



3M Science.
Applied to Life.™

When PCB Real Estate is at a Premium

3M™ Ribbon Cable Wire Socket Assembly 1.27 mm (0.050") Pitch 451 Series
3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series

Electronic Materials Solutions Division
August 2022

Agenda

- Market segment trends
- Wire-to-board system
- 3M™ Ribbon Cable Wire Socket Assembly 1.27 mm (0.050") Pitch 451 Series
- 3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series
- Mated Pair: 3M cable socket 451 and 3M header 452 Series
- Sales and marketing

Market trends

Technology

2000's



- Blackberry
- 3G Cellular
- Rise of data centres
- Many proprietary connectors
- 10GbE
- Chip feature size 90mm

2010's



- iPhone
- 4G cellular
- Cloud computing
- Licensed second-sourced connectors
- 40/100GbE
- Chip feature size 32mm

2020's



- Smartphones universal interface
- 5G cellular
- Edge/Fog computing
- Open components/system standard
- 200/400GbE
- Chip feature size 5-10mm
- Streaming TV
- Online gaming
- Social media (Tik Tok – Video)

Evolving



- Quantum computing
- Virtual collaboration
- IoT devices
- Security
- 6G cellular
- 800GbE
- Artificial Intelligence/Machine Learning
- Chip sub 5mm
- Autonomous vehicles
- Factory Automation

Source: Hult, R. (2021). Top 12 Technology Trends: PCIe Specification Roadmap Evolves in Tandem with Increasing Bandwidths. Connector Supplier™., <https://connectorsupplier.com/pcie-specification-roadmap-evolves-in-tandem-with-increasing-bandwidths/>.

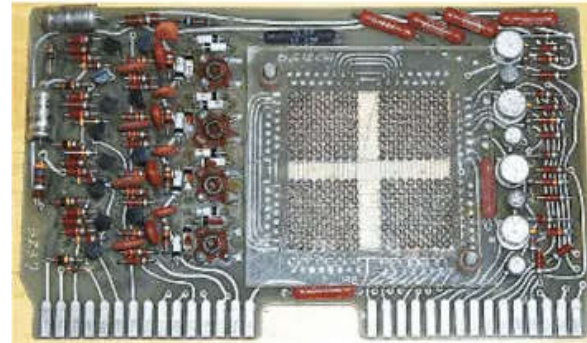
Market trends

History of PCB Design

- 20's: Printed Wire
- 40's: Double-sided circuits
- 60's: 3 layers of connective materials
- 80's: Surface Mount Technology & High Density Interconnect (HDI)
- 90's: Ball Grid Array packaging and Micro-via technique
- 00's: Every Layer Interconnect

PCB comparison

(1968 Calculator vs modern motherboard for computers)



30 transistors



1 million+ transistors on one chip

Everything on the left can be accommodated by one chip on the right

Source: Staff, M. (2021, June 28). *PCB History and Evolution: The Past, Present, and the Future*. MKTPCB. <https://www.mktpcb.com/pcb-history/>

Market segment trends

PCB market

- Global HDI PCB market size 19.1 B by 2027
- Drivers of growth:
 - Automotive
 - Consumer electronics
 - Miniaturization of electronic devices
 - High performance devices



Significant Opportunities for HDI PCB by Technology, Built-Up Structure, and End Use Industry		
Technology	Built-Up Structure	End Use Industry
<ul style="list-style-type: none"> • 4-6 Layer HDI PCB • 8-10 Layer HDI PCB • 10+ Layer HDI PCB 	<ul style="list-style-type: none"> • 1+N+1 HDI PCB • 2+N+2 HDI PCB • 3+N+3 HDI PCB • Others 	<ul style="list-style-type: none"> • Smartphones and Tablets • Computers • Telecom / Datacom • Consumer Electronics • Automotive • Others

Source: Lucintel. (2022, June 29). *HDI PCB Market Trends: Trends, Opportunities and Competitive Analysis*. HDI PCB Market Trends: Trends, Opportunities and Competitive Analysis. <https://www.lucintel.com/high-density-interconnect-printed-circuit-board-market.aspx>

