

VPB SERIES

Power Connectors



POSITRONIC®

GLOBAL *Connector* SOLUTIONS

Advanced TCA® Zone 1 Connector



UL Environment™
ENVIRONMENTAL CLAIMS VALIDATED

- ✓ Average power contact resistance is less than 0.001 ohms
- ✓ Average signal contact resistance is less than 0.005 ohms
- ✓ RoHS compliant



Catalog C-031 Rev. G

Other Front Board Power Connectors

To view all products visit

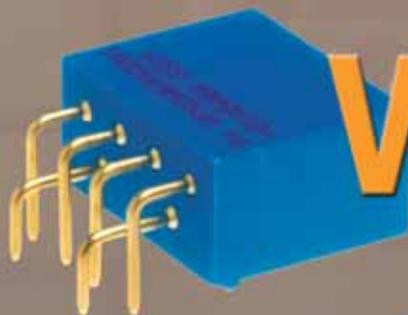
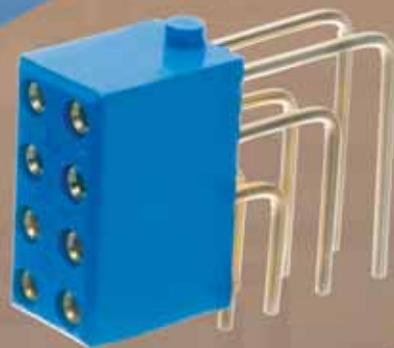
www.connectpositronic.com

The dedicated power interface
between plug-in boards and backplanes

VPN Series



- Six power contacts
- Three level of sequential mating
- Compatible with IEEE 1101.2 conduction cooled boards
- Compatible with popular high speed data connectors, no notching of the board required
- High reliability large surface area contact system



VPX Series



- Eight power contacts
- Four levels of sequential mating
- Compatibility with popular high speed data connectors, no notching of the board required
- High reliability large surface area contact system



Compliant to VITA 41 VXS power connector requirements



Plug-in boards used in today's computing platforms must provide higher reliability, greater functionality and require more power than ever before. Many next generation platforms deliver bulk voltage to boards. DC to DC converters are used to supply the various voltage requirements on the board. This allows systems to adapt as semiconductor voltages change.

The **VPB Series** was developed as a **dedicated interface** between backplanes and boards. The connector is capable of providing dual redundant power, system management and high voltage auxiliary circuits to each slot within the platform. The connector's outstanding blind mating capability can be used to align the board during insertion. The **VPB Series** is **compliant to PICMG 3.0, AdvancedTCA[®], Zone 1 connector requirements.**



www.picmg.com



www.advancedtca.com

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Visit our web site for the latest catalog updates and supplements at <http://www.connectpositronic.com/catalogs/updates.html>

Positronic Industries' **FEDERAL SUPPLY CODE** (Cage Code)
FOR MANUFACTURERS is **28198**

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Products described within this catalog may be protected by one or more of the following U.S. patents:

#4,900,261 #5,255,580 #5,329,697
#6,260,268 #6,835,079 #7,115,002

Patented in Canada, 1992 Other Patents Pending



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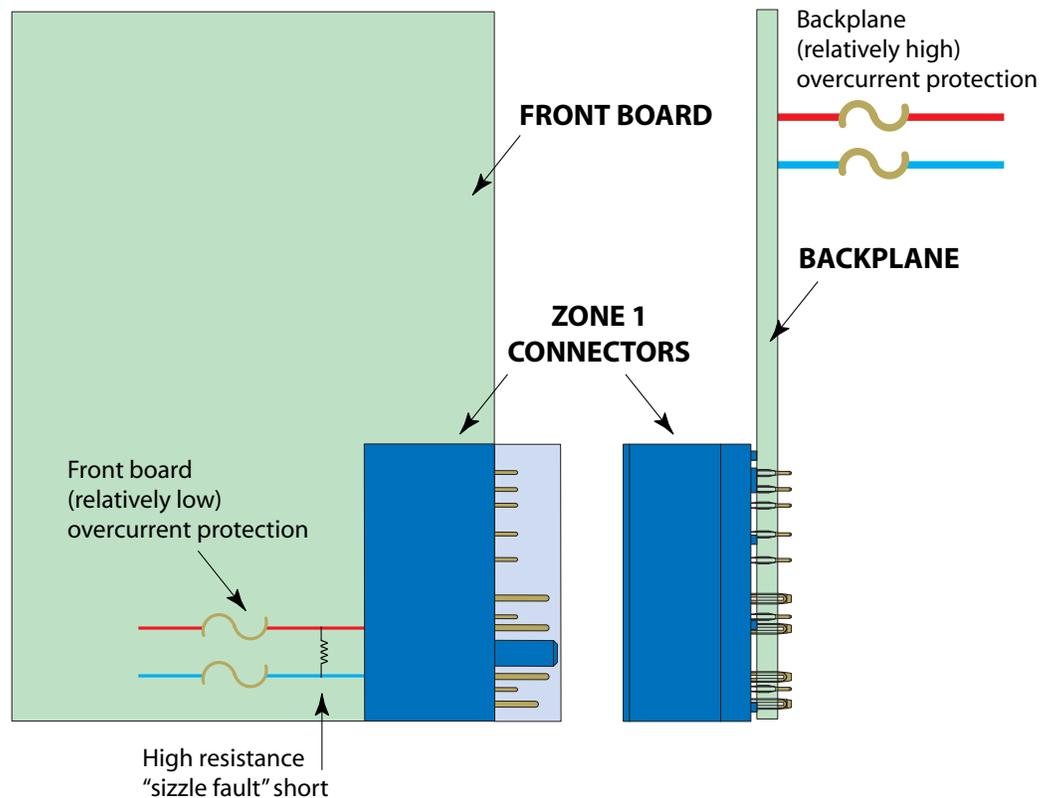
About the cover:

