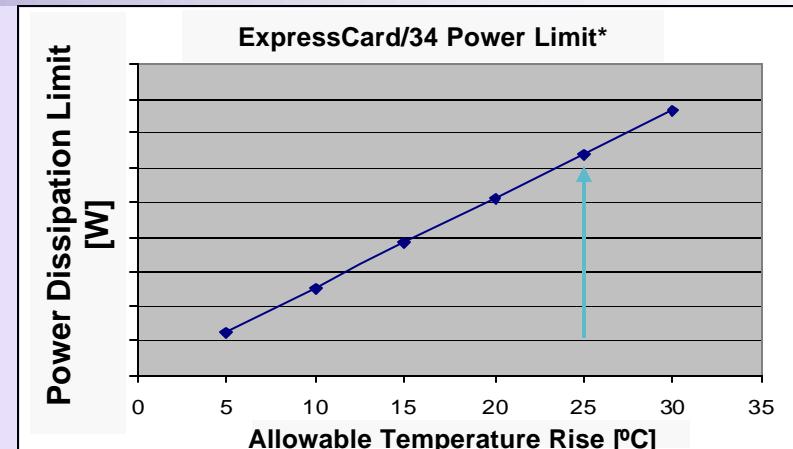


- Slot is cold when un-occupied
  - ✓ Module presence pins dictate when power is needed
    - No software needed
  - ✓ System in sleep state (S3/S4)
    - *Special case* – after insertion, power to module held off until after system returns to S0
- No 5V USB bus power
  - ✓ Replaced with regulated 3.3V (& 1.5V)
  - ✓ 3.3V auxiliary current on a separate pin
  - ✓ Replace regulator with rail switching in designs

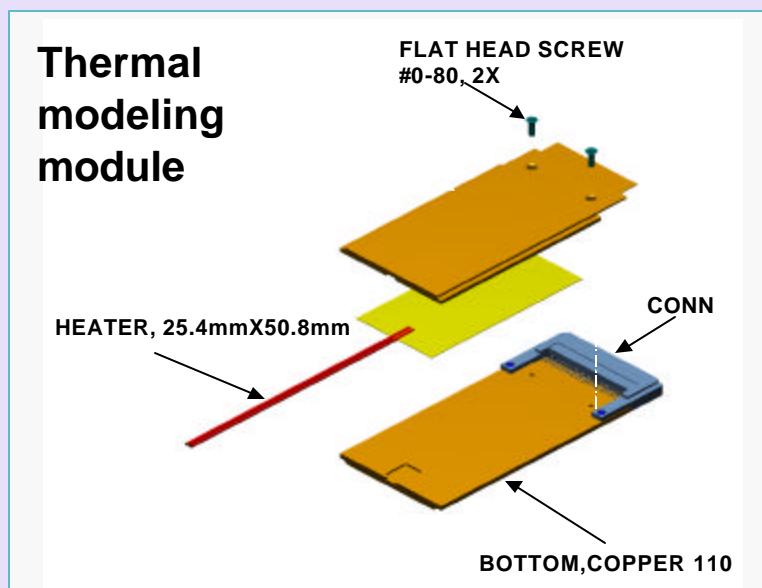
Simpler solution – no controller / software connection

# Thermals

- Smaller cards means less thermal capacity
  - ✓ *a matter of physics*
- Use PM aggressively to reduce thermal contribution
- High source power provided for short-term application needs
  - ✓ Duty-cycle/usage profile determines long-term contribution to the thermal average



\* 65°C still air environment assumed



# Power Management

- Support for PM in modules is mandatory
  - ✓ Active State PM (PCI Express – L0s & L1)
  - ✓ D3 support (PCI Express & USB 2.0)
- Wakeup mechanisms
  - ✓ PCI Express
    - WAKE# – sideband to wake system power
    - PME in-band messaging
  - ✓ USB
    - USB in-band wake signaling

# Modules using both PCI Express and USB in a single instance

- Current bus driver stacks: no knowledge of physical dependency
  - ✓ When a request is made to remove or stop a function: *one function will be knowingly removed, the other function will suffer surprise removal*
- Use ACPI – *legacy solution*
  - ✓ \_EJD (Eject Dependencies) – cross declarations in port descriptions
- Updated driver stacks – *future solution*
  - ✓ Require serial numbers be implemented in the PCI Express Extended Configuration Space
  - ✓ Reflect the PCI Express serial number in USB device configuration space under a new string descriptor

# Ease-of-Use Considerations

- Surprise insertion and removal
  - ✓ HW/SW tolerant of user actions
- Module extraction from the slot
  - ✓ Spec targeted at manual removal over need for ejector systems
- Module installation is independent of which interface used by the application
- Proper marking and labeling techniques aids in module insertion

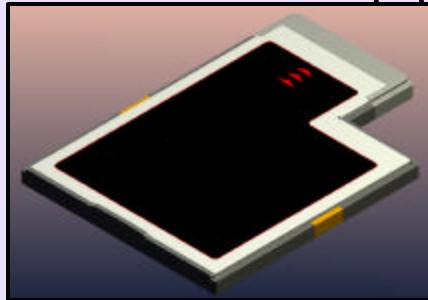
# ExpressCard Compliance

- Will be tied to *ExpressCard* logo usage for registered products
- Proposed compliance program
  - ✓ Combination of checklist & interop testing
    - Requires use of silicon that meets PCI-SIG and USB-IF silicon compliance programs
  - ✓ Co-sponsored SIG events to ease participation costs



