

Class 1

RJ45 Jack with Integrated Magnetics

1. INTRODUCTION

This specification covers the requirements for application of RJ45 Jack with integrated Magnetics designed to be mounted to a Printed Circuit Board (PCB). The Jacks are available in low-profile, vertical, single-port or multi-port configuration in 6, 8, 10 or 12 positions with 8 contacts, shielded designs to accommodate specific application requirements. This specification pertains to all shielded jacks with right-angled (R/A) and vertical orientation, with single or multiple ports.

When corresponding with TE Personnel, use the terminology provided on this specification to help facilitate assistance. Basic terms and features of components are provided in Figure 1.

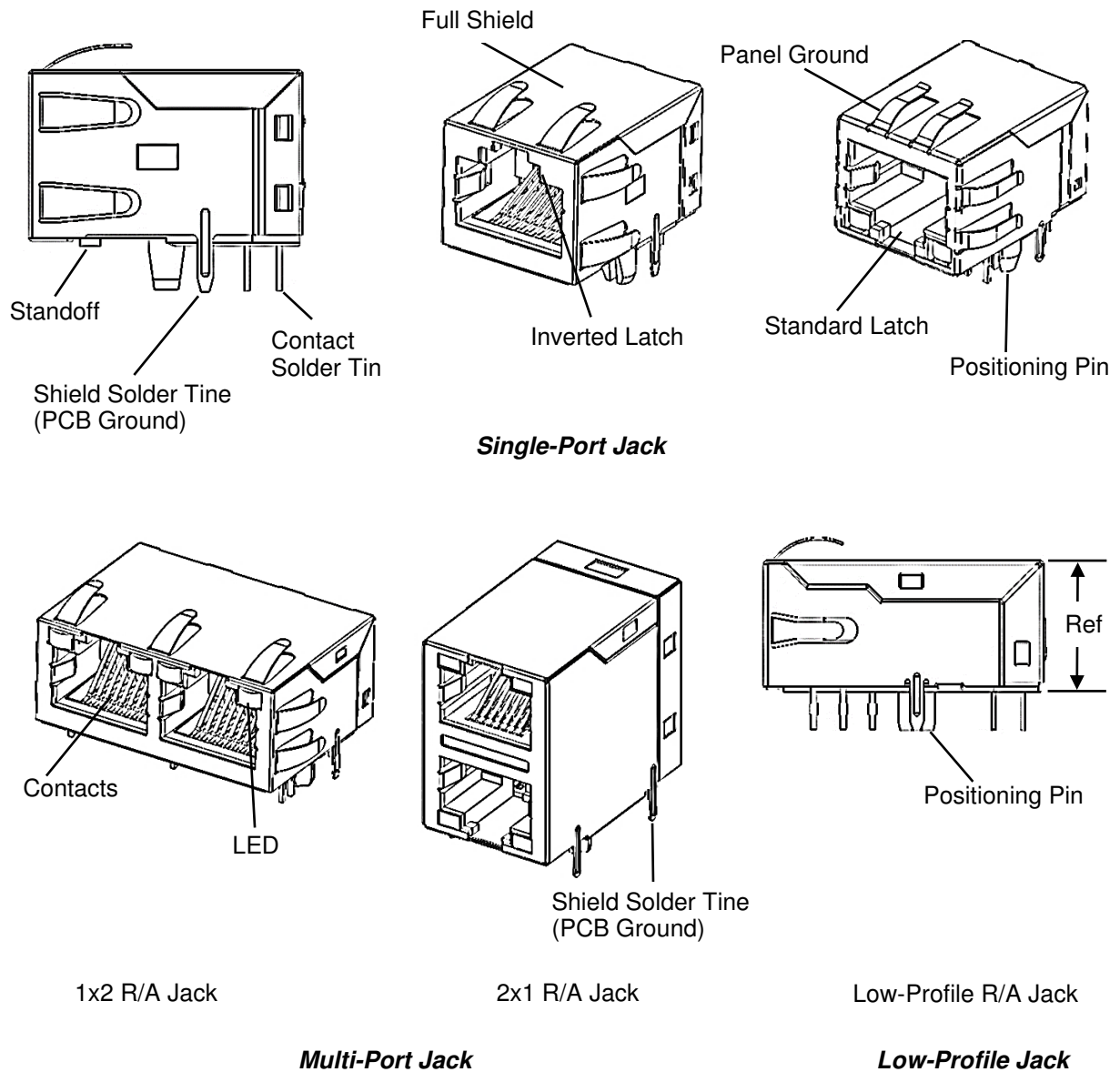


Figure 1: Basic terms and features of components

2. REFERENCE MATERIAL

2.1. Revision summary

Since the previous version of this document, the following changes were made:

- Updated document to corporate requirements
- Added Circuitry and Pin description

2.2. Customer Assistance

Reference Base Numbers 2301994, 2301995, 2301996, 2301997 and Product Code K842 identify the PCB mounted RJ45 jacks with integrated magnetics. These numbers are used in a service network of customer service to access tooling and product application information. This service is provided by your local TE Representative or, after purchase, by calling the Tooling Assistance Center or Product Information number at the bottom of page 1.

2.3. Drawings

Customer Drawings for product numbers are available from the service network. The information on the customer drawing takes priority over this specification and any other document supplied by TE.

2.4. Product Specifications

Product Specifications 108-94552 covers test and performance requirements.

2.5. Soldering specification

Manual 402-40 is available upon request and can be used as a guide to soldering. This manual provides information on various flux types and characteristics with the commercial designation and flux removal procedures. A checklist is included in the manual as a guide for information on soldering problems.

3. REQUIREMENTS

3.1. Safety

Do not stack component packages so high that the shipping containers buckle or deform.

3.2. Material

The RJ45 Jack with integrated Magnetics housing is made of high temperature thermoplastic, UL94-V-0. The contacts are made of copper alloy under plated with nickel and plated with gold; solder tines are plated with tin over nickel. Positioning pins are made of LCP. The shield is made of brass plated with nickel.

3.3. Storage

Ultraviolet Light

Prolonged exposure to ultraviolet light may deteriorate the chemical composition used in the RJ45 Jack with integrated Magnetics material.

Shelf Life

RJ45 Jack with integrated Magnetics should remain in the shipping containers until ready for use to prevent damage. The products should be used on a first in, first out basis to avoid storage contamination that could adversely affect signal transmissions and degrade shield appearance.

Chemical Exposure

Do not store RJ45 Jack with integrated Magnetics near any chemicals listed below, as they may cause stress corrosion cracking in the components.

Alkalies	Ammonia	Citrates	Phosphates	Citrates	Sulfur Compounds
Amines	Carbonates	Nitrites	Sulfur Nitrites		Tartrates

Soldering ability over time

To ensure a good solderability of RJ45 Jack with magnetics, conditions below should be followed:

Table 1: Storage time and conditions

Packaging type	Condition	Maximal storage time
Tray	Original and unopened package, at temperature $\leq 30^{\circ}\text{C}$	1 year
Reel		

If storage time exceeds one year, a complete quality check on function & mechanical before parts can be used.

Moisture Sensitivity Level (MSL)

All RJ45 Jacks with LCP housing material pass MSL 1 according to J-STD-020.

3.4. Circuitry and pin description

The PHY chip to which the RJ45 jack with integrated magnetics is connected to has either a current-mode line driver or a voltage-mode line driver. This affects the choice of circuitry that the RJ45 jack with integrated magnetics requires. For a current-mode line driver the center tap of the transformer on the PHY side is connected to a power source to supply current to the PHY, see Figure 2. For a voltage-mode line driver such an external power source is not needed. Here the left center tap of the transformer is only connected via a capacitor to the system ground as shown in Figure 3.

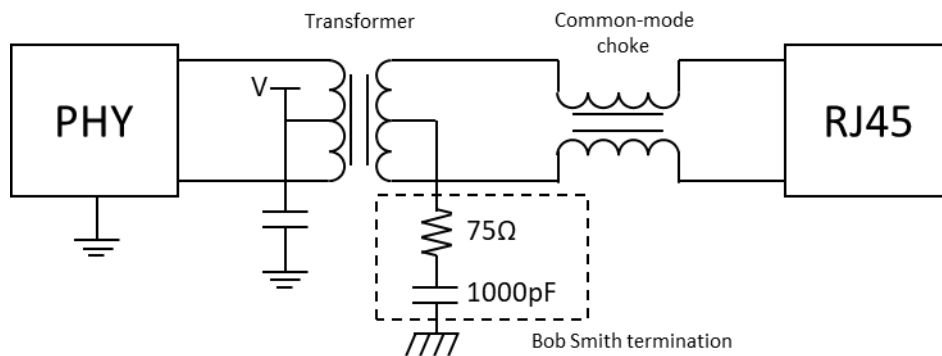


Figure 2: Current-mode driven magnetics

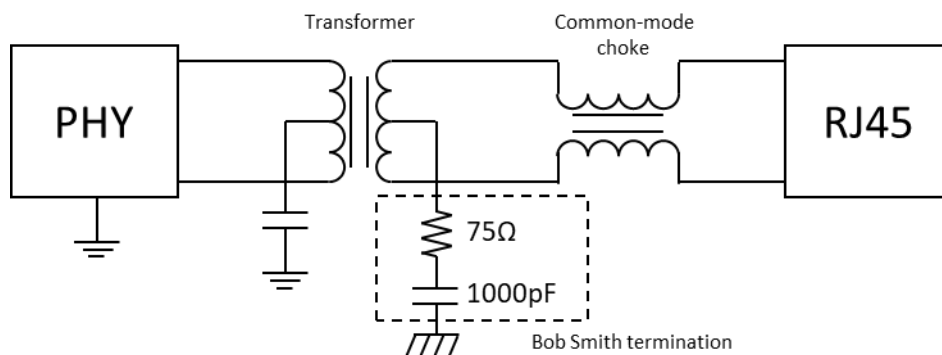


Figure 3: Voltage-mode driven magnetics

The center tap on the left side of the transformer ground is connected to the system ground and the ground connection on the right side of the transformer is connected to the shield ground. This connection to the shield is sometimes made inside the RJ45 jack with integrated magnetics.

On the schematic of the product drawings the connections are numbered on one side with the prefix P and on the other side with the prefix J. The prefix P refers to the PHY side. So, for example, if an RJ45 jack with integrated magnetics that has 10 contact pins, the numbering goes from P1 to P10. Note that the functionality of the connections with prefix P can differ between different RJ45 jacks with integrated magnetics. This depends on the used electrical circuit diagram inside the RJ45 jack, which can be found on the product drawing. The prefix J refers to the jack side and represent the eight contacts of the jack numbered from J1 to J8 as provided in Figure 4.

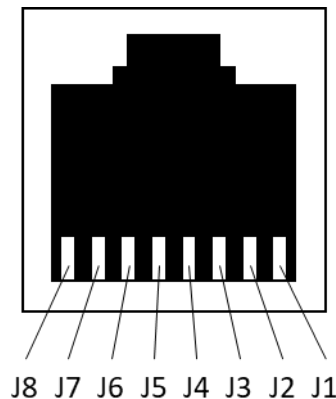


Figure 4: Pinout of RJ45 jack

Ethernet transmits its data over signal pairs. Two signal pairs are used for 10/100BASE-TX Ethernet, having 10 or 100Mbps data rate. Four signal pairs are used for 1000BASE-TX Ethernet, having 1Gbps data rate. Each signal pair and its relation to the pinout of Figure 4 are given in Table 2. Typically, a variety of labels are used for each connection of the signal pairs on the PHY and RJ45 jack side. One possible set of labels are mentioned in Table 2 as well.

Table 2: Signal pair definition

Signal pair	Pinout RJ45 jack	10/100BASE-TX		1000BASE-TX	
		PHY side	Jack side	PHY side	Jack side
1	J1	TD+	TX+	TD1+	TX1+
	J2	TD-	TX-	TD1-	TX1-
2	J3	RD+	RX+	TD2+	TX2+
	J6	RD-	RX-	TD2-	TX2-
3	J4	Not used	Not used	TD3+	TX3+
	J5	Not used	Not used	TD3-	TX3-
4	J7	Not used	Not used	TD4+	TX4+
	J8	Not used	Not used	TD4-	TX4-

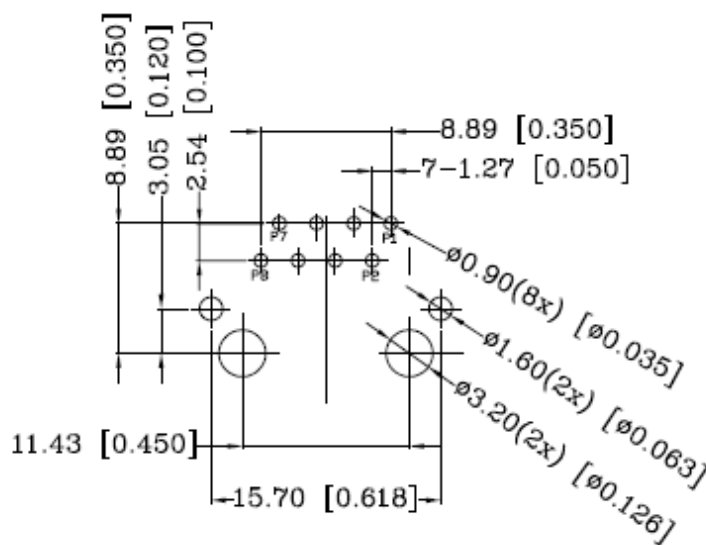
3.5. PCB Layout

The solder tine hole layout for all 6, 8, 10, and 12 position single- and multi-port jacks is typical for all jacks with comparable positions. The mounting hole location will depend on the number of ports and contact positions. The PCB layout views shown represent the component side of the PCB.

