Intel Mini PCI Wireless Card Specification

(Supplement to Mini PCI Specification)

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Table of Contents

1. Document Revision History

Revision	Date	Comments
0.1	Dec 28, 2001	First draft
0.8	Jan. 08, 2002	Released to Engineering
0.85	Feb. 11, 2002	• Updated for OEM customizations: • Added antenna mechanical tolerances for type 3A and type 3B card. •
0.90	11 March 11, 2002	Updated pinout table Updated LED configuration (again)
0.95	March 14, 2002	Updated Mini PCI edge connector deviations section. Simplified LED function description.
0.99	March 18, 2002	Draft release. Need Dual LED circuit implementation yet.
1.0	April 12, 2002	Updated LED reference circuit. Updated H/W Kill switch implementation
1.0b	May 20, 2002	Updated edge connector pin-out for Bluetooth co-existence Updated manufacturing bevel design requirements

2. References

This addendum is based upon the Mini PCI Specification, Revision 1.0, October 25th, 1999. Additional information can be found in the PCI 2.2 specification.

3. Purpose

This document is intended for PC OEM customers designing for a wireless Mini PCI solution the opportunity to review Intel's Calexico Mini PCI pin out connections, mechanical requirements, and custom interfaces and be able to design their platform(s) to support the Calexico Mini PCI card.

4. Background of this Mini PCI Specification Addendum

The Mini PCI specification is an industry-standard specification whose intent is to provide system/platform designers and card designers with the ability to use a standards-based interface to design to while still providing some flexibility/options in system and card designs. The original Mini PCI specification did achieve its goal but at the time only LAN and modem technologies were envisioned for this form-factor. Since the release of the first Mini PCI specification, wireless technology has appeared in the market and is now appearing on Mini PCI cards, which introduces unique challenges to both the system and card manufacturers. The purpose of this document is to define the "custom" pinout configuration used by Calexico to achieve the proper performance and unique feature set that Intel is providing with this generation of wireless Mini PCI card.

5. Mini PCI v1.0 Defined Function-Specific Connectors

The MPCI specification defines function-specific connectors on the MPCI card for Wired LAN and Modem functionality.

- The function-specific LAN connector. This is a 14-pin connector.
- The function-specific Modem connector. This is a 2-pin connector.

After reviewing next generation board layouts as well as the customer drive for more and more capability while driving smaller form factors, the 14 pin I/O connector will no longer be supported on Intel wireless Mini PCI cards going forward. Intel will continue to support the two-pin connector for support of an AC'97 modem.

6. Mini PCI System Connector Pins

The Mini PCI edge connector pinout definition as described in the Mini PCI Specification, Revision 1.0, is shown below. The Intel wireless Mini PCI card will comply to this pinout for compatibility purposes except for deviations as noted in this section.

Table 1: Mini PCI Card Type III System Connector Pinout

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	TIP	**2**	RING	**63**	**3.3V**	**64**	FRAME#
KEY		**KEY**		**65**	CLKRUN#	**66**	TRDY#
3	8PMJ-3	**4**	8PMJ-1	**67**	SERR#	**68**	STOP#
5	8PMJ-6	**6**	8PMJ-2	**69**	GROUND	**70**	3.3V
7	8PMJ-7	**8**	8PMJ-4	**71**	PERR#	**72**	DEVSEL#
9	8PMJ-8	**10**	8PMJ-5	**73**	C/BE[1]#	**74**	GROUND
11	LED1_GRNP	**12**	LED2_YELP	**75**	AD[14]	**76**	AD[15]
13	LED1_GRNN	**14**	LED2_YELN	**77**	GROUND	**78**	AD[13]
15	CHSGND	**16**	RESERVED	**79**	AD[12]	**80**	AD[11]
17	INTB#	**18**	5V	**81**	AD[10]	**82**	GROUND
19	3.3V	**20**	INTA#	**83**	GROUND	**84**	AD[09]
21	RESERVED	**22**	RESERVED	**85**	AD[08]	**86**	C/BE[0]#
23	GROUND	**24**	3.3VAUX	**87**	AD[07]	**88**	3.3V
25	CLK	**26**	RST#	**89**	3.3V	**90**	AD[06]
27	GROUND	**28**	3.3V	**91**	AD[05]	**92**	AD[04]
29	REQ#	**30**	GNT#	**93**	RESERVED	**94**	AD[02]
31	3.3V	**32**	GROUND	**95**	AD[03]	**96**	AD[00]
33	AD[31]	**34**	PME#	**97**	5V	**98**	RESERVED_WIP 4
35	AD[29]	**36**	RESERVED	**99**	AD[01]	**100**	RESERVED_WIP 4
37	GROUND	**38**	AD[30]	**101**	GROUND	**102**	GROUND
39	AD[27]	**40**	3.3V	**103**	AC_SYNC	**104**	M66EN
41	AD[25]	**42**	AD[28]	**105**	AC_SDATA_IN	**106**	AC_SDATA_OUT
43	RESERVED	**44**	AD[26]	**107**	AC_BIT_CLK	**108**	AC_CODEC_ID0#
45	C/BE[3]#	**46**	AD[24]	**109**	AC_CODEC_ID1#	**110**	AC_RESET#
47	AD[23]	**48**	IDSEL	**111**	MOD_AUDIO_MON	**112**	RESERVED
49	GROUND	**50**	GROUND	**113**	AUDIO_GND	**114**	GROUND
51	AD[21]	**52**	AD[22]	**115**	SYS_AUDIO_OUT	**116**	SYS_AUDIO_IN
53	AD[19]	**54**	AD[20]	**117**	SYS_AUDIO_OUT	**118**	SYS_AUDIO_IN