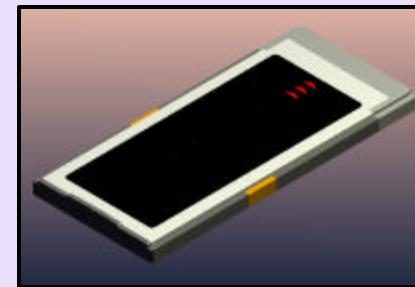
# Application Opportunities

- Transition existing applications from CardBus to ExpressCard technology
  - ✓ Leverage the broad range of existing USB silicon
- Introduce new applications
  - ✓ Enabled by PCI Express and USB
  - ✓ New desktop platform and consumer opportunities



Designed for adapters,  
rotating media, higher  
power applications

1.8" HD app



Designed as long term  
form factor, fit for smaller  
next generation systems

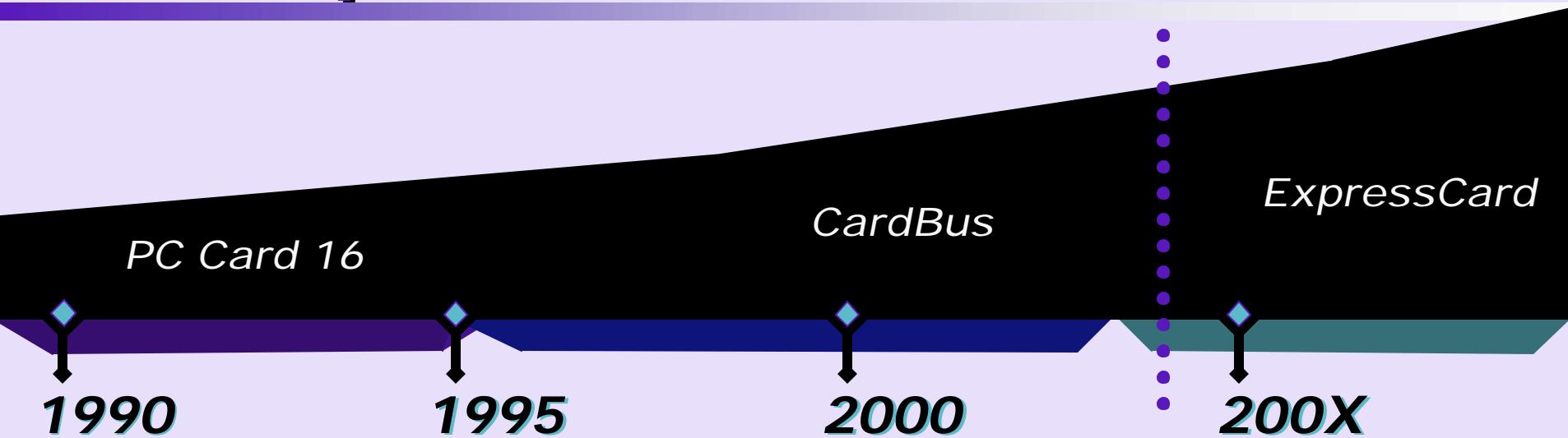
# Target Applications

Interface	Performance <sup>1</sup>	Target Applications
PCI Express	2.0 Gbps (full-duplex)	Wired & Wireless LAN Broadband modems Audio/Video Steaming TV Tuners/Decoders I/O Adapters (e.g. 1394a/b) Magnetic Disk Drives
USB 2.0	1 Mbps to 480 Mbps (half-duplex)	Wired & Wireless WAN Wireless PAN Flash Memory SFF Flash Card Adapters Security Legacy I/O (PS2, serial, parallel) Optical Disk Drives GPS Receiver
SMBus <sup>2</sup>	100 Kbps (half-duplex)	Sideband system management

<sup>1</sup> nominal data throughput

<sup>2</sup> optional host feature

# ExpressCard Timeline



Planned for 2003-2004 ...

- ✓ *Formal specification release – complete!*
- ✓ *Publish design collaterals – in progress!*
- ✓ *Compliance program begins – in progress!*

PCMCIa participation = developer support and compliance program access

# ExpressCard Summary

- The *ExpressCard Standard* enables modular card solutions for *PCI Express* and *USB*
- *ExpressCard* technology is targeted for a wide range of platforms including mobile and desktop PCs
- *ExpressCard* solutions will provide the best end-user experience for PC upgrades

# ExpressCard Next Steps

- *Module and system developers:* join and participate in the PCMCIA  
[www.expresscard.org](http://www.expresscard.org)
- *Silicon developers:* design ingredients for ExpressCard applications *emphasizing low power and power management features*
- Get *ExpressCard technology* included on *your 2004 product roadmaps*

# Summary

- PCI Express functions will be available in a wide variety of form factors serving multiple market segments
- Each form factor addresses the specific physical, power, thermal and performance needs of the markets they are intended to serve
- Each form factor has a solid transition strategy for end-users/customers

# Call to Action

- Prepare your product roadmaps to intercept the first launch of systems, cards, and modules
  
- Utilize the PCI-SIG (and other industry groups, as appropriate) for specifications and support

Thank you for attending the  
2004 PCI-SIG Asia-Pacific  
Developers Conference.

For more information please go to  
[www.pcisig.com](http://www.pcisig.com)

**PCI**  **SIG™**

The logo features the letters "PCI" in a bold, black, sans-serif font. To the right of "PCI" is a stylized graphic element consisting of a blue ribbon-like shape that loops back over itself, partially enclosing the word "SIG". Below this graphic, the letters "SIG" are displayed in a large, bold, black, sans-serif font. A small "TM" symbol is positioned in the top right corner of the "G". The background of the logo is a dark purple color.