The mounting holes must be placed in accordance with the customer drawing to ensure proper alignment and optimum continuity for circuits after soldering. The holes must be drilled to specific dimensions to prevent stubbing during placement of the RJ45 Jack with integrated Magnetics on the PCB.

A. Single-Port shielded Jack with inverted Latch (Tab up)

The hole patterns that apply to all single-port jacks with inverted Latch are provided in the following figures.



Component Side of PC Board

Unit: mm [μ in]

Figure 5: 8 Position Jack, Tab up without LED

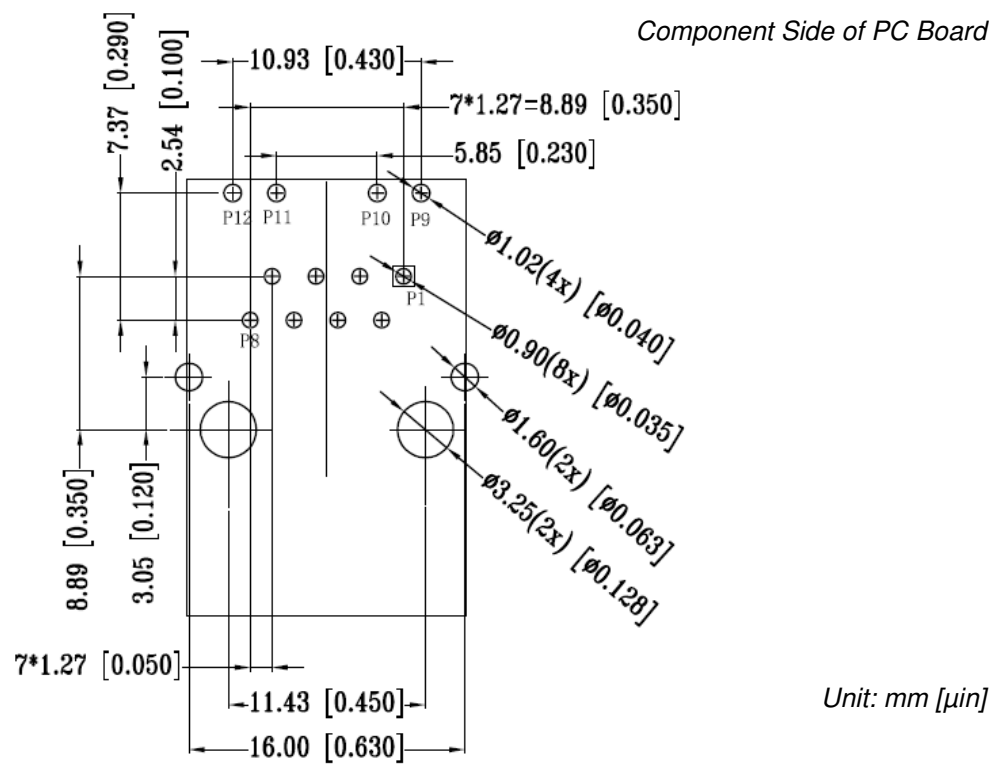


Figure 6: 8 Position Jack, Tab up with LED

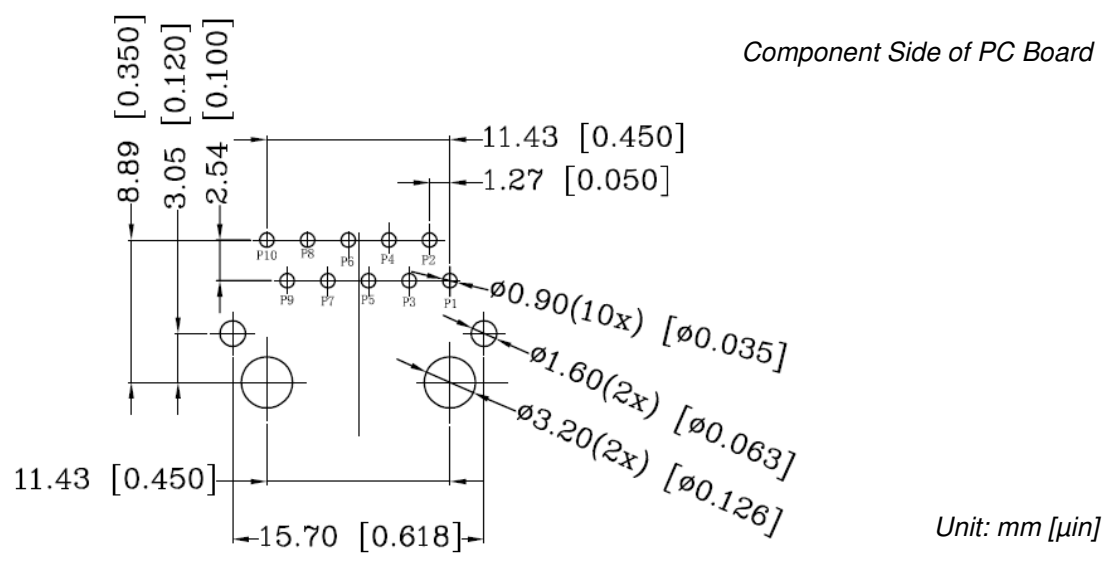
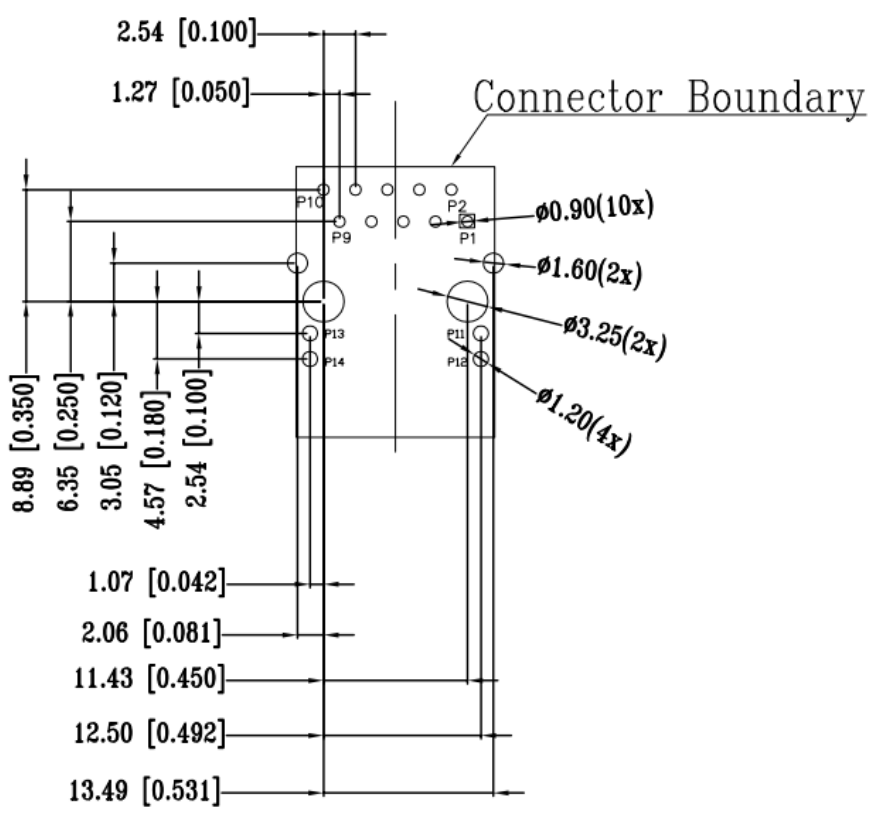


Figure 7: 10 Position Jack, Tab up without LED

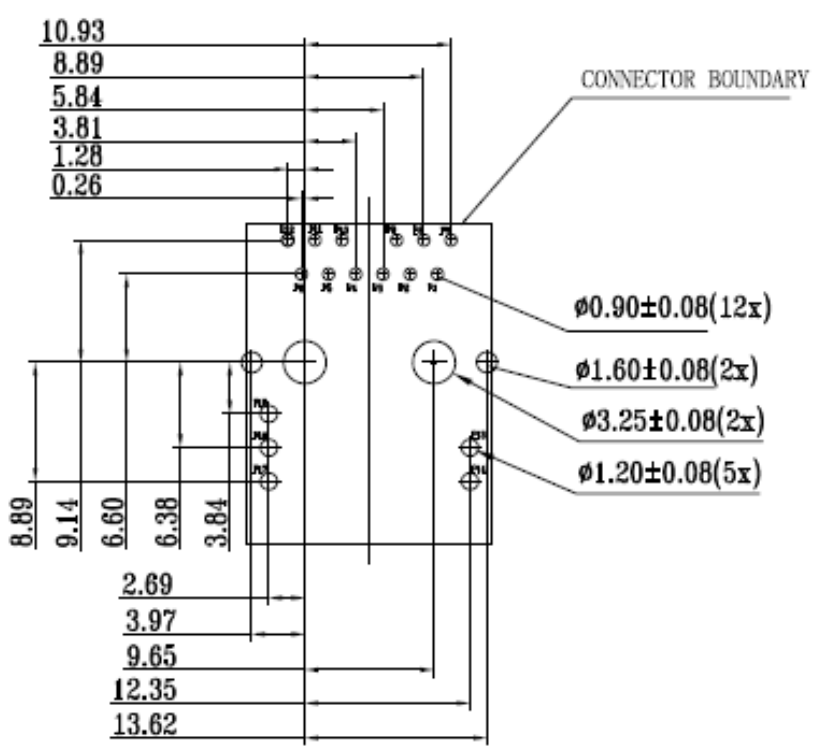
Component Side of PC Board



Unit: mm [μ m]

Figure 8: 10 Position Jack, Tab up with LED

Component Side of PC Board



Unit: mm [μ m]

Figure 9: 12 Position Jack, Tab up with LED (Low Profile)

B. Single-Port shielded Jack with standard Latch (Tab down)

The hole patterns that apply to all single-port jacks with standard Latch are provided in the following figures.