For more information about the products shown on the front cover, visit the following web sites:

- **Rittal** backplane (top left) <http://www.rittal-corp.com>
- **Diversified Technology, Inc** ATS1160 (middle left) <http://www.dtims.com>
- **F9 Systems, Inc.** AdvancedTCA Thermal Blade™ (bottom left) <http://www.f9-systems.com>
- **GE Fanuc Embedded Systems** AT4-AMC-1 carrier blade (bottom left) <http://www.gefanucembedded.com>

“SIZZLE FAULT”

A high resistance short between a front board's overcurrent protection and the backplane's overcurrent protection could allow high currents to be drawn through the Zone 1 Power Connector indefinitely. These currents could reach a value that is slightly less than the overcurrent protection for the entire backplane.



Zone 1 backplane connectors must survive sizzle fault conditions when tested per PICMG 3.0, R3.0, Section B.4.2.4.

- Conditions: IEC 60512-3, Test 10d
- The mated set of connectors (specimens) shall be comprised of a Front Board connector with right angle (90°) press-in terminations and a backplane connector having press-in terminations
- Standard atmospheric conditions
- Ambient temperature shall be 55 degrees C
- Contact positions 28 and 33 shall be energized at 10 amperes through a circuit path sized to simulate a standard PICMG 3.0 frontboard/backplane
- Contact positions 29 and 34 shall be energized at 50 amperes through a circuit path sized to simulate a standard PICMG 3.0 frontboard/backplane
- There shall be a one hour stabilization time after test set up
- Test time shall be four hours after one hour stabilization period
- After completion of test, connectors shall be immediately uncoupled
- Requirements after test conditioning:
- Visual inspection of backplane connector shall show no defect that would impair normal operation
- After backplane connectors are allowed to cool to room ambient temperature the connectors shall be mated to fresh Front Board connectors that have right angle (90°) press-in terminations. The mated connector sets shall pass the test requirements of B.4.2.2; B.4.2.3; B.4.2.4; B.4.2.5; and B.4.3.2.

Positronic's VPB series meets the requirements of this test!

**NEW!**

VPB FEATURES

Positronic's Blue Connectors are Green

Energy is essential to everyone. Often we do not give thought to where energy comes from or how much we consume until energy is not readily available.

Energy has become an area of focus for governments, private industry, and citizens. Enhanced methods of producing energy from traditional sources, development of new energy sources and conservation of energy from all sources have become more crucial than ever before.

Across the world, a vast amount of energy is consumed by the electronic equipment which we all rely upon in our daily lives. An unavoidable waste of energy occurs when power is distributed throughout electronic equipment. As electrical current flows through conductors and connectors, unwanted heat is generated in proportion to the amount of electrical resistance encountered.

Lowering resistance in connector contacts and conductors will reduce the amount of heat generated, and result in less lost or wasted energy. Additional energy will be saved as cooling systems will have less heat to draw out of the equipment.

In the past, the primary metric for power connectors has been contact current ratings. In the future, contact resistance may become equally important. While it is true that contact resistance and contact current ratings are closely associated, contact current ratings cannot be used to quantify the energy consumed by contacts.

Current ratings are based on the temperature rise of a connector or contact at a specific current level. A connector design or test method allowing relatively rapid heat dissipation may yield a reasonable temperature rise, while a relatively high amount of energy is still being wasted.

Within the connector industry, there are a variety of test methods used to quantify a particular performance metric. Different test methods can yield different values for the same metric. This lack of uniformity can be confusing to connector users who are trying to compare connectors offered by various manufacturers. Third party assessment can give connector users a common point of reference when making connector choices.

Contact resistance is used by **UL Environment** as the metric to determine the relative efficiency of connector contacts. **UL Environment** offers independent third party assessment and verification of claims made by manufacturers.