					GND		GND
55	GROUND	**56**	PAR	**119**	AUDIO_GND	**120**	AUDIO_GND
57	AD[17]	**58**	AD[18]	**121**	RESERVED	**122**	MPCIACT#
59	C/BE[2]#	**60**	AD[16]	**123**	VCC5VA	**124**	3.3VAUX
61	IRDY#	**62**	GROUND				

6.1 Sparks/Calexico Mini PCI Pinout Deviation to System Connector Pins:

6.1.1 LEDs

PIN	Old Signal Name	New Signal Name	Signal Definition .
11	LED1_GRNP	LED_WLAN_LINK	Active-high LED drive signal provides an indication of access point association. This signal will blink slowly every 3 seconds until association occurs at which time it will be HIGH until association is lost. During initialization or while the radios are in reset, the signal will be LOW. Note: 0 ohm series resistor provides connection to the Mini PCI edge connector
12	LED2_YELP	LED_WLAN_ACT	Active-high LED drive signal provides an indication of data activity. This signal will blink rapidly when data traffic is occurring. During initialization, or while the radios are in reset, or if the client is not associated with an access point the signal will be LOW. Note: 0 ohm series resistor provides connection to the Mini PCI edge connector
13	LED1_GRNN	HW_RadioXMIT_OFF#	Active low input from a hardware switch to the card to disable the radio from transmitting. See further description in this document. Note: 0 ohm series resistor provides connection to the Mini PCI edge connector
14	LED2_YELN	WLAN_Radio_State# (spectrum identification)	This signal is an indication of which frequency spectrum the wireless client is transmitting in. During initialization or while the radios are in reset, this signal will be LOW. Note: 0 ohm series resistor provides connection to the Mini PCI edge connector
36	RESERVED	Channel_Clk BT_priority	Active high input from the Bluetooth module to the card Note: 0 ohm series resistor provides connection to the Mini PCI edge connector
43	RESERVED	Channel_Data 11b_activity	Active high output from the miniPCI card to the Bluetooth module. Note: 0 ohm series resistor provides connection to the Mini PCI edge connector

6.2 Other Deviations on the Mini PCI edge connector

Additional modifications are being done to the Intel wireless Mini PCI card to eliminate potential cross-talk on to the OEM base board. To that end, Intel is buffering the following interfaces with 0 ohm resistors which can be either populated or de-populated depending on the customer need. These interfaces include:

Pins 11-14 (LED and RF control)
Pins 103 – 120 (AC Link)

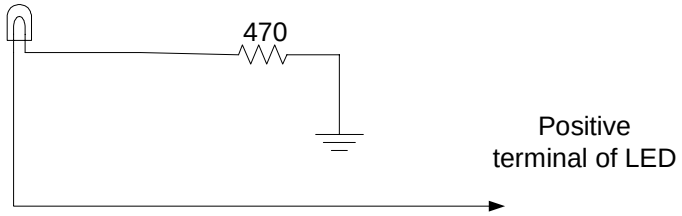
7. LED Indicators and Switch

The Mini PCI specification calls for the support of two LEDs which are used for the wired LAN function. These LEDs indicate LINK and Activity. Even though in the wireless space these functions are not quite the same, they do provide a parallel meaning. Below is the definition of the two LEDs being supported in this specification. In addition to support for LINK and Activity, two additional features are provided to support a hardware kill switch for the RF radio as well as a control signal that can be used to identify which spectrum of operation the radio is operating in. Additional information is discussed in the following paragraphs.