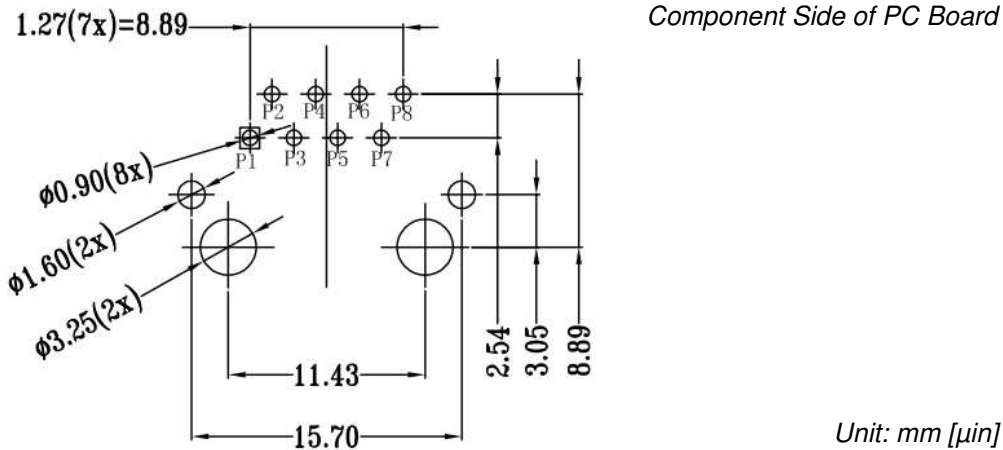


Figure 10: 8 Position Jack, Tab down without LED

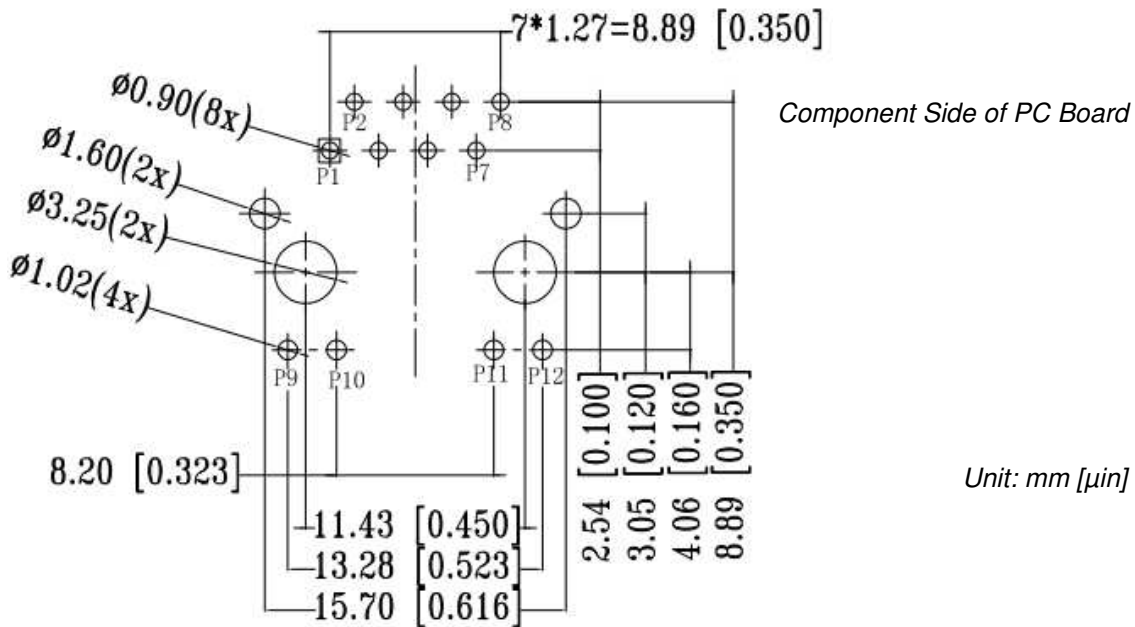


Figure 11: 8 Position Jack, Tab down with LED

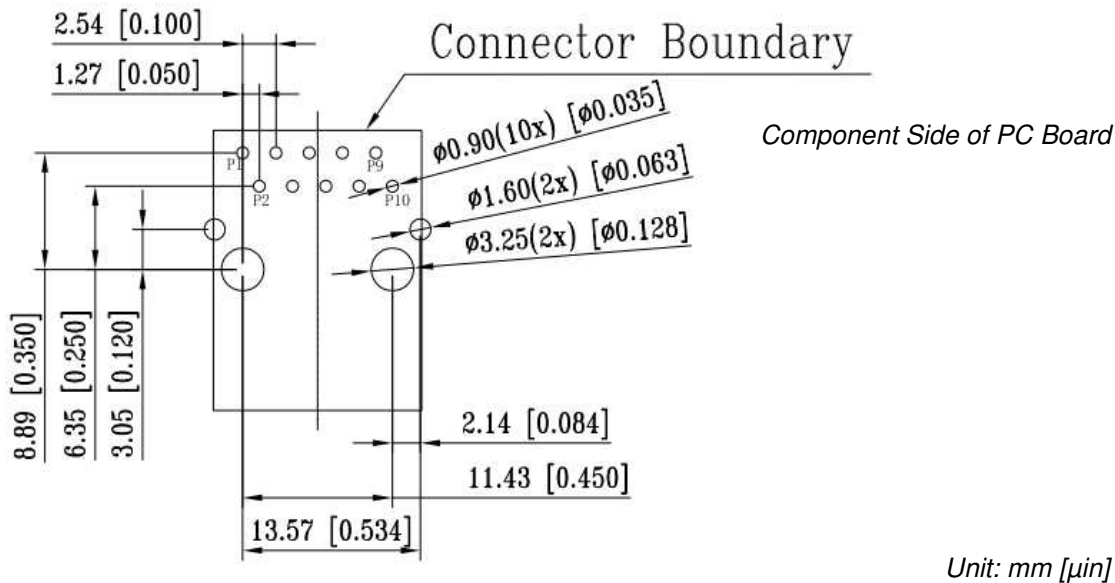


Figure 12: 10 Position Jack, Tab down without LED

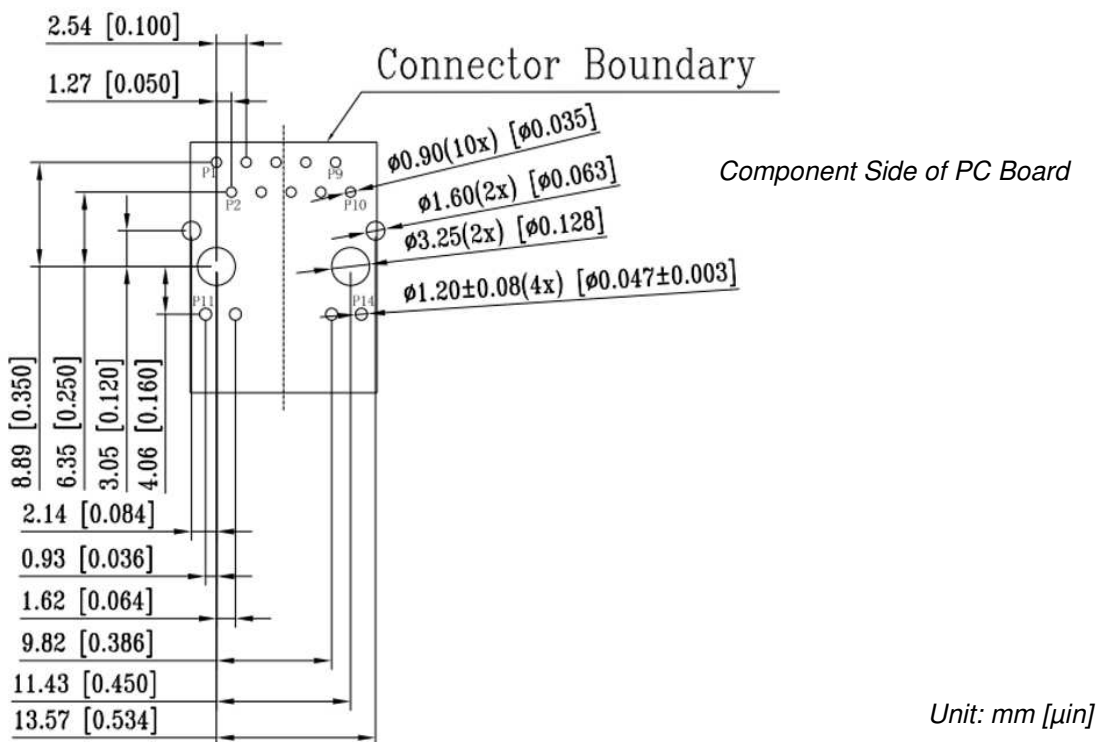
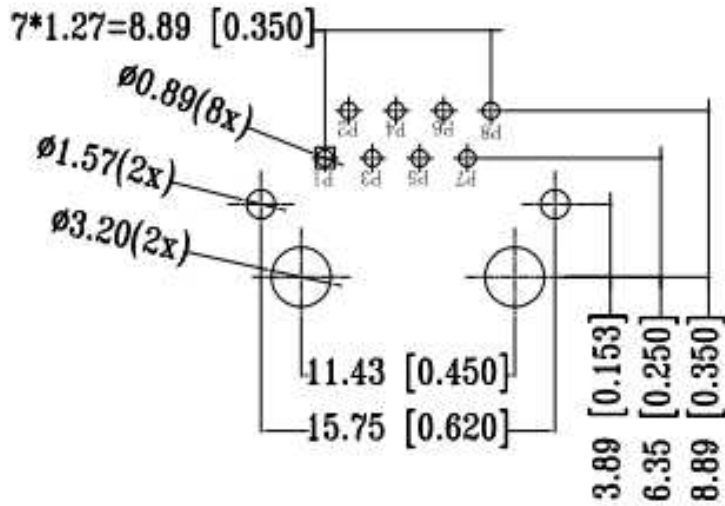


Figure 13: 10 Position Jack, Tab down with LED

C. Single-Port shielded Jack Vertical

The hole patterns that apply to all single-port jacks vertical are provided in the following figures.

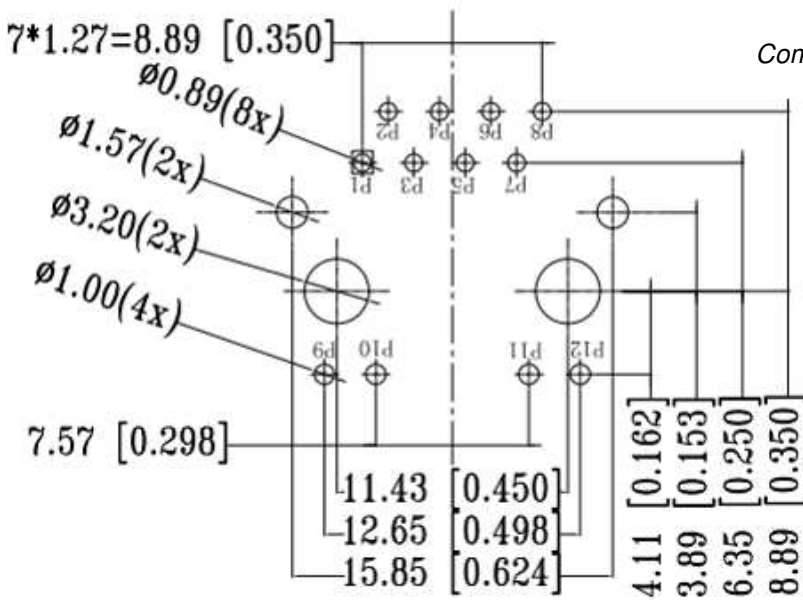
Component Side of PC Board



Unit: mm [μ in]

Figure 14: 8 Position Jack, Vertical without LED

Component Side of PC Board



Unit: mm [μ in]

Figure 15: 8 Position Jack, Vertical with LED

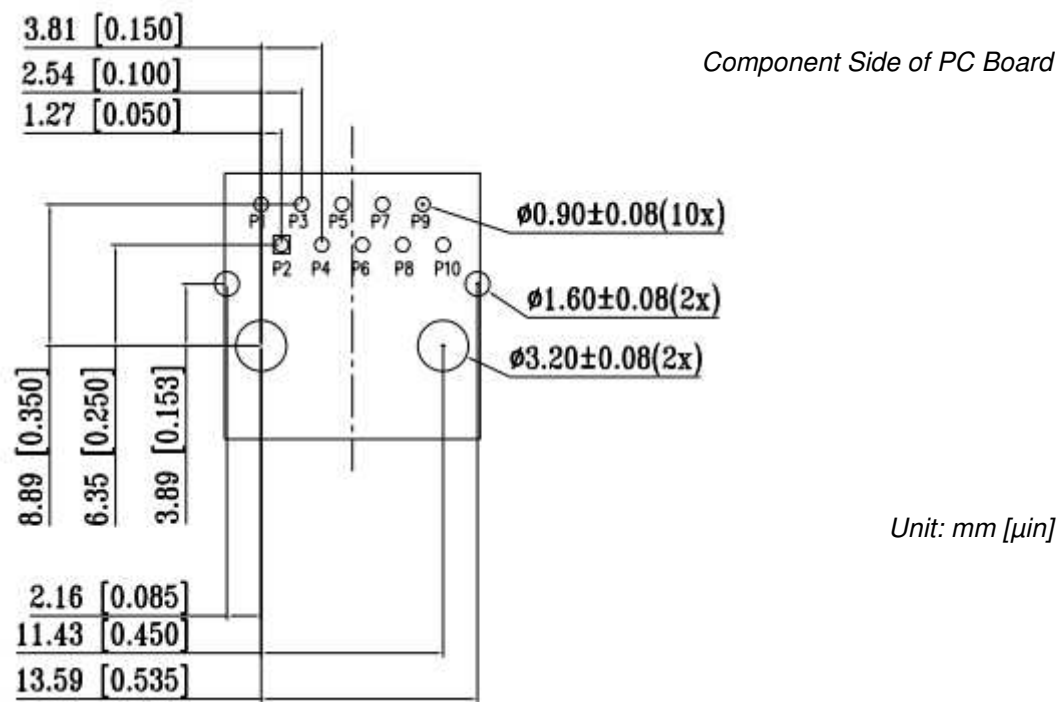


Figure 16: 10 Position Jack, Vertical without LED

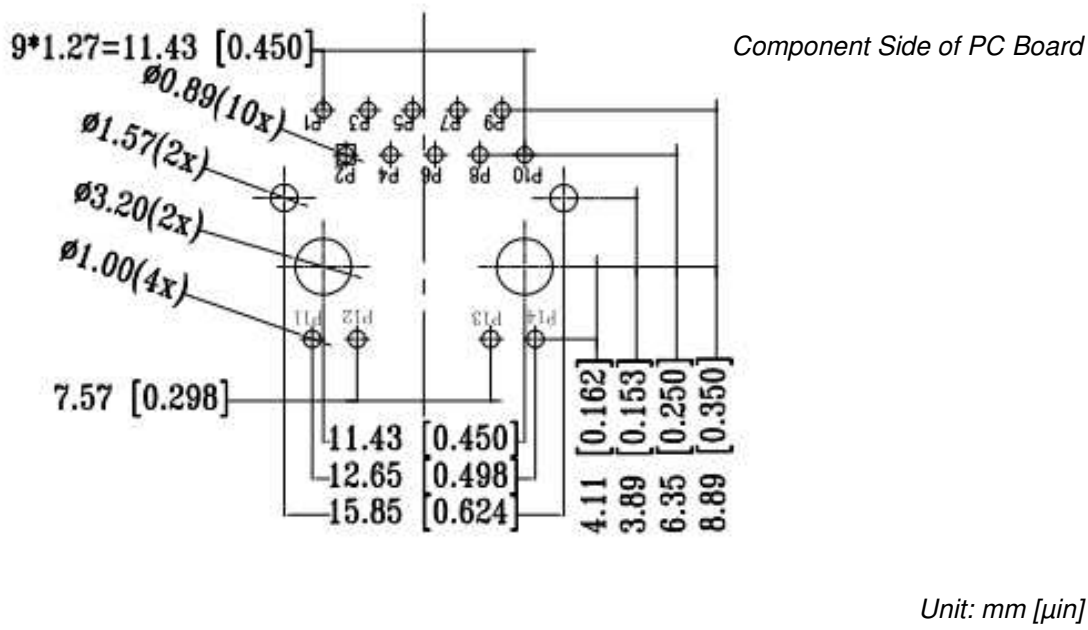
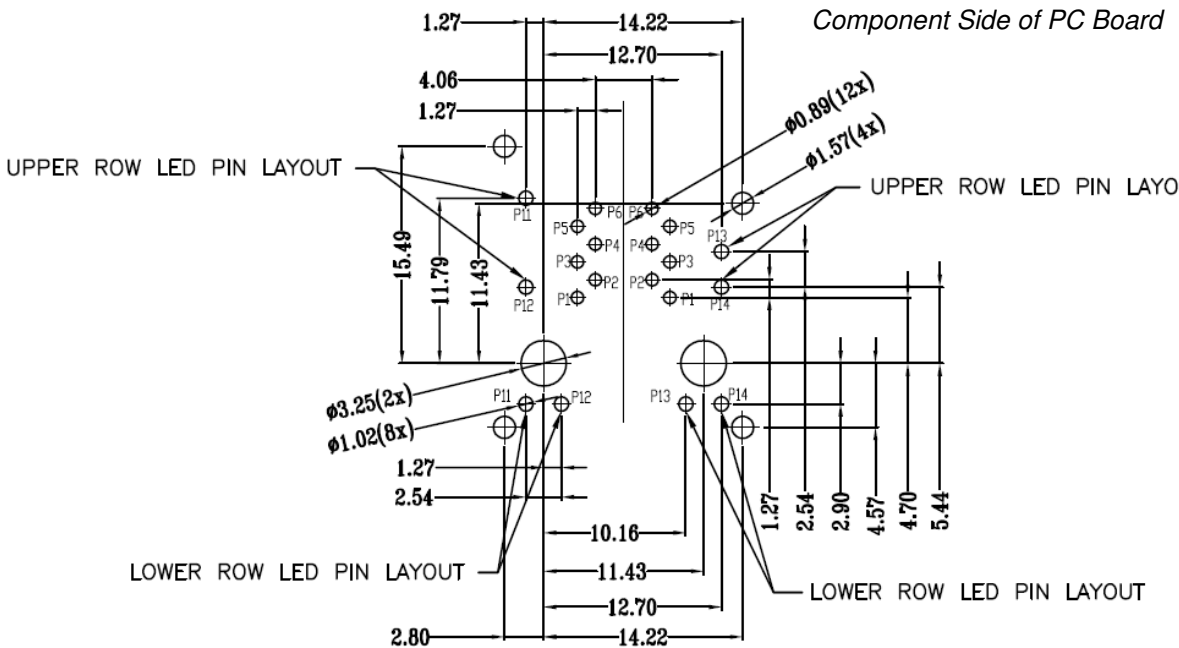