Once assessments are made, **UL Environment** issues an Environmental Claims Validated (ECV) Mark, in this case contact resistance. The ECV will aid power connector users in evaluating contact efficiency as it relates to energy consumption. Visit www.ulenvironment.com for more information.

As an example, recently an ECV was presented to **Positronic** by **UL Environment**. The ECV lists the average contact resistance for **Positronic's** VPB series size 16 power contacts at less than one milliohm each. This low contact resistance is achieved by use of high conductivity contact materials. In addition, **Positronic's** Large Surface Area (LSA) contact system is utilized as the interface between male and female power contacts in VPB series connectors.



- ✓ Average power contact resistance is less than 0.001 ohms
- ✓ Average signal contact resistance is less than 0.005 ohms
- ✓ RoHS compliant

The VPB series was designed for use as the Zone 1 power connector in AdvancedTCA (ATCA) telecommunication computing systems. Zone 1 connectors provide power from backplanes to front boards in ATCA chassis. The low contact resistance of **Positronic's** VPB series provides energy savings opportunities in any application using this connector.

The following formula verifies the energy savings of a lower resistance contact at a given current: **Power Consumption (Watts) = Current Flow² (Amperes²) X Contact Resistance (Ohms)**. Contact resistance has a one-to-one effect on power consumption. If, the contact resistance is reduced by half, the power consumption is reduced by half.

Low resistance power contacts also provide benefits in systems sensitive to voltage drop. This is demonstrated in the following formula: **Voltage drop across contact pairs = Current Flow (Amperes) X Contact Resistance (Ohms)**. Once again, contact resistance has a one-to-one effect. Reducing the contact resistance by half reduces voltage drop by half.

Higher energy costs and government legislation will cause energy conservation efforts to continue to intensify. If we consider the vast numbers of power contacts in electronic equipment around the world, it is clear how lower contact resistance can play a role in meeting energy conservation goals. **Positronic** utilizes high conductivity contact materials and unique contact interfaces to provide low contact resistance in our power connector products. To learn more about these products, visit connectpositronic.com.

VPB SERIES TECHNICAL CHARACTERISTICS

MATERIALS AND FINISHES:

Connector Insert:	Glass-filled polyester, UL 94V-0, blue color.
Contacts:	Precision-machined copper alloy with gold flash over nickel plate. Other finishes available upon request.

MECHANICAL CHARACTERISTICS:

Blind Mating System:	Male and female connector bodies provide "lead-in" for 2.0 mm [0.078 inch] diametral misalignment.
Polarization:	Provided by connector body design.
Fixed Contacts:	Printed board mount terminations, both straight and right angle (90°). Size 16 female contacts feature "Closed Entry" design. Size 22 female contacts feature rugged "Robi-D" open entry design. "PosiBand" closed entry contacts are optional.
Fixed Contact Retention in Connector Body:	
Size 16 Contacts:	31 N [7 lbs.]
Size 22 Contacts:	25 N [5 lbs.]
Sequential Contact Mating System:	First mate contacts 25, 26, 28, 29, 30 and 31. Second mate contact 33. Third mate contact 34. Contacts 1-24 mate before 27 and 32. Last mate contacts 27 and 32.

Power to be enabled through a last mate contact within VPB Series or another connector.

Consult Technical Sales for customer specified sequential mating.

Printed Board Mounting:	Mounting holes provided in connector body for printed board. Self-tapping screws are available, see ordering information page.
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Mechanical Operations:	250 couplings, minimum.
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ELECTRICAL CHARACTERISTICS:

Contact Current Ratings, per UL 1977:	<i>See temperature rise curve on page 9 for details.</i>
Size 16 Power Contacts:	30 amperes continuous, all contacts under load.
Size 22 Signal Contacts:	2 amperes nominal rating.
Current Overload Test	Tested per PICMG 3.0, R3.0 Section B.4.2.4, <i>see page 4 for more information.</i>
Initial Contact Resistance: Termination to termination:	
Size 16 Contacts:	*1 Average resistance is less than 0.001 ohms. Tested per IEC 60512-2, Test 2a. Compliant to PICMG 3.0, R3.0 requirements of 0.0022 ohms maximum. Tested per IEC 60512-2, Test 2b.
Size 22 Contacts:	*1 Average resistance is less than 0.005 ohms. Tested per IEC 60512-2, Test 2a. Compliant to PICMG 3.0, R3.0 requirements of 0.0085 ohms maximum. Tested per IEC 60512-2, Test 2a.
Insulation Resistance:	5 G ohms per IEC 60512-2, Test 3a.
Voltage Proof:	
Contacts 1-16:	1,000 V r.m.s.
Contacts 17-34:	2,000 V r.m.s.
Creepage and Clearance Distance; minimum:	
Contact positions 1-16 to any other contact within this group:	0.7mm [0.028 inch]
Contact positions 17-24 to any other contact within this group:	2.5mm [0.098 inch]
Contact positions 25-34 to any other contact within this group:	1.4mm [0.055 inch]
Contact positions 13-16 to 17-20:	3.0mm [0.118 inch]
Contact positions 21-24 to 25, 26:	4.0mm [0.157 inch]
Contact positions 25, 26 to 27-29:	2.0mm [0.079 inch]

CLIMATIC CHARACTERISTICS:

Working Temperature:	-55°C to +125°C.
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For RoHS options see page 10.