3M™ Wire-to-Board System

3M Wire-to-Board System



3M™ Ribbon Cable Wire Socket Assembly 1.27 mm (0.050") Pitch 451 Series

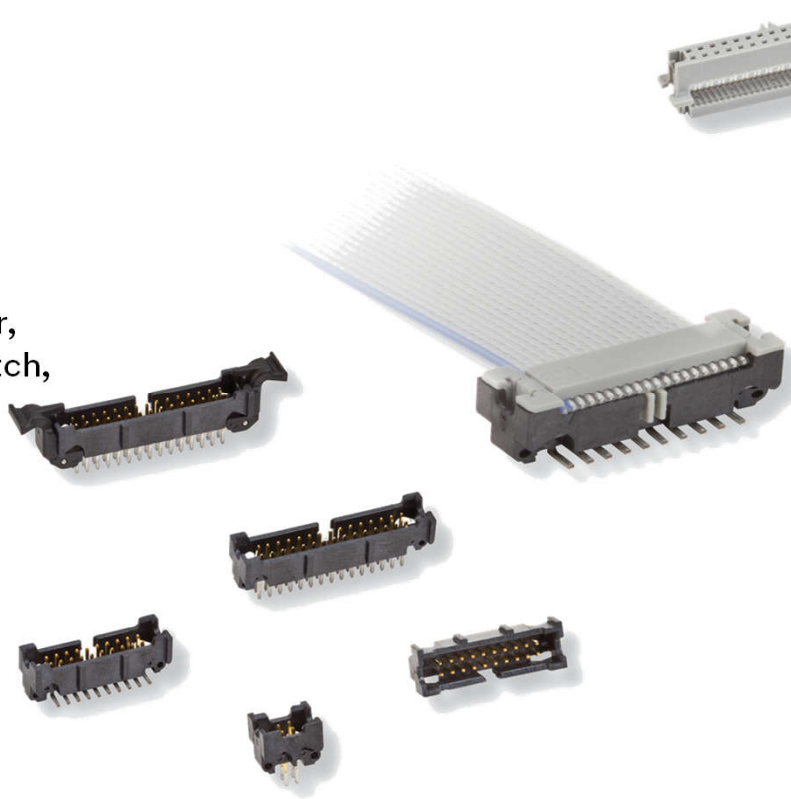
- 1.27 mm (0.050") pitch
- 4-50 positions (NEW – 26, 40 and 50)
- 30u" min gold, flash gold
- IDC socket
- Sockets can be daisy-chained
- Terminates to broad range of .025" pitch cables
- Center polarization with available friction bump option
- Strain relief option

3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series

- 1.27 (0.050") pitch
- 4-50 positions (NEW – 26, 40 and 50)
- 30u" min gold, flash gold
- Box header with optional latch and eject (L/E)
 - Right angle, vertical thru-hole and vertical surface mount
- Pin-in-paste capable
- Incredibly small – pin-for-pin 75% smaller than comparable .100" solutions. Smaller than most competitive .050" solutions.
- L/E header nearly the same size as box header
- L/E header allows dual sided PCB wave solder

3M Wire-to-Board System

3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series



3M™ Ribbon Cable Wire Socket Assembly 1.27 mm (0.050") Pitch 451 Series

3M Wire-to-Board System

Space Savings: 0.050" vs 0.100"

- Smaller size than .100, 2mm, .050x.100", and most other competitive .050" solutions
- Board mount compatible with most other .050" solutions

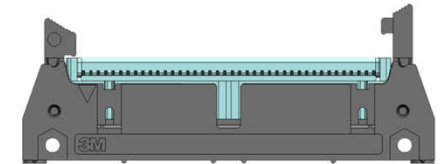
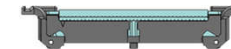
Mated 3M™ socket and header 451 and 452 Series

Mated 3M™ Four-Wall Header and Socket, 3000 Series

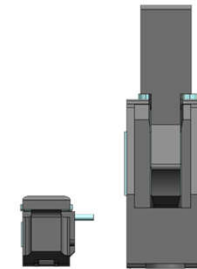
Top View



Side View



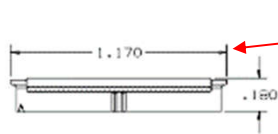
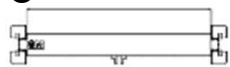
End View



*40 position rendering

3M Wire-to-Board System

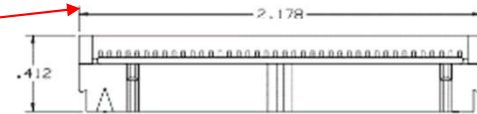
Space Savings: 0.050" vs 0.100"



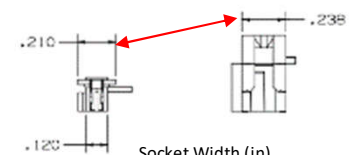
451 SERIES SOCKET
45140-0100

Socket Height (in)