Figure 17: 10 Position Jack, Vertical with LED

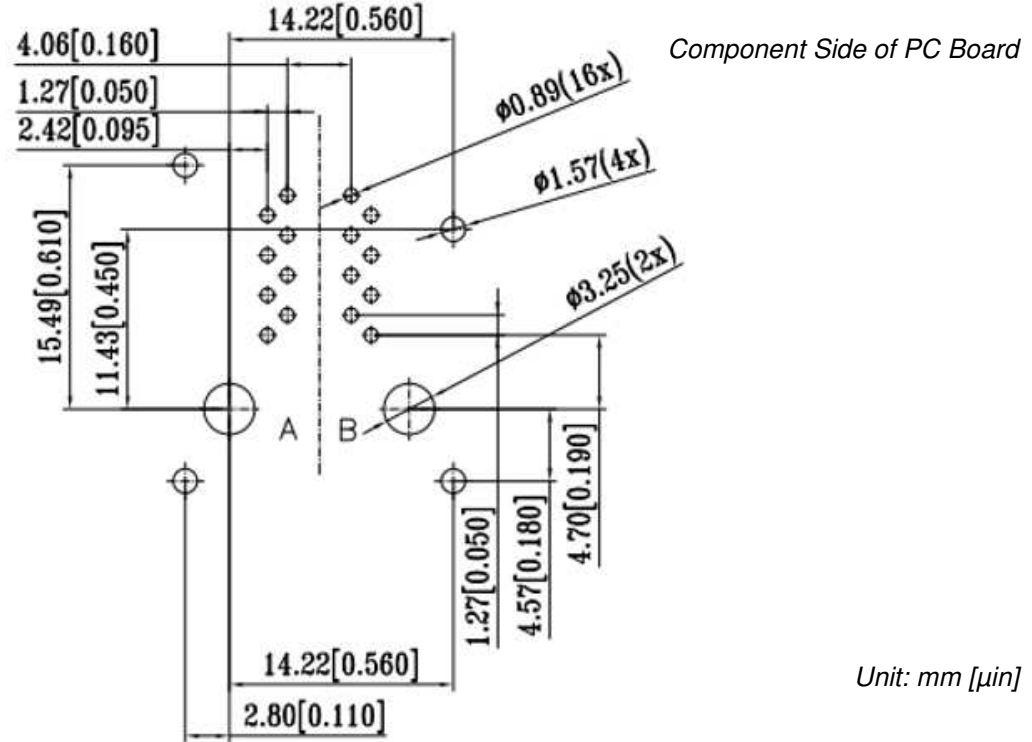
D. Dual Port (Stacked) shielded Jack with magnetics

The hole patterns that apply to all dual port stacked jacks are provided in the following figures.



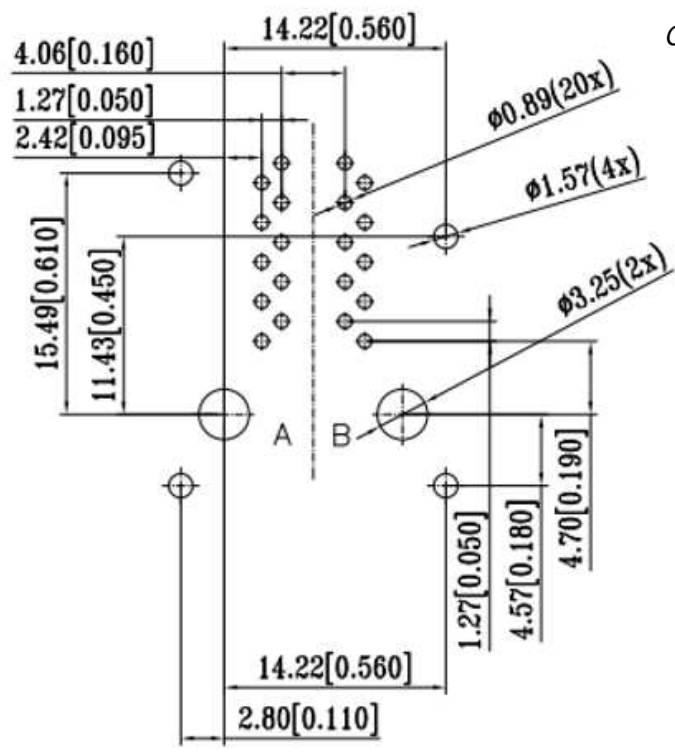
Unit: mm [μ in]

Figure 18: 6 Position Jack, 2x1p with LED



Unit: mm [μ in]

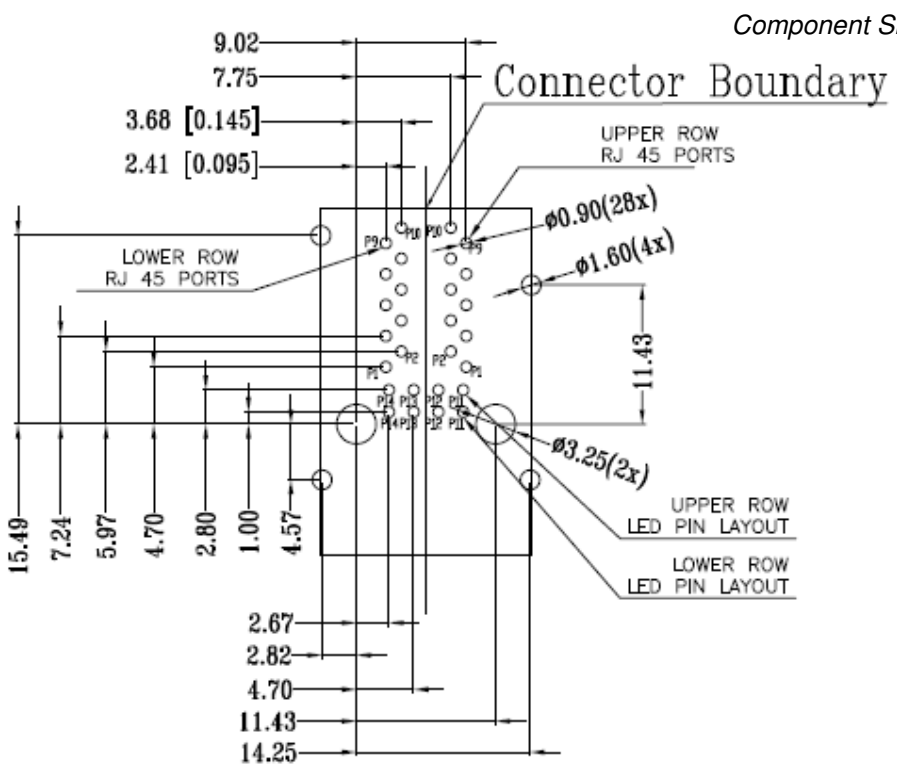
Figure 19: 8 Position Jack, 2x1p without LED



Component Side of PC Board

Unit: mm [μ in]

Figure 20: 10 Position Jack, 2x1p without LED



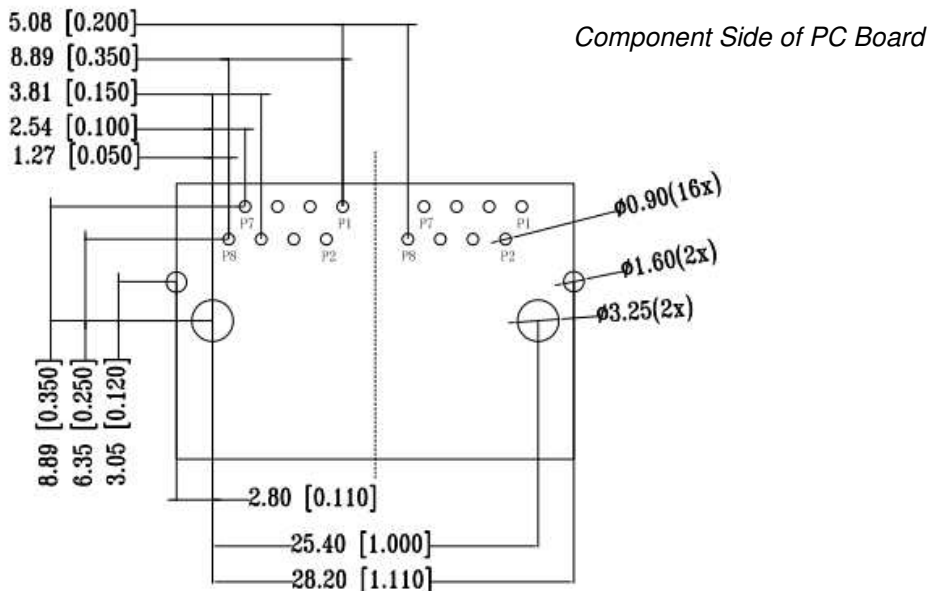
Component Side of PC Board

Unit: mm [μ in]

Figure 21: 10 Position Jack, 2x1p with LED

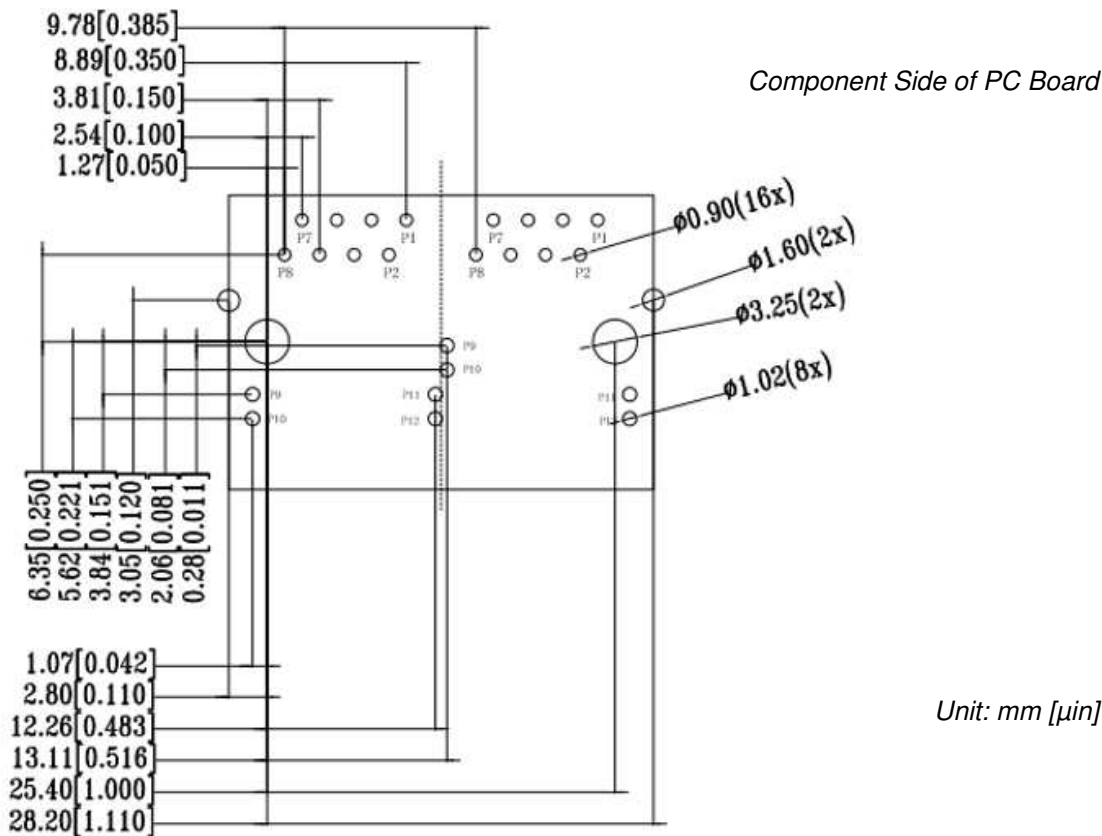
E. Dual Port 1x2 shielded Jack with inverted Latch (Tab up)

The hole patterns that apply to all Dual port 1x2 jacks with inverted latch are provided in the following figures.