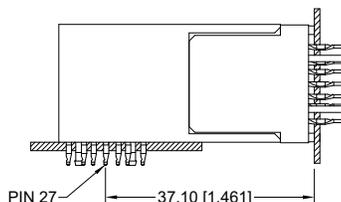
UL and C.N.R. Recognized
File #E49351

NOTES:

*1 Values shown are based on **UL Environment** testing requirements. Environmental Claims Validation (ECV) can be found at www.ulenvironment.com/.

MATING DIMENSIONS

Right Angle (90°) Board Mount Male to Straight Board Mount Female (FULLY MATED)



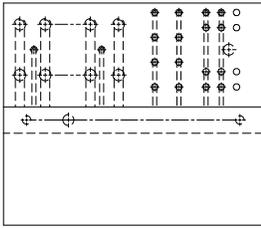
1 mm [0.039 inch] separation allowed

MALE CONNECTOR WITH RIGHT ANGLE (90°) COMPLIANT PRESS-FIT PRINTED BOARD MOUNT TERMINATIONS

CODE 62

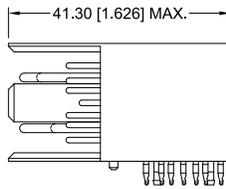
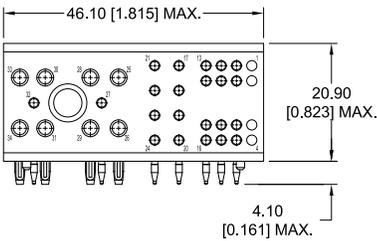
Typical Part Numbers

VPB30W8M6200*1/AA

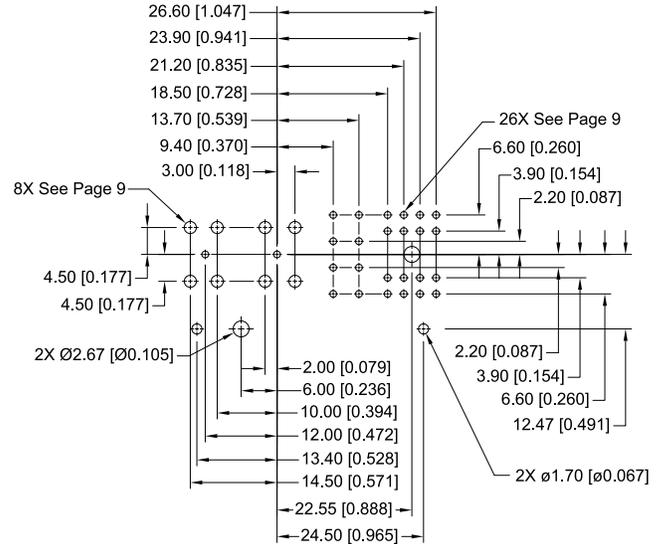


NOTE:

*1 Indicates contact plating options for connectors. See Step 7 of ordering information on page 10.



VPB30W8M6200A1/AA shown for reference.
Positions 1-4 are not populated with contacts.



CONTACT HOLE PATTERN

NOTE: See page 9 for suggested printed board hole sizes.

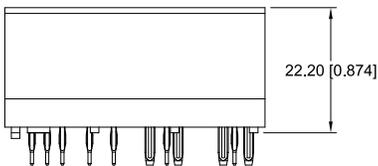
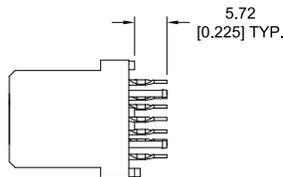
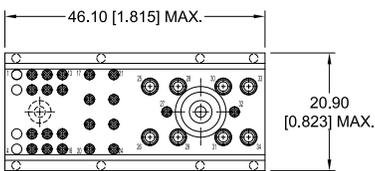
FEMALE CONNECTOR WITH STRAIGHT COMPLIANT PRESS-FIT PRINTED BOARD MOUNT TERMINATIONS