45140-0100	3417-6600	Difference	% Difference
0.180	0.412	0.232	56%



3000 SERIES SOCKET
3417-6600



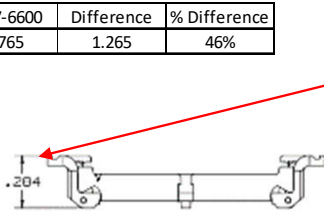
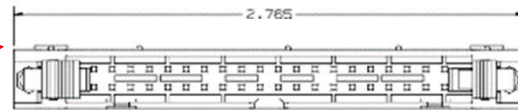
Socket Width (in)

45140-0100	3417-6600	Difference	% Difference
0.210	0.238	0.028	12%



Header Width (in)

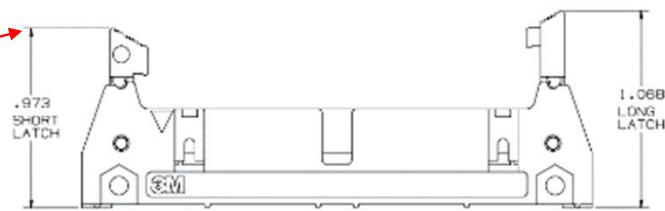
45140-0100	3417-6600	Difference	% Difference
1.500	2.765	1.265	46%



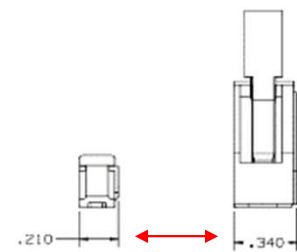
452 SERIES HEADER
45240-6202

Header Height (in)

45140-0100	3417-6600	Difference	% Difference
0.284	0.973	0.689	71%



3400 SERIES HEADER
3432-6X02



Header Depth (in)

45140-0100	3417-6600	Difference	% Difference
0.210	0.340	0.130	38%

**3M™ Ribbon Cable Wire
Socket Assembly
451 Series**

3M™ Ribbon Cable Wire Socket Assembly 451 Series

Built using 3M's proven and trusted Insulation Displacement Contact (IDC) technology

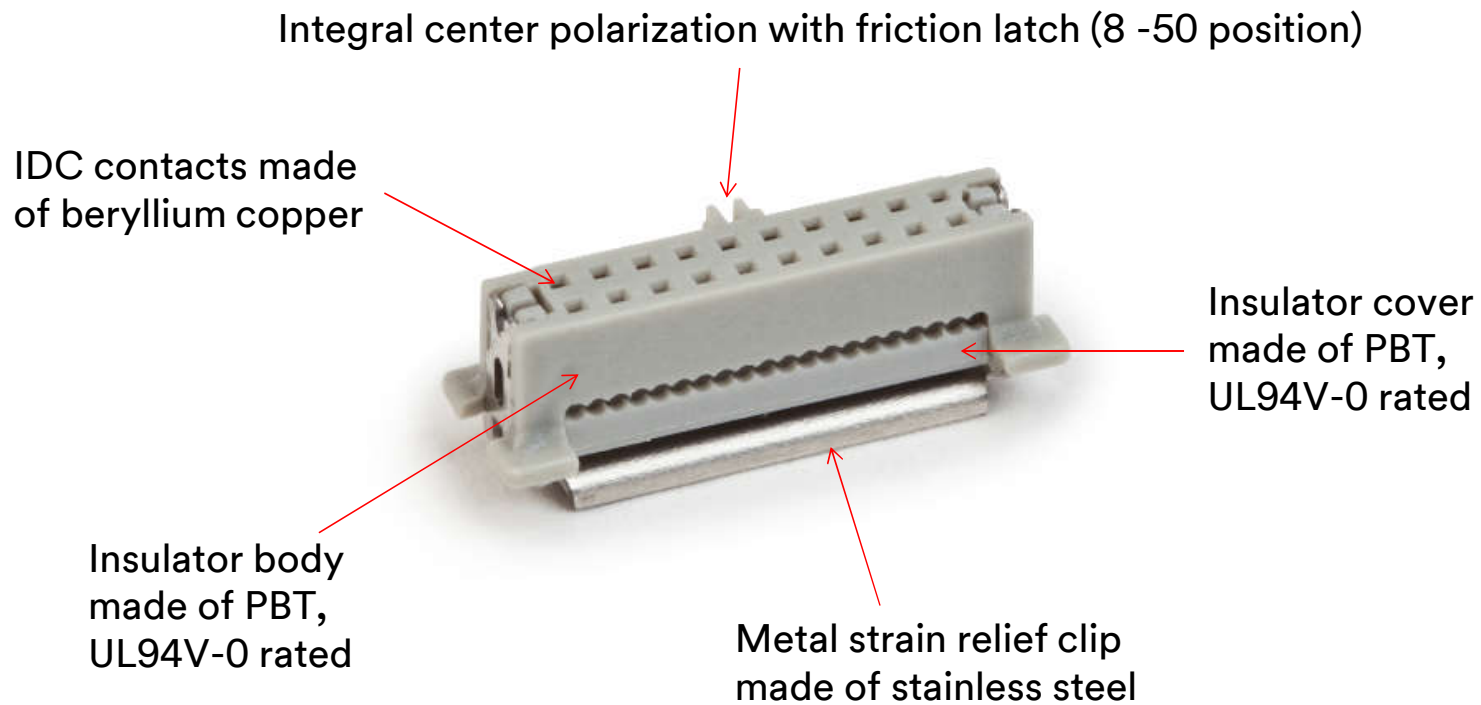
Unsupported cantilever beryllium copper (BeCu) contacts:

- Provide low stress relaxation, good overall reliability and long service life for secure connections and signal integrity
- 30μ" gold and gold flash plating versions offer multiple mating/unmating cycles at different price points

Quickly terminate up to 50 conductors in a single cycle

Compatible with a wide range of .025" pitch ribbon cables

3M™ Ribbon Cable Wire Socket Assembly 451 Series



3M™ Ribbon Cable Wire Socket Assembly 451 Series

Cable considerations

Compatible with 30 AWG, solid or 7 stranded flat ribbon cables on .025” pitch

- Examples:

- 3M™ Ribbon Cables

- 3M™ Round Conductor Flat Cable, 3754 Series: PVC, round stranded conductor

- 3M™ Round Conductor Flat Cable, 3447 Series: PVC, round solid conductor

- 3M™ Round Conductor Flat Cable, 3756 Series: TPE, round stranded conductor

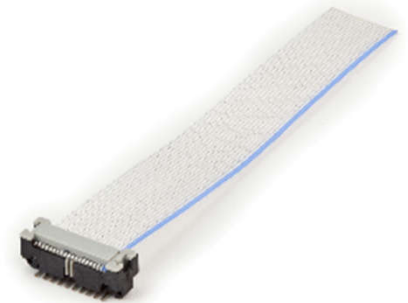
- 3M™ Round Conductor Flat Cable, 3749 Series: TPE, round solid conductor

- 3M™ Round Conductor Flat Cable, 3609 Series: FEP, round stranded conductor

- 3M™ Round Conductor Flat Cable, 3604 Series: FEP, round solid conductor

- 3M™ Round Conductor Flat Cable, HF447 Series: PO, Halogen Free, round solid conductor

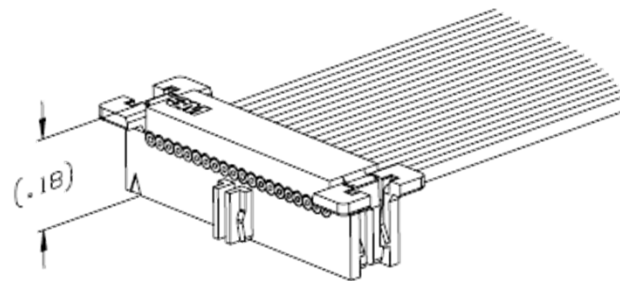
- 3M™ Round Conductor Flat, Controlled Impedance Cable, 7700 Series: PO, shielded, round solid conductor



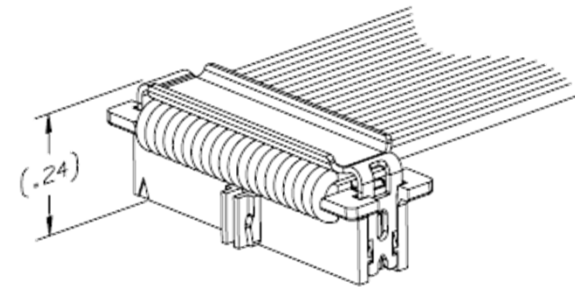
3M™ Ribbon Cable Wire Socket Assembly 451 Series

Accessory

The 3M™ Strain Relief Clip, 3448-451XX Series provides additional protection to help guard against damage when users pull on a terminated cable