Unit: mm [μ m]

Figure 22: 8 Position Jack, 1x2p Tab up without LED



Unit: mm [μ m]

Figure 23: 8 Position Jack, 1x2p Tab up with LED

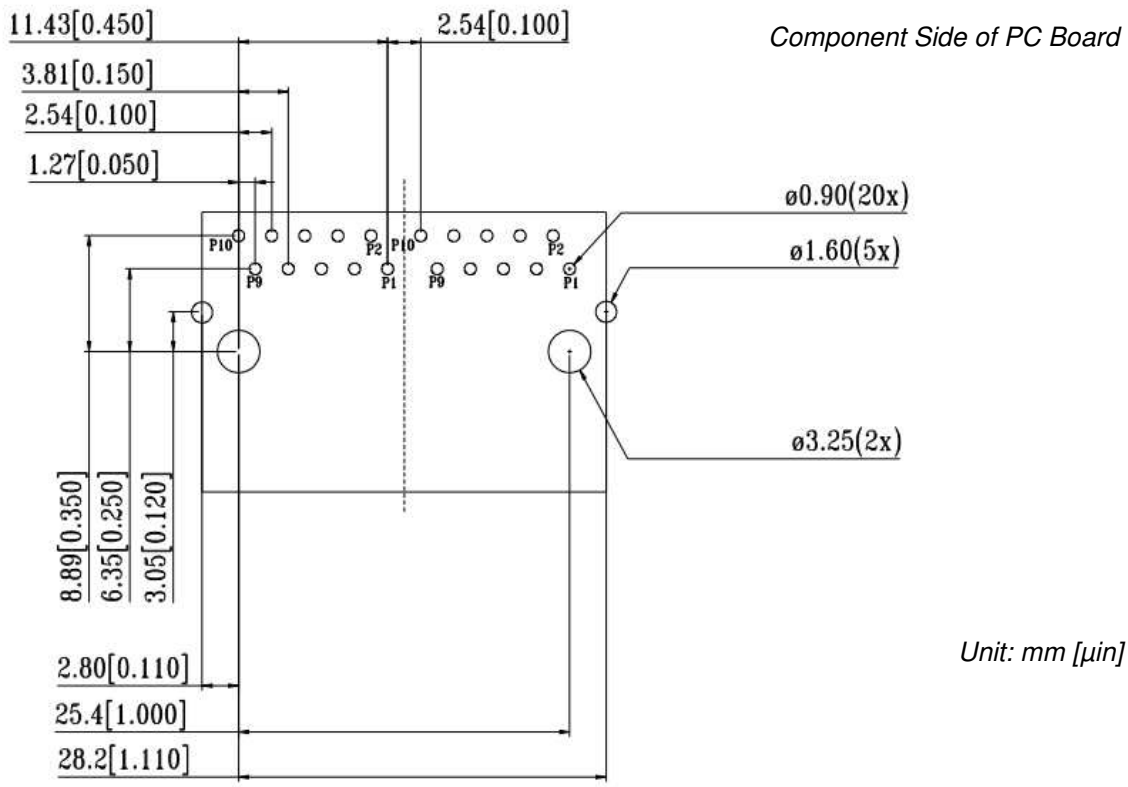


Figure 24: 10 Position Jack, 1x2p Tab up without LED

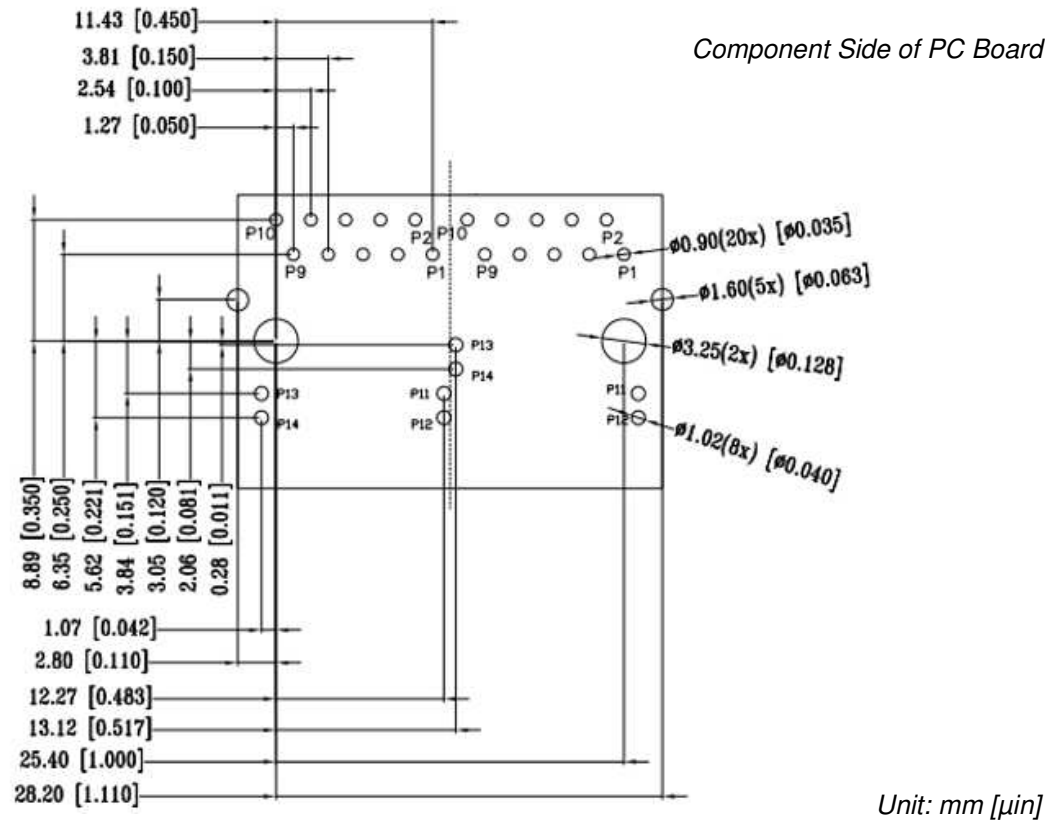


Figure 25: 10 Position Jack, 1x2p Tab up with LED

F. Dual Port 1x2 shielded Jack with standard Latch (Tab down)

The hole patterns that apply to all Dual port 1x2 jacks with standard latch are provided in the following figures.