CODE 93

Typical Part Numbers

VPB30W8F9300*1/AA

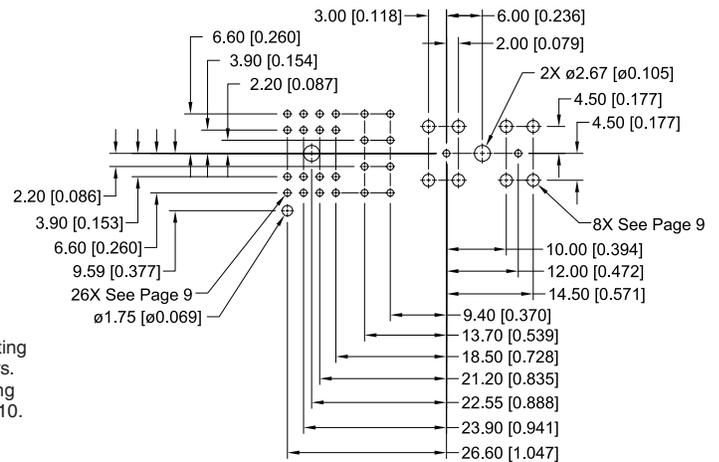
VPB30W8S9300*1/AA



NOTE:

*1 Indicates contact plating options for connectors. See Step 7 of ordering information on page 10.

VPB30W8F9300A1/AA shown for reference .
Positions 1-4 are not populated with contacts.



CONTACT HOLE PATTERN

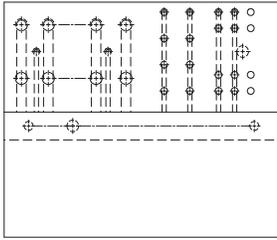
NOTE: See page 9 for suggested printed board hole sizes.

MALE CONNECTOR WITH RIGHT ANGLE (90°) SOLDER PRINTED BOARD MOUNT TERMINATIONS

CODE 4

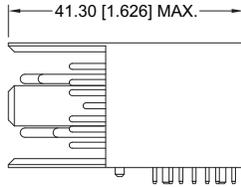
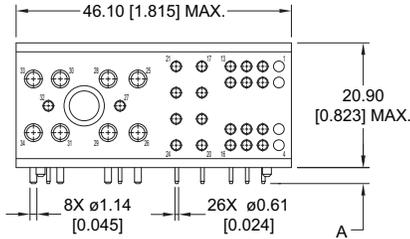
Typical Part Numbers

VPB30W8M400*1/AA



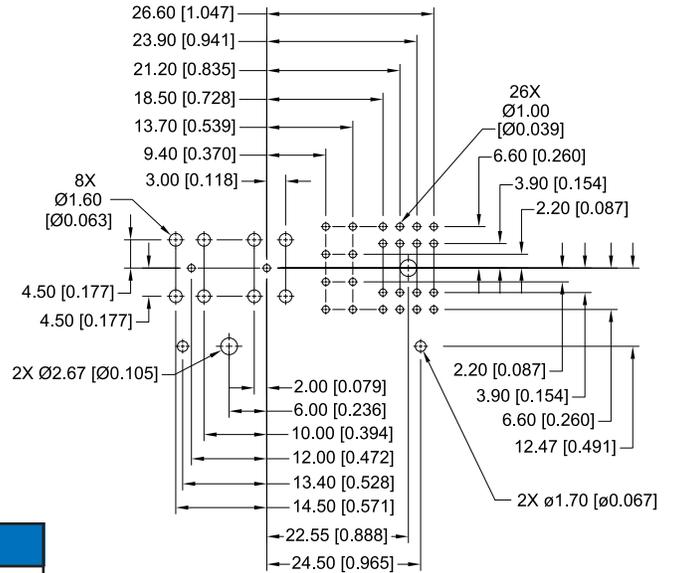
NOTE:

*1 Indicates contact plating options for connectors. See Step 7 of ordering information on page 10.



VPB30W8M400A1/AA shown for reference.
Positions 1-4 are not populated with contacts.

CODE	A
4	2.68 [0.106]
42	4.09 [0.161]



CONTACT HOLE PATTERN

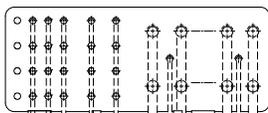
FEMALE CONNECTOR WITH RIGHT ANGLE (90°) SOLDER PRINTED BOARD MOUNT TERMINATIONS

CODE 4 WITH -394.0 MOS

Typical Part Numbers

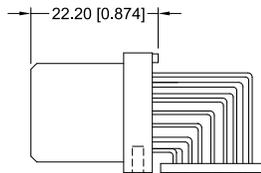
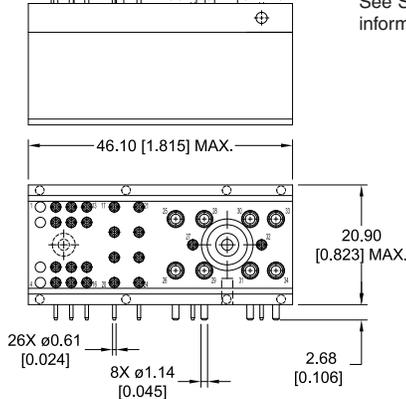
VPB30W8F400*1/AA-394.0