7.1 WLAN LINK Indicator

The **LED WLAN_LINK** output signal from Pin11 of the MPCI system connector indicates wireless LAN association. Frequency of LED blink rate is dependent upon the state of the adapter in association with the network. If the WLAN client is associated with an access point, the LED will be solid ON (High). If the client is not associated, the LED will blink slowly and regularly (at the rate of 1 flash per every 3 seconds).

The MPCI specification states that the card will provide a 7mA source current for 3.3V LED operation. Termination for the LED is assumed to be on the OEM motherboard. Below is a typical termination circuit for this LED:



The operation of the LED is:

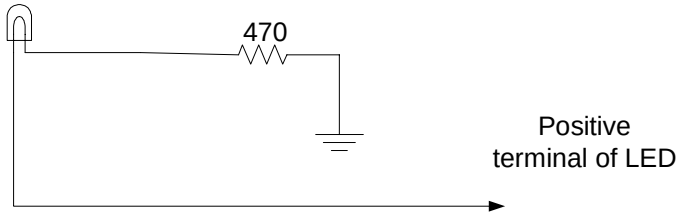
- Blinking regularly @ 3Sec intervals (3.3V) = Wireless client is not associated with the network.
- Solid ON (3.3V) = Wireless client is associated with the network.
- OFF (low) = The WLAN card is does not have power or the wireless NIC is held in RESET

7.2 WLAN Activity Indicator

The **LED_WLAN_ACT** output signal from Pin12 of the MPCI system connector indicates wireless LAN data activity. When the wireless client is associated, data traffic will commence. The rate of blink is determined by the amount of data activity between the access point and the wireless client, but will be fast enough at all times as to be clearly distinguishable between beacon activity (re: LINK) versus data traffic.

If the WLAN client is not associated with an access point, the LED will be solid OFF (Low).

The MPCI specification states that the card will provide a 7mA source current for 3.3V LED operation. Termination for the LED is assumed to be on the OEM motherboard. Below is a typical termination circuit for this LED:

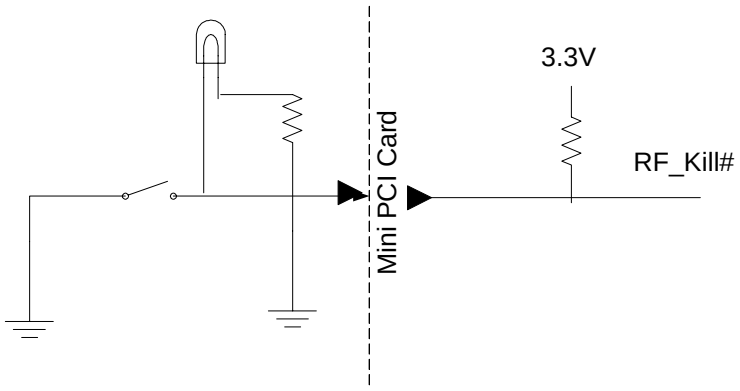


The operation of the LED is:

- Rapidly blinking (3.3V) = Wireless client is passing data traffic to the access point.
- OFF (low) = The WLAN card is does not have power or the RF_Kill switch is active.
  NOTE: The RF_Kill signal over rides Activity and drives this signal off (LOW)

7.3 Radio Transmitter Disable Switch

The **HW_RadioXMIT_OFF#** input signal on Pin13 of the Mini PCI system connector provides to the OEM the opportunity to use a hardware implementation to disable the RF portions of the Calexico Mini PCI card. The OEM recommended circuit for implementation is shown in the diagram below.



The Mini PCI card will provide support circuitry necessary to clean up the drive signal (i.e.: de-bounce circuits and pull-up resistor) from the OEM platform.

The Intel Mini PCI card will also "remember" the last switch position implemented. The last user setting (radio enabled or disabled, whether through software or hardware) should be "sticky" and will be remembered by the Mini PCI card's hardware/software across suspends, boots, power cycles, etc. (driven via GPIO and firmware controlled). This will be accomplished with registry entries for easy software tracking.