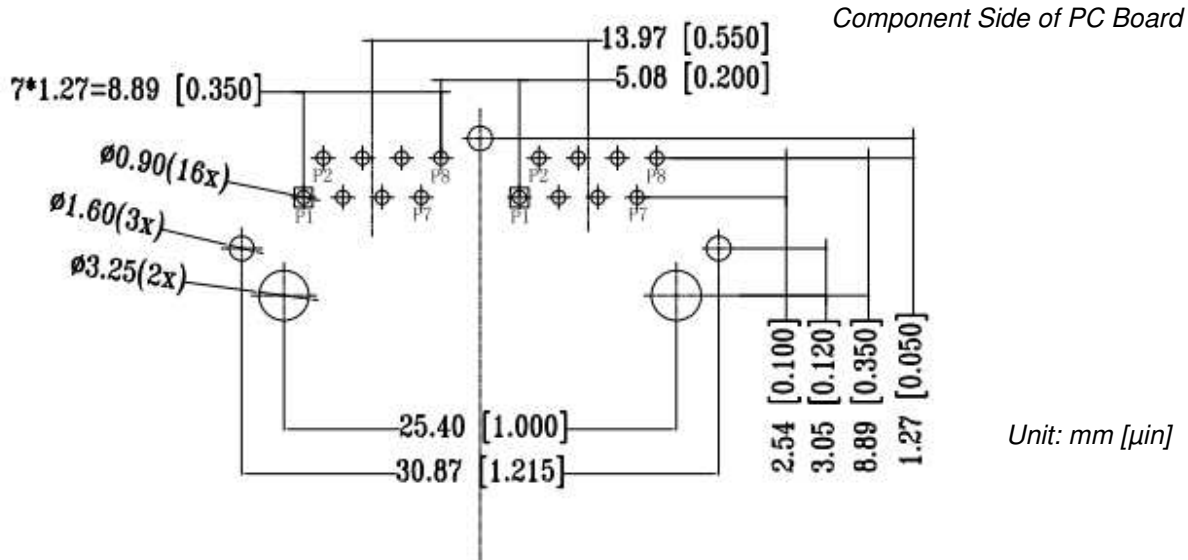


Figure 26: 8 Position Jack, 1x2p Tab down without LED

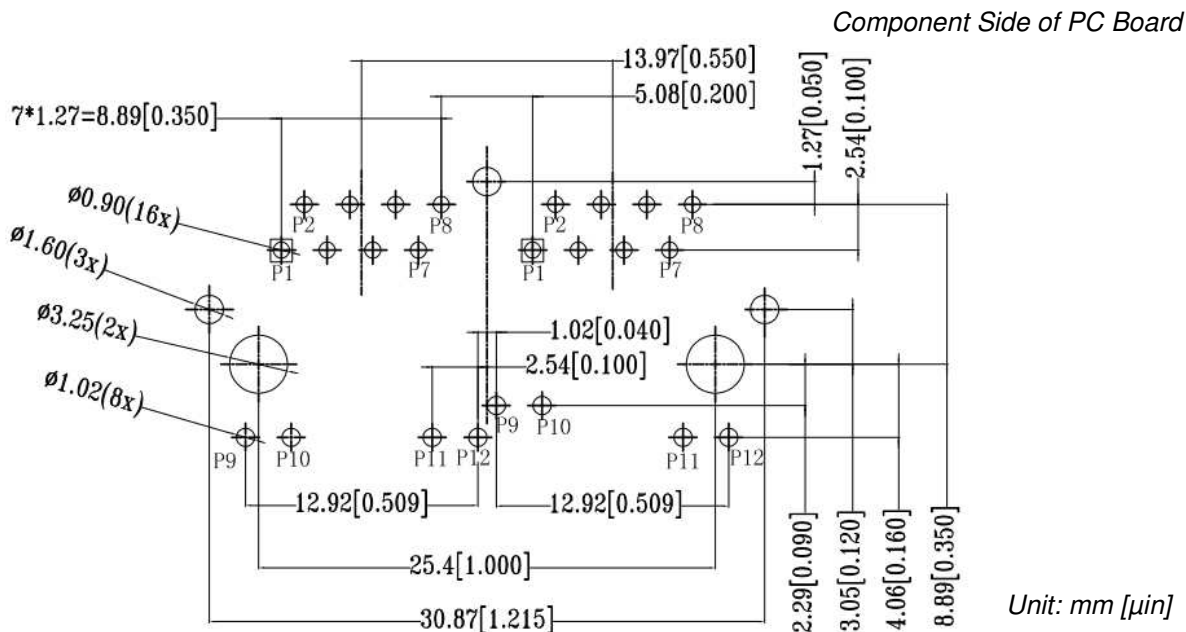


Figure 27: 8 Position Jack, 1x2p Tab down with LED

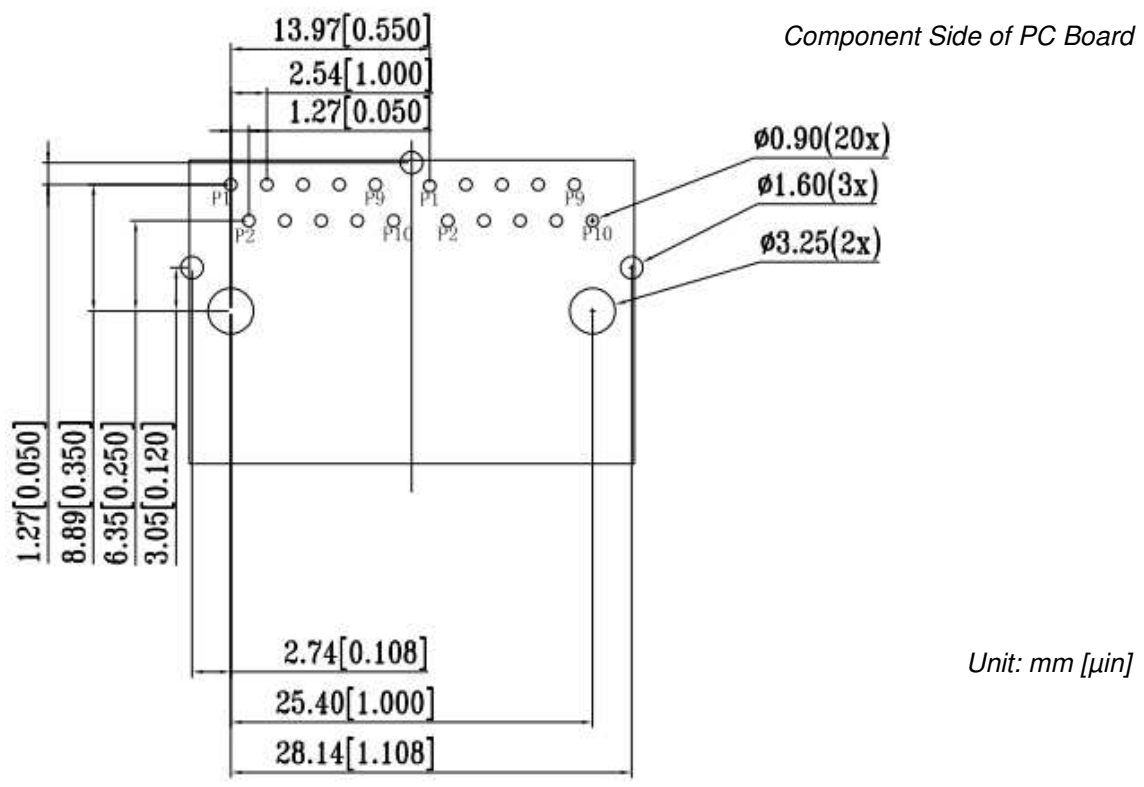


Figure 28: 10 Position Jack, 1x2p Tab down without LED

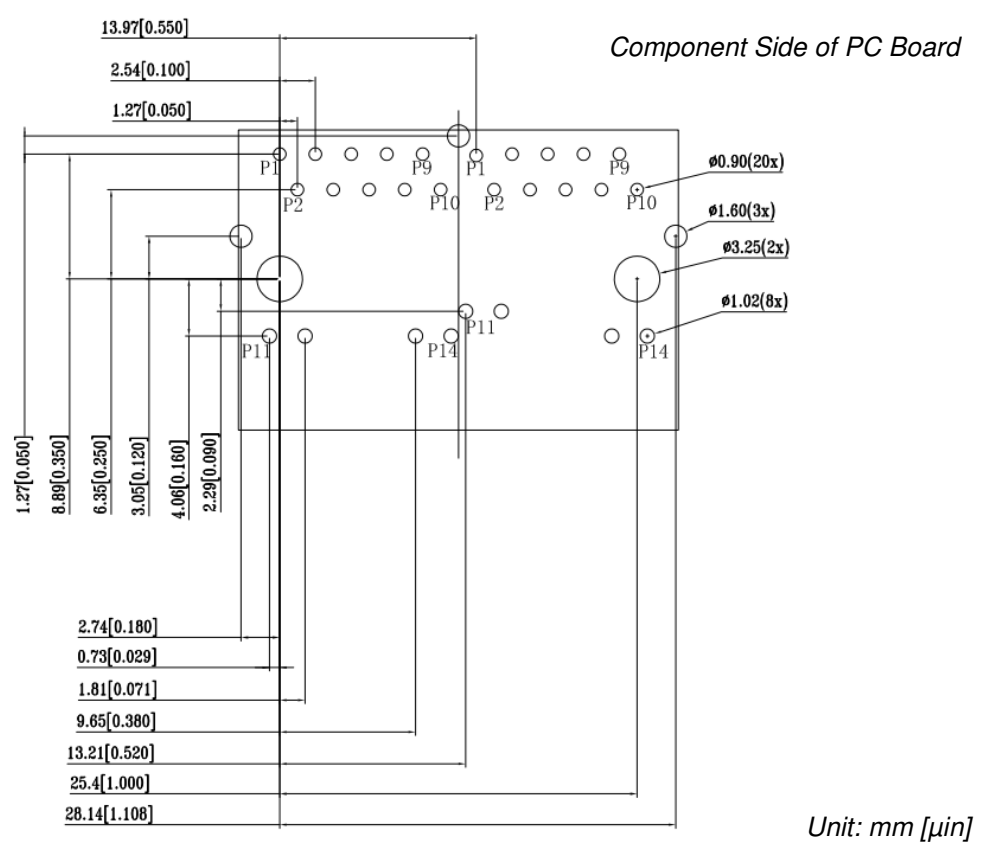


Figure 29: 10 Position Jack, 1x2p Tab down with LED

3.6. PCB Contact Tine Holes

Plated through holes should be used for contact solder tines and, when applicable, shield solder tines. The drilled hole size, plating types, and plating thickness are dependent on your application requirements. The finished hole size must be as stated to provide unrestricted insertion, proper retention in the PCB, and to ensure adequate application of solder to the tines. See Figure 35.

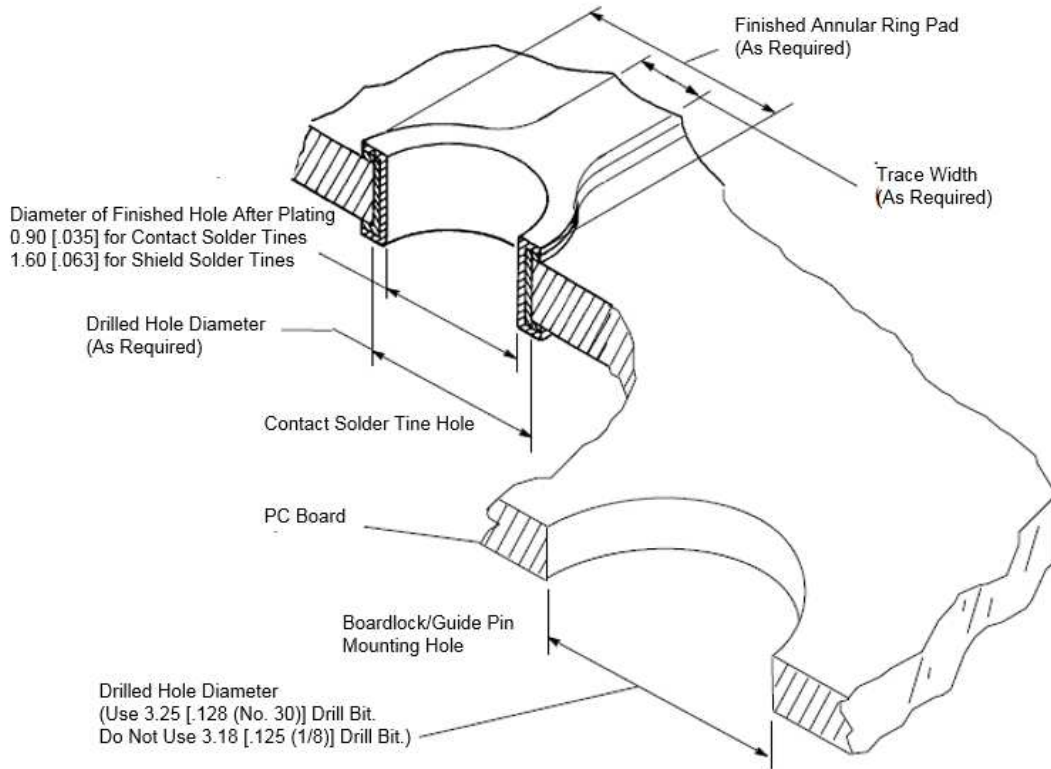


Figure 30: Contact Tine Holes dimensions in PCB

3.7. Jack placement



The connector should be handled only by the housing to avoid deformation, contamination, or other damage to the contact solder tines and, where applicable, shield solder tines

A. Alignment

The RJ45 Jack with integrated Magnetics shall be flush and evenly seated on the PCB. A hold-down may be used to hold the jack in place during the soldering process.

B. Position

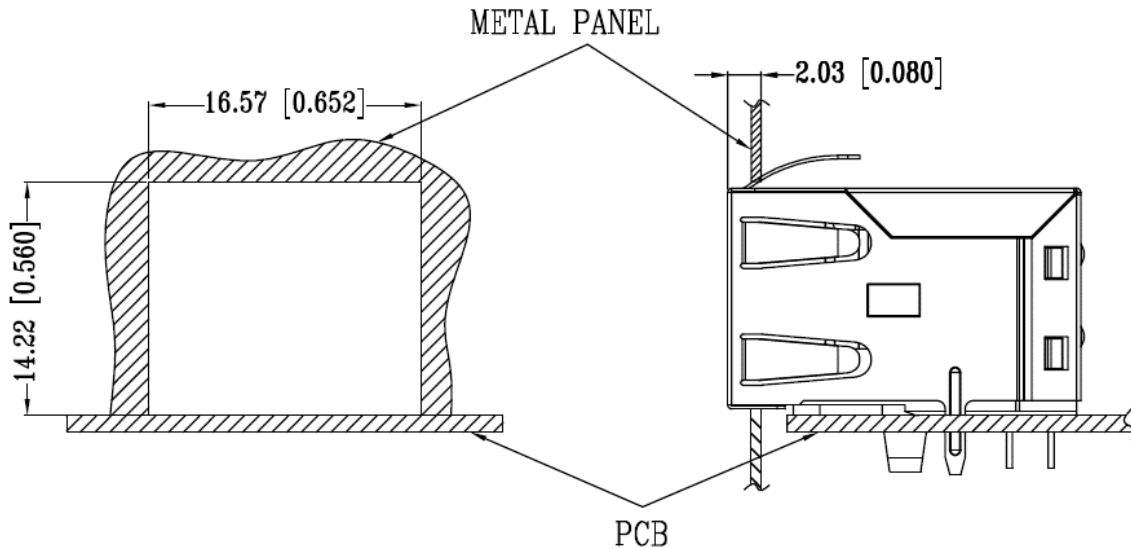
Determine which hole in the PCB is to receive the number one contact tine, then orient the jack so the number one solder tine is aligned with the hole. Insert all solder tines into the board, then press on the top of the jack until it seats on the PCB.

3.8. Shielding

Shielded RJ45 Jack with integrated Magnetics features brass shells which provide continuity for EMC (Electromagnetic Compatibility) applications. When mated with corresponding shielded RJ45 plugs, shielding and grounding continuity are achieved. When the shield solder tines are soldered to the PCB they provide electrical continuity to any ground path on the PCB and, where applicable, panel ground tabs on the shield provide electrical continuity to any ground path through the equipment panel.

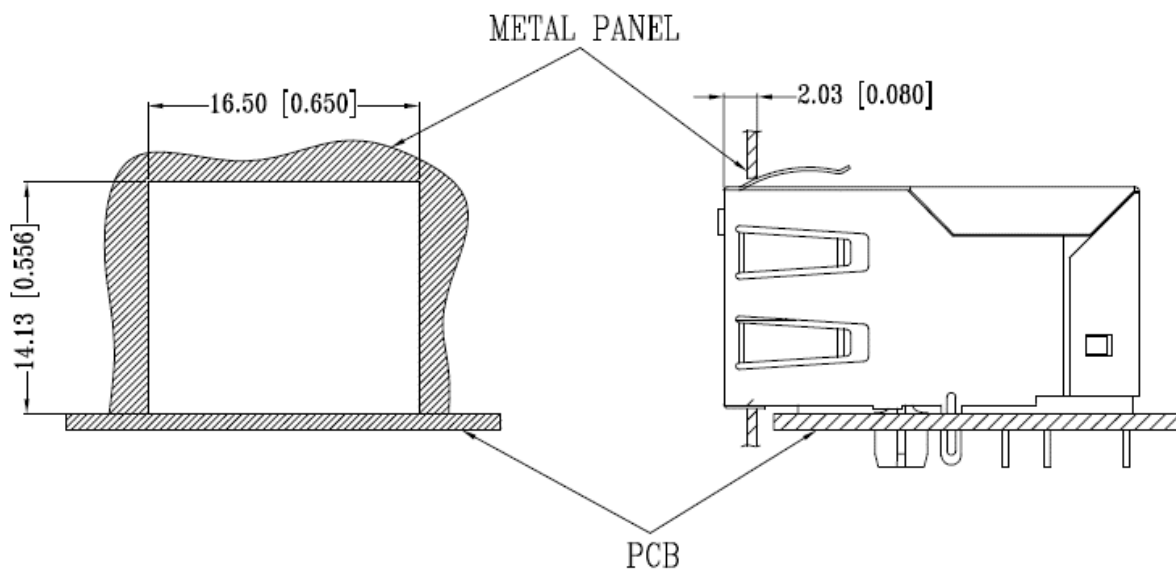
3.9. Panel Cutout

After the modular jack is secured to the PCB, the modular jack can be positioned in a cutout in a panel. Dimensions for recommended panel cutout are shown in following figures.