VPB30W8S400*1/AA-394.0

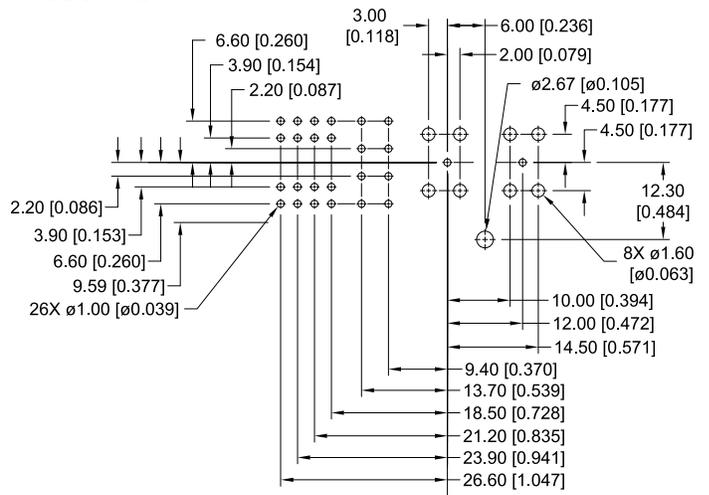


NOTE:

*1 Indicates contact plating options for connectors. See Step 7 of ordering information on page 10.



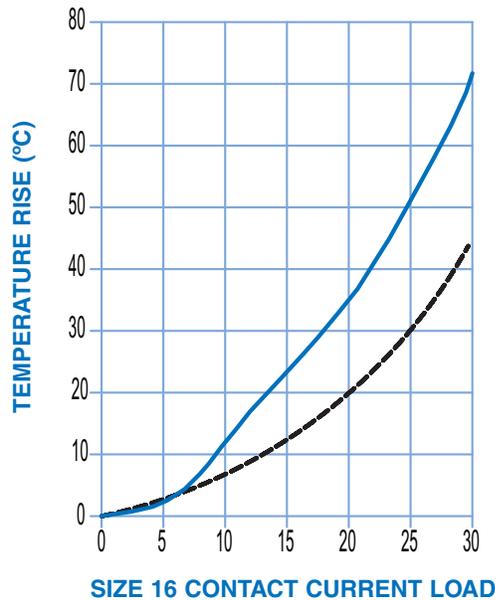
VPB30W8F400A1/AA-394.0 shown for reference.
Positions 1-4 are not populated with contacts.



CONTACT HOLE PATTERN

This connector option is offered to support extender cards.
Consult Technical Sales for higher volume requirements.

TEMPERATURE RISE CURVE



Above curve developed using VPB30W8M6200A1 and VPB30W8F9300A1 connectors.

- **CURVE A** - ALL SIZE 16 POWER CONTACT UNDER LOAD, SIGNAL CONTACTS 1-24 UNDER 1 AMP LOAD
- - - **CURVE B** - SIZE 16 POWER CONTACT POSITIONS 28, 33 UNDER LOAD, SIGNAL CONTACTS 1-24 UNDER 1 AMP LOAD

EXAMPLES OF POSSIBLE CONTACT ASSIGNMENTS

CONTACT POSITION	FUNCTION
1-16	Low Speed Hardware Management
17-24	High Voltage Metallic Test and Ringing Generator Signals
25	Shelf Ground
26	Logic Ground
27/32	Enables for A and B power
28	A Return
29	B Return
30	A Early
31	B Early
33	A Voltage
34	B Voltage

SUGGESTED PRINTED BOARD HOLE SIZES FOR COMPLIANT PRESS-FIT CONNECTORS

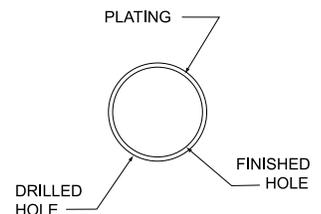
Traditionally, tin-lead has been a popular plating for printed circuit board (PCB) holes. However, many PCB hole platings must now be RoHS compliant. Positronic is pleased to offer **PCB HOLE SIZES FOR RoHS** PCB platings as shown below.