The operation of the Signal is:

- ON (3.3V) = The radio transmitter is ON (powered and enabled).
- OFF (low) = The radio transmitter is turned OFF, and made incapable of transmitting unless the user performs some action to change the state of the radio (such as manually changing the switch)

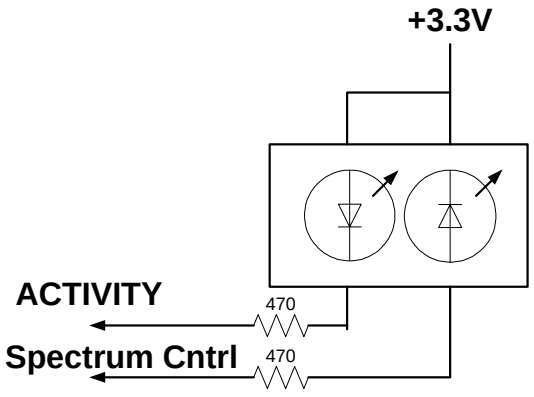
Note: The control of the radio transmitter is an AND of the software and hardware mechanisms. The radio transmitter must remain disabled unless BOTH the software and hardware settings are enabled for the radio transmitter.

SW Setting	HW Switch	Radio Transmitter Function
Enable	Enable/High	Enabled
Enable	Disable/Low	Disabled
Disable	Enable/High	Disabled
Disable	Disable/Low	Disabled

Note: The LINK and Activity LEDs (Pins 11 and 12) should reflect normal operation of the Mini PCI card unless the RF_Kill switch and/or software control pins are enabled. If either the software control or RF_Kill hardware switches are enabled, both LINK and Activity signals will be OFF (low).

7.4 Spectrum Indication Control Signal

This CMOS driver is intended to provide a control signal to a dual color LED. Depending on the spectrum of radio operation, this control signal will direct current flow through the dual color LED providing visual indication of which spectrum the wireless client is currently transmitting in. The recommended OEM dual color LED implementation is shown below (note: an additional dual-colored LED circuit will be required for LINK/Association):



The operation of the Spectrum Control signal is:

- ON (3.3V) = The radio 5.2GHz transmitter is ON and transmitting.

- OFF (low) = The radio 2.4GHz transmitter is ON and transmitting.

7.5 Bluetooth Coexistence

Bluetooth priority information and 802.11b channel information are exchanged over a 2-wire interface. The BT_Priority Signal and the Channel_Clk Signal are multiplex on the same physical interface with each signal transmitted in real-time and a coordinated manor. The Channel_Data Signal transfers the current 802.11b channel in use, and indicates long-term channel inactivity, e.g., sleep modes to the Bluetooth module.

8. Mechanical

Intel's Mini PCI cards should be designed for the smallest form-factor possible to ensure maximum OEM platform compatibility. The target form-factor is the Mini PCI type 3B form-factor. If the card grows for additional capability, maximum allowable card size if the Mini PCI type 3A form-factor as defined in the Mini PCI rev. 1.0 specification.

Due to OEM demand, the Hirose U.FL-R-SMT (or equivalent) connector will be used on all Intel Mini PCI cards to mate with cable connector U.FL-LP-066. The U.FL-R-SMT connector, though it meets the RF requirements for operation, violates the Mini PCI Z-dimension by 0.1mm. Notification of this spec violation will be worked via the OEM channel using product mechanical specifications.

Mini PCI card shielding requirements will be reviewed on a project-by-project basis. No restrictions will be placed upon the design team for RF shielding outside of Z-height restrictions.

8.1 PCB Card Design

The purpose of this Guideline is to insure the card properly seats into a Mini-PCI Type III system connector.

Connector Interface

Below is the mechanical information for the Mini PCI edge connector as it is specified within the Mini PCI rev. 1.0 specification. The following sections detail Intel's modifications from this specification to improve the contact reliability for our customers.

Figure 5-15 shows contact finger detail for the Type III PCB.