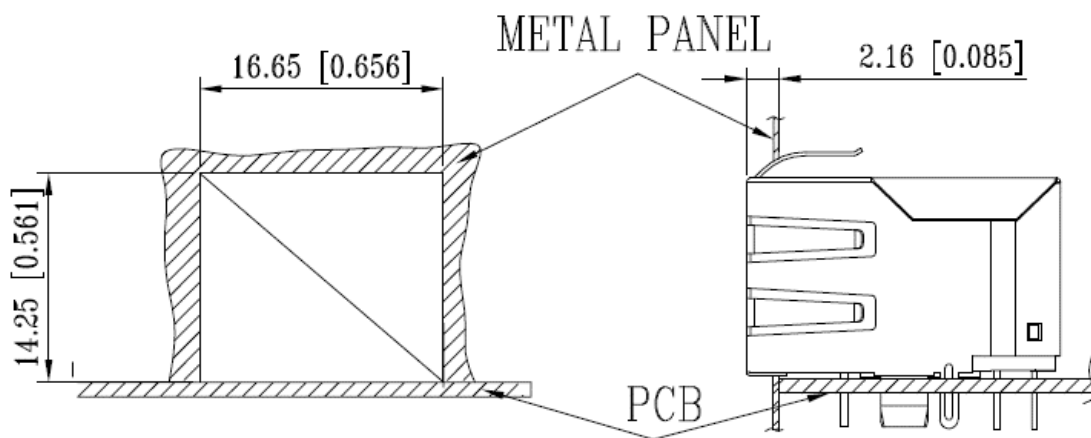
Unit: mm [mil]

Figure 31: 8 and 10 position Jack without LEDs, Tab Up (2301994-1 / 2301994-3 / 2301994-5 / 2-2301994-0)



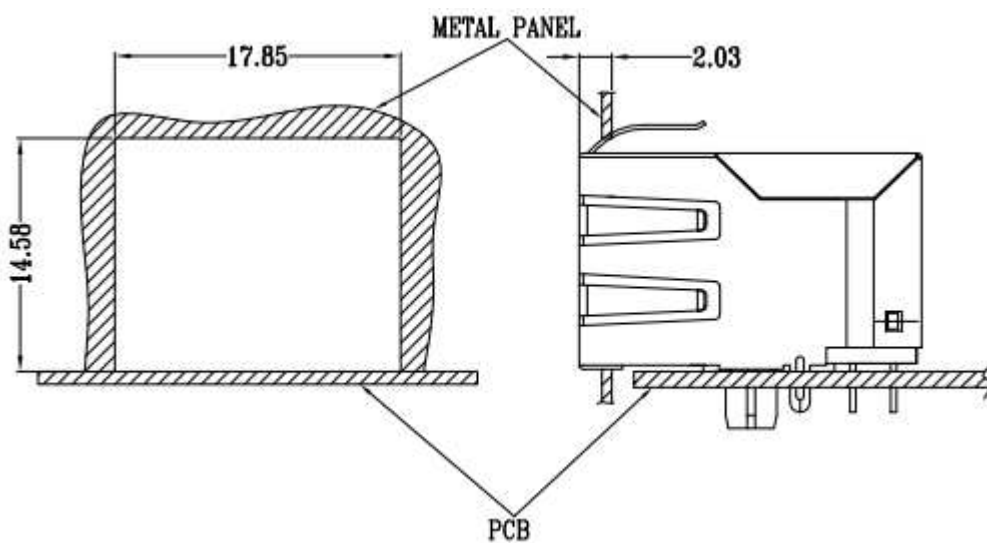
Unit: mm [mil]

Figure 32: 8 position Jack with LED, Tab Up (2301994-2, 2301994-8, 1-2301994-5)



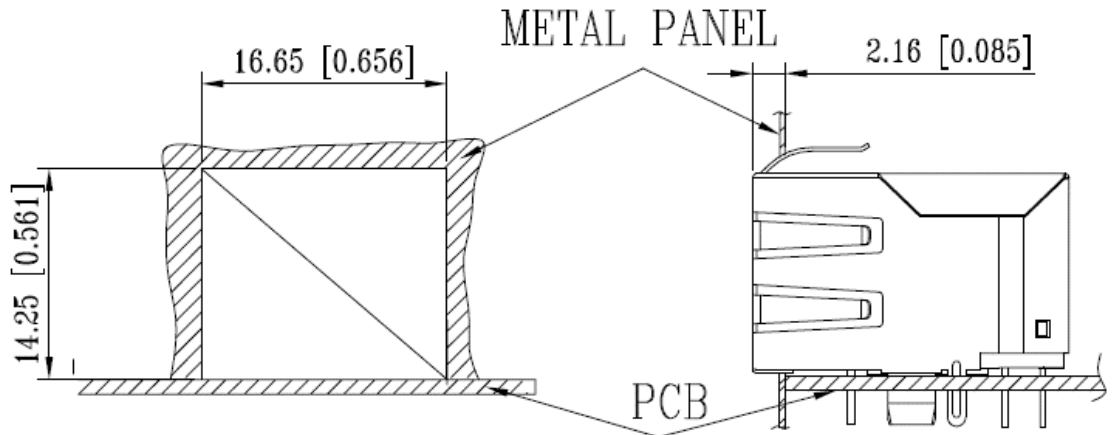
Unit: mm [mil]

Figure 33: 10 position Jack with LED, Tab up (1-2301994-3)



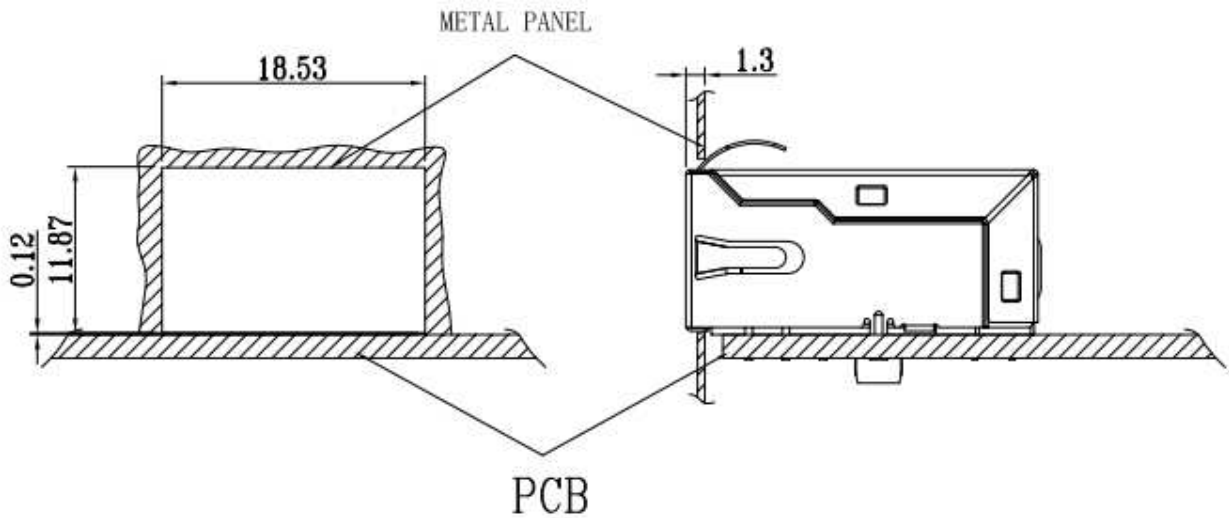
Unit: mm [mil]

Figure 34: 8 position Jack with and without LED, Tab down (2301994-4 / 2301994-9 / 1-2301994-9)



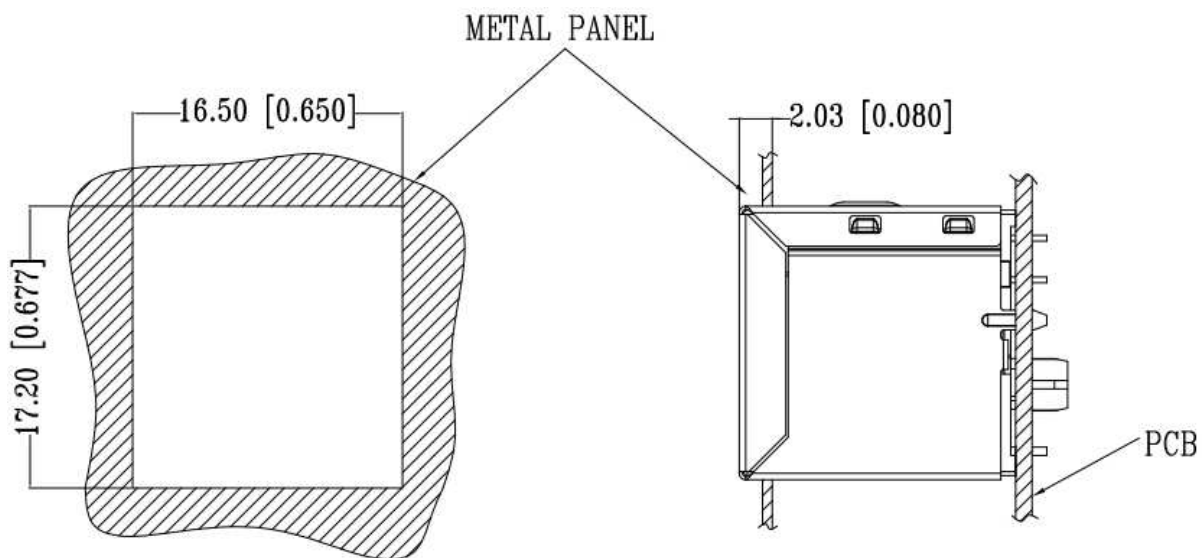
Unit: mm [mil]

Figure 35: 10 position Jack with and without LED, Tab down (2301994-6 / 2301994-7 / 1-2301994-0 / 1-2301994-2 / 2-2301994-1 / 2-2301994-2 / 2-2301994-3 / 2-2301994-4)



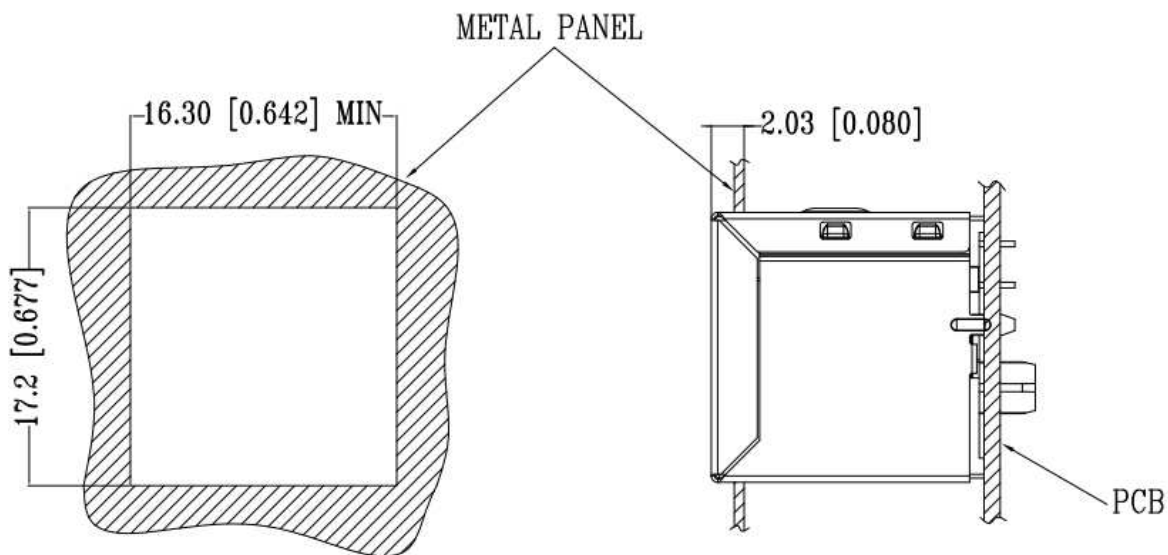
Unit: mm [mil]

Figure 36: 12 position Jack with LED, Tab up, Low-profile (1-2301994-1)



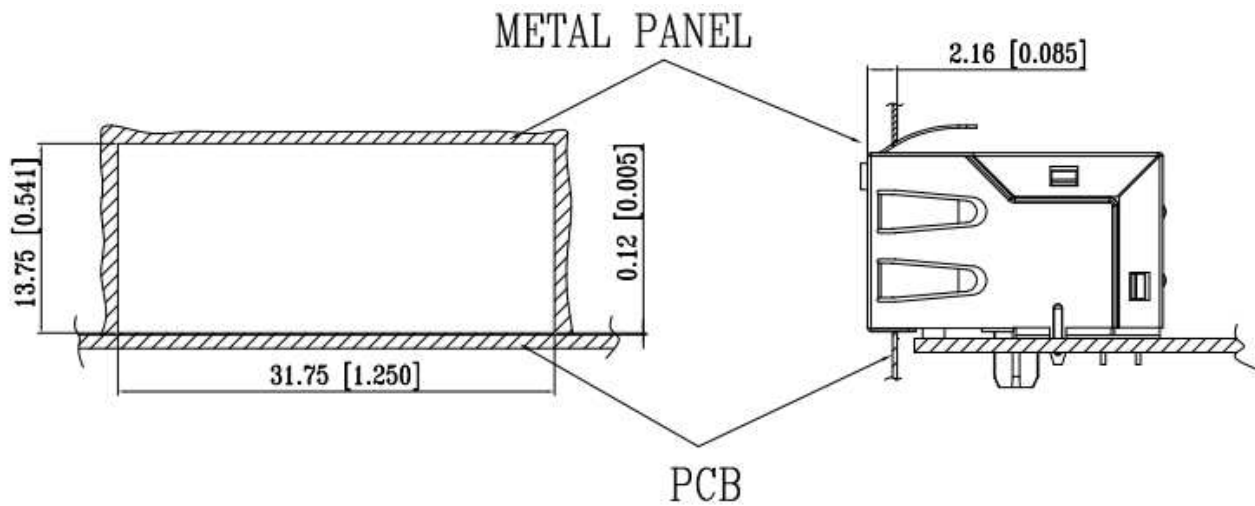
Unit: mm [mil]

Figure 37: 8 position Jack, Vertical with and without LED (2301995-2 / 2301995-3)