OMEGA & BI-SPRING COMPLIANT PRESS-FIT CONTACT HOLE				
BOARD TYPE	CONTACT SIZE	RECOMMENDED DRILL HOLE SIZE	RECOMMENDED PLATING	FINISHED HOLE SIZES
TIN-LEAD SOLDER PCB	22 OMEGA	$\phi 1.150 \pm 0.025$ [$\phi 0.0453 \pm 0.0010$]	15 μ [0.0006] minimum solder over 25 μ [0.0010] min. copper	$\phi 1.000 \pm 0.090 - 0.060$ [$\phi 0.0394 \pm 0.0035 - 0.0024$]
	16 BI-SPRING	$\phi 1.750 \pm 0.025$ [$\phi 0.069 \pm 0.001$]		$\phi 1.600 \pm 0.090 - 0.060$ [$\phi 0.0630 \pm 0.0035 - 0.0024$]
RoHS PRINTED CIRCUIT BOARD (PCB) PLATING OPTIONS				
COPPER PCB	22 OMEGA	$\phi 1.19 \pm 0.025$ [$\phi 0.047 \pm 0.001$]	25 μ [0.0010] min. copper	$\phi 1.09 \pm 0.05$ [$\phi 0.043 \pm 0.002$]
	16 BI-SPRING	$\phi 1.750 \pm 0.025$ [$\phi 0.069 \pm 0.001$]		$\phi 1.600 \pm 0.090 - 0.060$ [$\phi 0.0630 \pm 0.0035 - 0.0024$]
IMMERSION TIN PCB	22 OMEGA	$\phi 1.19 \pm 0.025$ [$\phi 0.047 \pm 0.001$]	0.85 \pm 0.15 μ [0.000033 \pm 0.000006] immersion tin over 25 μ [0.0010] min. copper	$\phi 1.09 \pm 0.05$ [$\phi 0.043 \pm 0.002$]
	16 BI-SPRING	$\phi 1.750 \pm 0.025$ [$\phi 0.069 \pm 0.001$]		$\phi 1.600 \pm 0.090 - 0.060$ [$\phi 0.0630 \pm 0.0035 - 0.0024$]
IMMERSION SILVER PCB	22 OMEGA	$\phi 1.19 \pm 0.025$ [$\phi 0.047 \pm 0.001$]	0.34 \pm 0.17 μ [0.000013 \pm 0.000007] immersion silver over 25 μ [0.0010] min. copper	$\phi 1.09 \pm 0.05$ [$\phi 0.043 \pm 0.002$]
	16 BI-SPRING	$\phi 1.750 \pm 0.025$ [$\phi 0.069 \pm 0.001$]		$\phi 1.600 \pm 0.090 - 0.060$ [$\phi 0.0630 \pm 0.0035 - 0.0024$]
ELECTROLESS NICKEL/IMMERSION GOLD PCB	22 OMEGA	$\phi 1.19 \pm 0.025$ [$\phi 0.047 \pm 0.001$]	0.05 μ [0.000002] min. immersion gold over 4.5 \pm 1.5 μ [0.000177 \pm 0.000059] electroless nickel per IPC-4552 over 25 μ [0.0010] min. copper	$\phi 1.09 \pm 0.05$ [$\phi 0.043 \pm 0.002$]
	16 BI-SPRING	$\phi 1.750 \pm 0.025$ [$\phi 0.069 \pm 0.001$]		$\phi 1.600 \pm 0.090 - 0.060$ [$\phi 0.0630 \pm 0.0035 - 0.0024$]

“Omega” Termination utilized on signal contacts



“Bi-Spring” Termination utilized on power contacts



COMPLIANT PRESS-FIT CONTACT HOLE

NOTE: For PCB plating compositions not shown, consult Technical Sales.

ORDERING INFORMATION – CODE NUMBERING SYSTEM

Specify Complete Connector By Selecting an Option From Steps 1 Through 8

STEP	1	2	3	4	5	6	7	8	9
EXAMPLE	VPB	30W8	F	93	0	0	A1	/AA	-394.0

STEP 1 - BASIC SERIES
VPB - VP Series

STEP 2 - CONNECTOR VARIANTS

- *1 30W8 - Contact positions 1-4 are not populated. **Standard variant for AdvancedTCA® backplanes. Standard option for frontboards.**
- *1 22W8 - Contact positions 1-4 and 17-24 are not populated. **Standard cost saving option for AdvancedTCA® frontboards.**

STEP 3 - CONNECTOR GENDER

- M - Male
- *2 F - Female - Professional Level
- *2 S - Female - Industrial/Military Level

STEP 4 - CONTACT TERMINATION TYPE

- 4 - Right Angle (90°) Board Mount, Solder, termination length 2.68 [0.106] (30W8 female requires MOS 394.0, contact Technical Sales for 22W8 female MOS part number)
- 42- Right Angle (90°) Board Mount, Solder, termination length 4.09 [0.161].
- 62 - Right Angle (90°) Board Mount, Press-fit. Male only
- 93 - Straight Board Mount, Press-fit. Female only

STEP 5

0 - None

Notes

- *1 VPB series can be supplied with contacts populated in all 34 positions. Use part number VPB34W8*****.
- *2 Female signal contacts are offered in open and closed entry. Closed entry contacts are designed with an unbroken ring at the opening of the contact. This closed entry feature provides higher reliability in environments experiencing higher levels of shock and vibration. Closed entry contacts are also more abuse resistant than open entry designs. VPB Power contacts are always closed entry design.