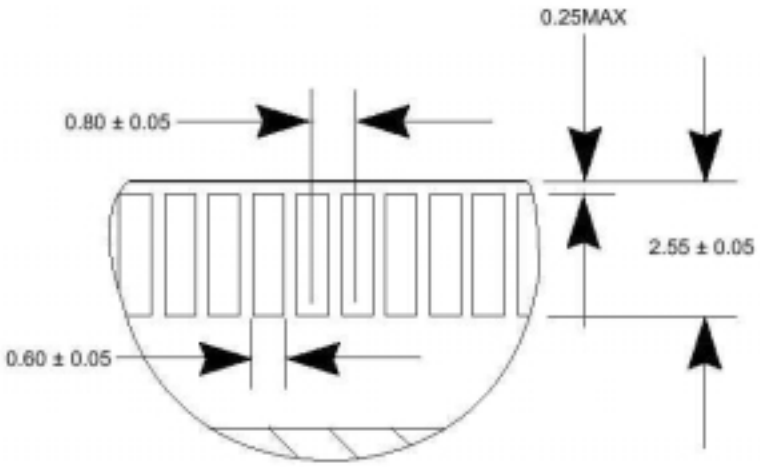


Figure 5-15: Type III PCB, Bottom Side, Detail E

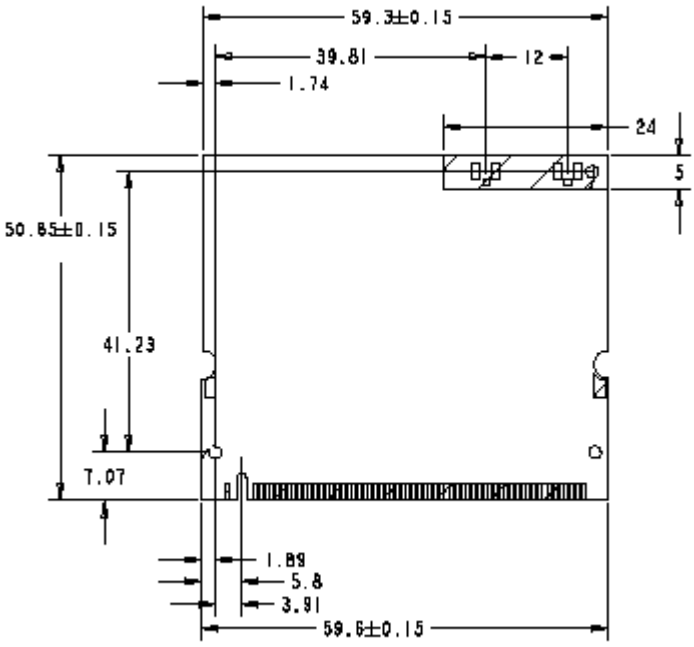
8.2 Antenna Connection

Antenna connector locations for both the type 3A and type 3B Mini PCI cards are illustrated below. Intel's 802.11 cards offer a diversity antenna scheme which allows for receiving or transmitting on either antenna. The diagram shows a primary and secondary antenna connection which refers to the default transmit antenna established by firmware.

Hirose style UL-F connector for attachment between the Mini PCI card to the co-ax cable attaching the antenna elements. The mechanical information is shown in figure X. Please note the mechanical Z-dimension exceeds the current Mini PCI specification by 0.1mm. The OEM must make allowances for this in their chassis design.

The figures below specify the Primary and Secondary antenna connector locations on the type 3A and type 3B Mini PCI cards. Note tolerances for antenna connector placement for the type 3A card will be +/- 1.0mm in the Y-dimension only. X-dimension tolerance is +/- 1.0mm. For the type 3B card the tolerance will be increased for additional design flexibility. Tolerances for the type 3B card will be +/- 2.0mm in the Y-dimension and in the X-dimension tolerance is +/- 1.0mm. Component keep-out zone around the connectors for both form-factors will be a 5.0mm radius.

Type 3A Mini PCI Antenna Connector Placement

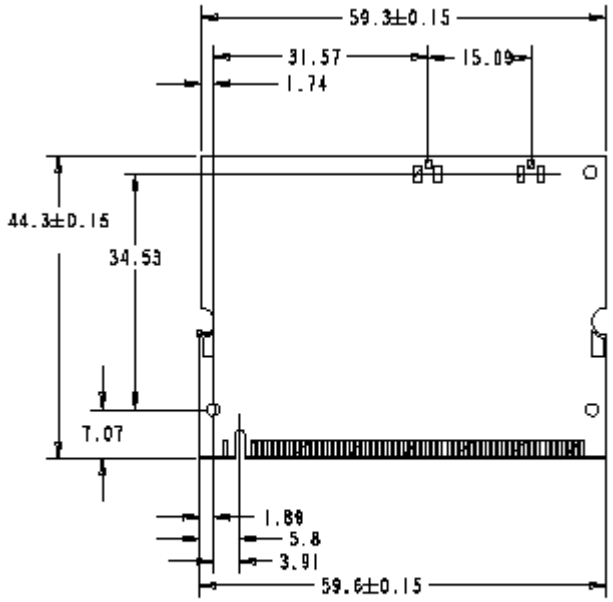


TOP SIDE PCB OUTLINE

Notes:

Dimensions in mm.
M refers to the MAIN.
A refers to the Auxiliary.

Type 3B Mini PCI Antenna Connector Placement



TOP SIDE PCB OUTLINE

Notes:

Dimensions in mm.
M refers to the MAIN.
A refers to the Auxiliary.

The card's Primary and Secondary connectors will be clearly silk-screened on the PCB as noted above.