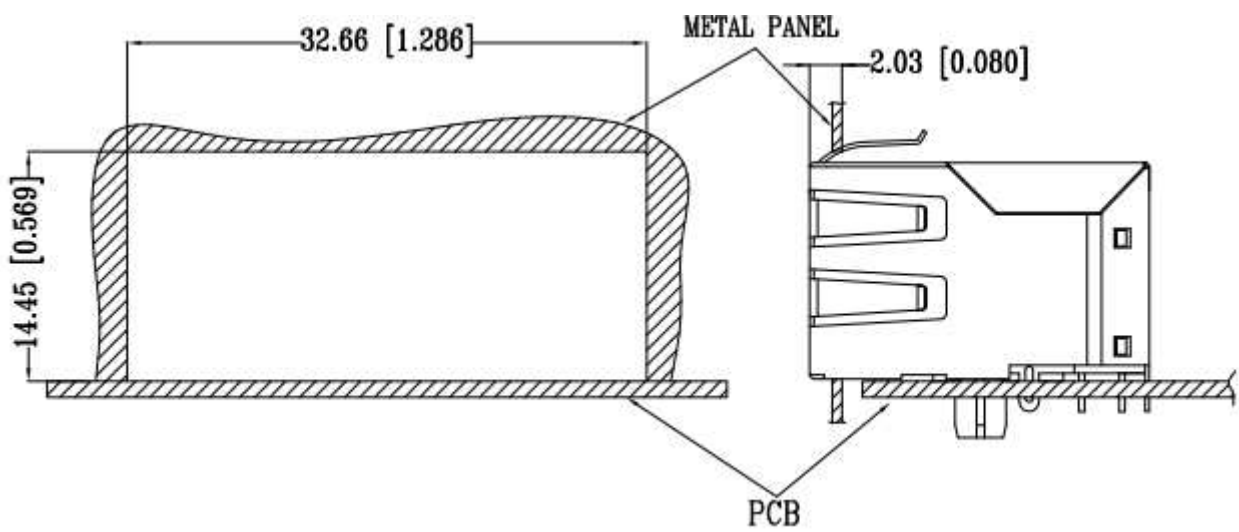
Unit: mm [mil]

Figure 38: 10 position Jack, Vertical with and without LED (2301995-1 / 2301995-4)



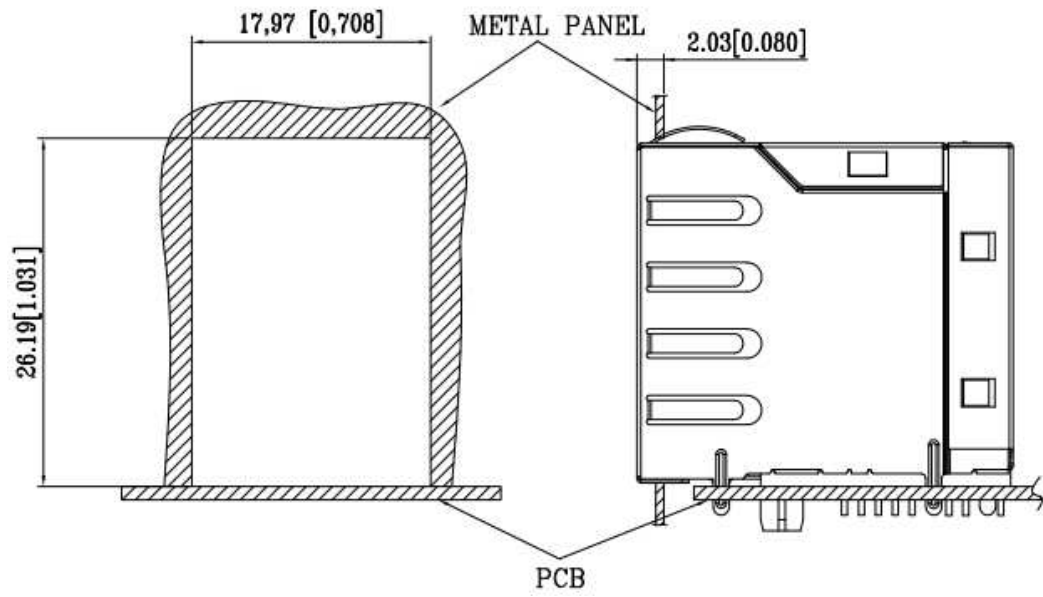
Unit: mm [mil]

Figure 39: 8 and 10 position Jack, 1x2p with and without LED, Tab Up (2301996-1 / 2301996-3 / 2301996-5 / 2301996-7)



Unit: mm [mil]

Figure 40: 8 and 10 position Jack, 1x2p with and without LED, Tab Down (2301996-2 / 2301996-4 / 2301996-6 / 2301996-8)



Unit: mm [mil]

Figure 41: 6 and 10 position Jack, 2x1p with LED (2301997-5 / 2301997-7)

3.10. Soldering Guidelines

RJ45 Jack with integrated Magnetics can be soldered using reflow or equivalent soldering techniques according to IPC/JEDEC J-STD-020D. The temperatures and exposure time shall be within the ranges specified in Table 3.

Table 3: Temperature and exposure time

SOLDERING PROCESS	TEMPERATURE		TIME (At Max Temp)
	CELSIUS	FAHRENHEIT	
Reflow Soldering	260	500	10 Seconds



The connector should not be cleaned by immersion in liquid or by an aqueous spray-in-air process. The manual removal of the flux or the use of no-clean flux is recommended.

3.11. Checking Installed Jack

The Jack must be seated on the PCB as shown in figure 47.

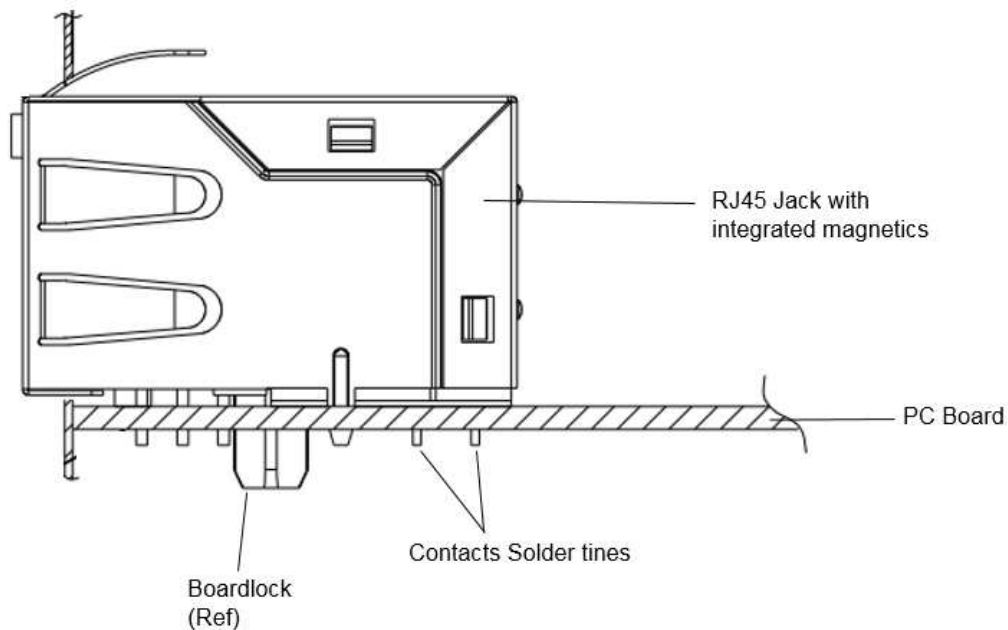


Figure 42: RJ45 Jack with integrated magnetics installed on PCB

3.12. Repair/Removal

If the jack should become damaged, it must be replaced. It may be removed from the PCB by normal desoldering methods and replaced with a new jack.



When repairing or replacing a RJ45 Jack with integrated Magnetics, be careful not to damage other PCB components during the desoldering process.

4. QUALITY

RJ45 Jack are recognized by Underwriters Laboratories Incorporated (UL) in File 81956.

5. TOOLING

No special tooling is required for hand placement of RJ45 Jack with magnetics onto a PCB. However, a backup support that provides relief for protruding components is needed to prevent deformation of contact solder tines and, when applicable, shield solder tines.

6. VISUAL AID

Figure 48 shows typical installation applications of RJ45 Jack with integrated magnetics and should be used by production personnel to ensure a correctly applied product. Applications which DO NOT appear correct should be inspected using the information in the preceding pages of this specification.

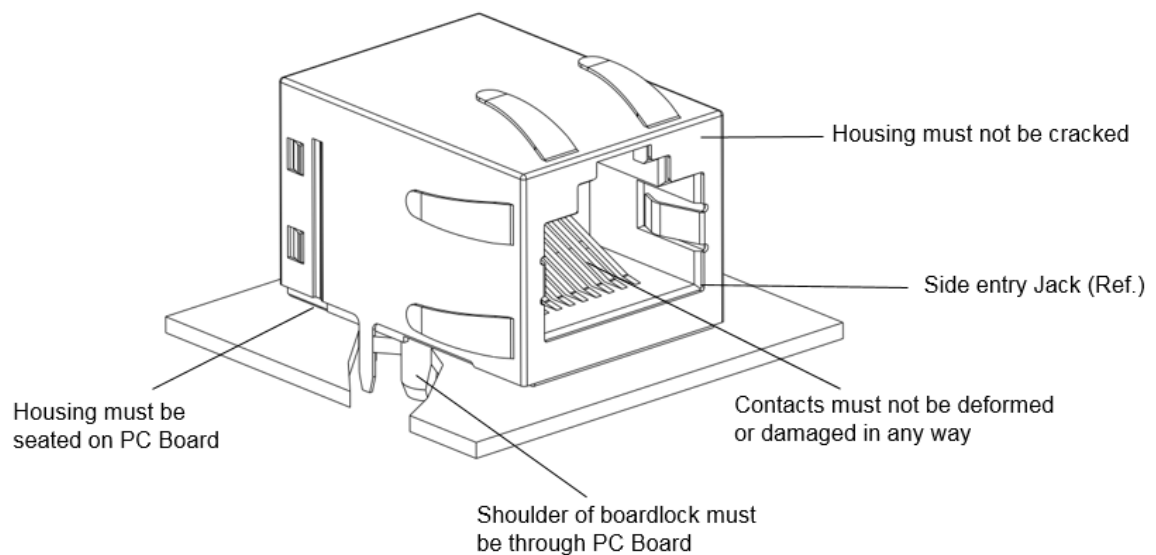


Figure 43: Visual aid

8. APPENDIX

8.1. List of figures

Figure 1: Basic terms and features of components.....	1
Figure 2: Current-mode driven magnetics.....	3
Figure 3: Voltage-mode driven magnetics.....	3
Figure 4: Pinout of RJ45 jack.....	4
Figure 10: 8 Position Jack, Tab up without LED.....	5
Figure 11: 8 Position Jack, Tab up with LED.....	6
Figure 12: 10 Position Jack, Tab up without LED.....	6
Figure 13: 10 Position Jack, Tab up with LED.....	7
Figure 14: 12 Position Jack, Tab up with LED (Low Profile).....	7
Figure 15: 8 Position Jack, Tab down without LED.....	8
Figure 16: 8 Position Jack, Tab down with LED.....	8
Figure 17: 10 Position Jack, Tab down without LED.....	9
Figure 18: 10 Position Jack, Tab down with LED.....	9
Figure 19: 8 Position Jack, Vertical without LED.....	10
Figure 20: 8 Position Jack, Vertical with LED.....	10
Figure 21: 10 Position Jack, Vertical without LED.....	11
Figure 22: 10 Position Jack, Vertical with LED.....	11
Figure 23: 6 Position Jack, 2x1p with LED.....	12
Figure 24: 8 Position Jack, 2x1p without LED.....	12
Figure 25: 10 Position Jack, 2x1p without LED.....	13
Figure 26: 10 Position Jack, 2x1p with LED.....	13
Figure 27: 8 Position Jack, 1x2p Tab up without LED.....	14
Figure 28: 8 Position Jack, 1x2p Tab up with LED.....	14
Figure 29: 10 Position Jack, 1x2p Tab up without LED.....	15
Figure 30: 10 Position Jack, 1x2p Tab up with LED.....	15
Figure 31: 8 Position Jack, 1x2p Tab down without LED.....	16
Figure 32: 8 Position Jack, 1x2p Tab down with LED.....	16
Figure 33: 10 Position Jack, 1x2p Tab down without LED.....	17
Figure 34: 10 Position Jack, 1x2p Tab down with LED.....	17
Figure 35: Contact Tine Holes dimensions in PCB.....	18
Figure 36: 8 and 10 position Jack without LEDs, Tab Up (2301994-1 / 2301994-3 / 2301994-5 /.....	19
Figure 37: 8 position Jack with LED, Tab Up (2301994-2, 2301994-8, 1-2301994-5).....	19
Figure 38: 10 position Jack with LED, Tab up (1-2301994-3).....	20
Figure 39: 8 position Jack with and without LED, Tab down (2301994-4 / 2301994-9 / 1-2301994-9).....	20
Figure 40: 10 position Jack with and without LED, Tab down (2301994-6 / 2301994-7 / 1-2301994-0 /.....	21
Figure 41: 12 position Jack with LED, Tab up, Low-profile (1-2301994-1).....	21
Figure 42: 8 position Jack, Vertical with and without LED (2301995-2 / 2301995-3).....	22
Figure 43: 10 position Jack, Vertical with and without LED (2301995-1 / 2301995-4).....	22
Figure 44: 8 and 10 position Jack, 1x2p with and without LED, Tab Up (2301996-1 / 2301996-3 /.....	23
Figure 45: 8 and 10 position Jack, 1x2p with and without LED, Tab Down (2301996-2 / 2301996-4 /.....	23
Figure 46: 6 and 10 position Jack, 2x1p with LED (2301997-5 / 2301997-7).....	24
Figure 47: RJ45 Jack with integrated magnetics installed on PCB.....	25
Figure 48: Visual aid.....	26

8.2. List of tables

Table 1: Storage time and conditions.....	3
Table 2: Signal pair definition.....	4
Table 3: Temperature and exposure time.....	25