STEP 9 - SPECIAL OPTIONS

394.0- Allows for female contact right angle (90°) solder mount.

CONTACT TECHNICAL SALES FOR SPECIAL OPTIONS



STEP 8 - ENVIRONMENTAL COMPLIANCE OPTIONS

/AA - Compliant per EU Directive 2002/95/EC (RoHS)

Note: This step should be included to create a standard part number. Example: VPB30W8F9300A1/AA

STEP 7 - CONTACT PLATING (choose plating based on end use requirements)

- A1 - Gold flash over nickel on mating end and termination end.
- A2 - Gold flash over nickel on mating end and 5.00µ [0.00020 inch] tin-lead solder coat on termination end. Not available with code 62 or 93 in step 4.
- C1 - 0.76µ [0.000030 inch] gold over nickel on mating end and termination end.
- C2 - 0.76µ [0.000030 inch] gold over nickel on mating end and 5.00µ [0.00020 inch] tin-lead solder coated termination end. Not available with code 62 or 93 in step 4.
- D1 - 1.27µ [0.000050 inch] gold over nickel on mating end and termination end.
- D2 - 1.27µ [0.000050 inch] gold over nickel on mating end and 5.00µ [0.00020 inch] tin-lead solder coated termination end. Not available with code 62 or 93 in step 4.

STEP 6

0 - None

Unless otherwise specified, dimensional tolerances are:

- 1) ±0.13 mm [0.005 inches] for all diameters.
- 2) ±0.38 mm [0.015 inches] for all other dimensions.

MOUNTING SCREWS

Telecordia GR1217 shows a preference that press-fit connectors use auxiliary mounting hardware. Also, the AdvancedTCA® Zone 1 connector serves as the lower alignment feature for front boards. Therefore, the use of mounting hardware is recommended.

However, VPB connectors have been tested to PICMG 3.0. B.5.1.3 requirements, which may guide connector users to omit use of screws. Contact Positronic for test details.

STEEL SCREW PART NUMBER	STAINLESS STEEL SCREW PART NUMBER	THREAD LENGTH
4546-7-1-16	4546-7-6-4	6.35±0.00-0.76 [0.250±0.000-0.030]
4546-7-2-16	4546-7-7-4	7.93±0.00-0.76 [0.312±0.000-0.030]
4546-7-3-16	4546-7-8-4	9.53±0.00-0.76 [0.375±0.000-0.030]
4546-7-4-16	4546-7-9-4	11.11±0.00-0.76 [0.438±0.000-0.030]

Install Screw to a Depth of:
3.50 [0.138] Minimum
5.00 [0.197] Maximum

Contact technical sales for RoHS compliant mounting screw information.

- Female compliant press-fit connectors **require a press-fit tool**, part number 9513-308-1-41, for installation.

- The use of a support tool when installing **press-fit** connectors is recommended. For female connectors use 9513-400-6-41, for male connectors use 9513-400-8-41.

Other Power Connector Products

To view all products visit

www.connectpositronic.com

Positronic Industries has a wide variety of power connector products. Let us provide solutions for Power Entry Modules (PEM) and other power distribution needs.



Scorpion Modular Connector

Build Your Own Connector

Modular tooling produces a one-piece insulator with almost infinite configurations using twenty-one different module types. Power, signal, and shielded contacts are offered. Options include: cooling vents, blind mate, sequential mate, integral locking and connector keying.



Power Connection Systems

Available with 3 to 30 contacts and utilizes an integral locking system. Offers a wide variety of termination styles and accessories for board to board, cable to board, and panel to cable applications.



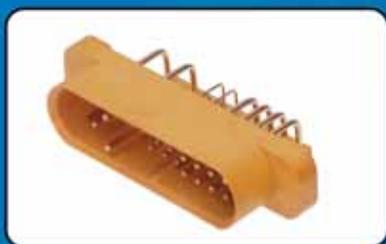
Infinity/Mini-Infinity

For low, medium and high power applications requiring outstanding blind mating capability. Offers mixed contact density, sequential mate contacts, and a wide variety of termination styles.



Compact Power Connector

The power interface for platforms that utilize IEEE1101.10 form factors including CompactPCP®. Offers a wide variety of sizes and contact variants. Provides for input, output, and system management in a single connector as well as three-level sequential mating.



Goldfish

For low to mid range power applications that require excellent blind mating. Additional options include float mounts, selective loading and sequential mating.



DragonFly

High density connectors having power and/or signal contacts. Multiple package sizes with integral locking system.



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