NO STRAIN RELIEF

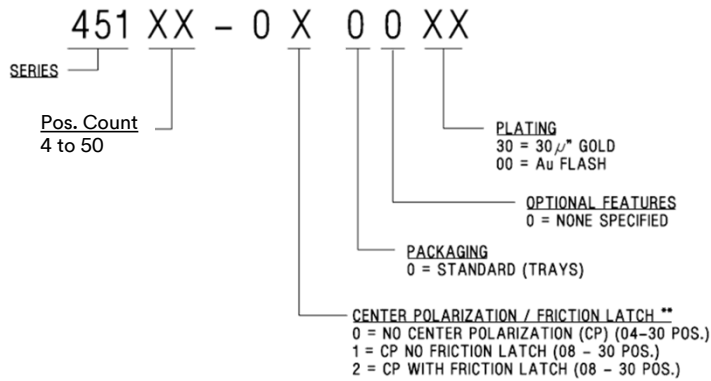


WITH OPTIONAL STRAIN RELIEF

3M™ Ribbon Cable Wire Socket Assembly 451 Series

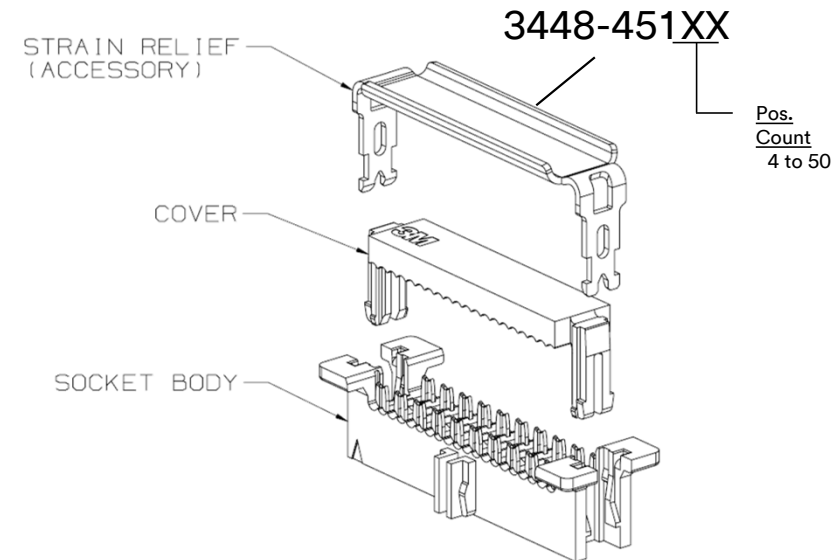
Ordering Information

ORDERING INFORMATION
FOR RAPID INSTALLATION ON
RIBBON CABLE APPLICATIONS



NOTE:
** FRICTION LATCH (OPTION 2) IS NOT SUITABLE
FOR HEADER WITH LATCH EJECT OPTION

PERFORMANCE:	
CURRENT RATING:	1.0A, UL 04P-50P, NOT FOR CURRENT INTERRUPTION
	1.0A, CUL 04P-30P, NOT FOR CURRENT INTERRUPTION
	0.75A, CUL 32P-50P, NOT FOR CURRENT INTERRUPTION
	0.75A, ALL LINES ENERGIZED, 30°C TEMP RISE PER EIA 364-70
	1.50A, 6 LINES ENERGIZED, 30°C TEMP RISE PER EIA 364-70
UL & CUL VOLTAGE RATING:	125V _{ac}
INSULATION RESISTANCE:	> 1 × 10 ⁹ Ohms AT 500 VDC
WITHSTANDING VOLTAGE:	1250V _{ac} AT SEA LEVEL
OPERATING TEMPERATURE:	-65°C TO +125°C
UL & CUL OPERATING TEMPERATURE:	+130°C

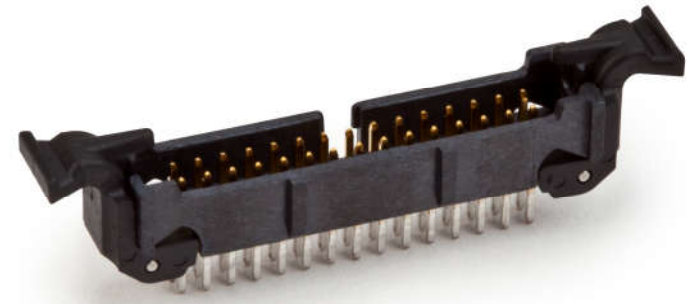


**3M™ Shrouded Boardmount
Header, 1.27mm (0.050")
Pitch, 452 Series**

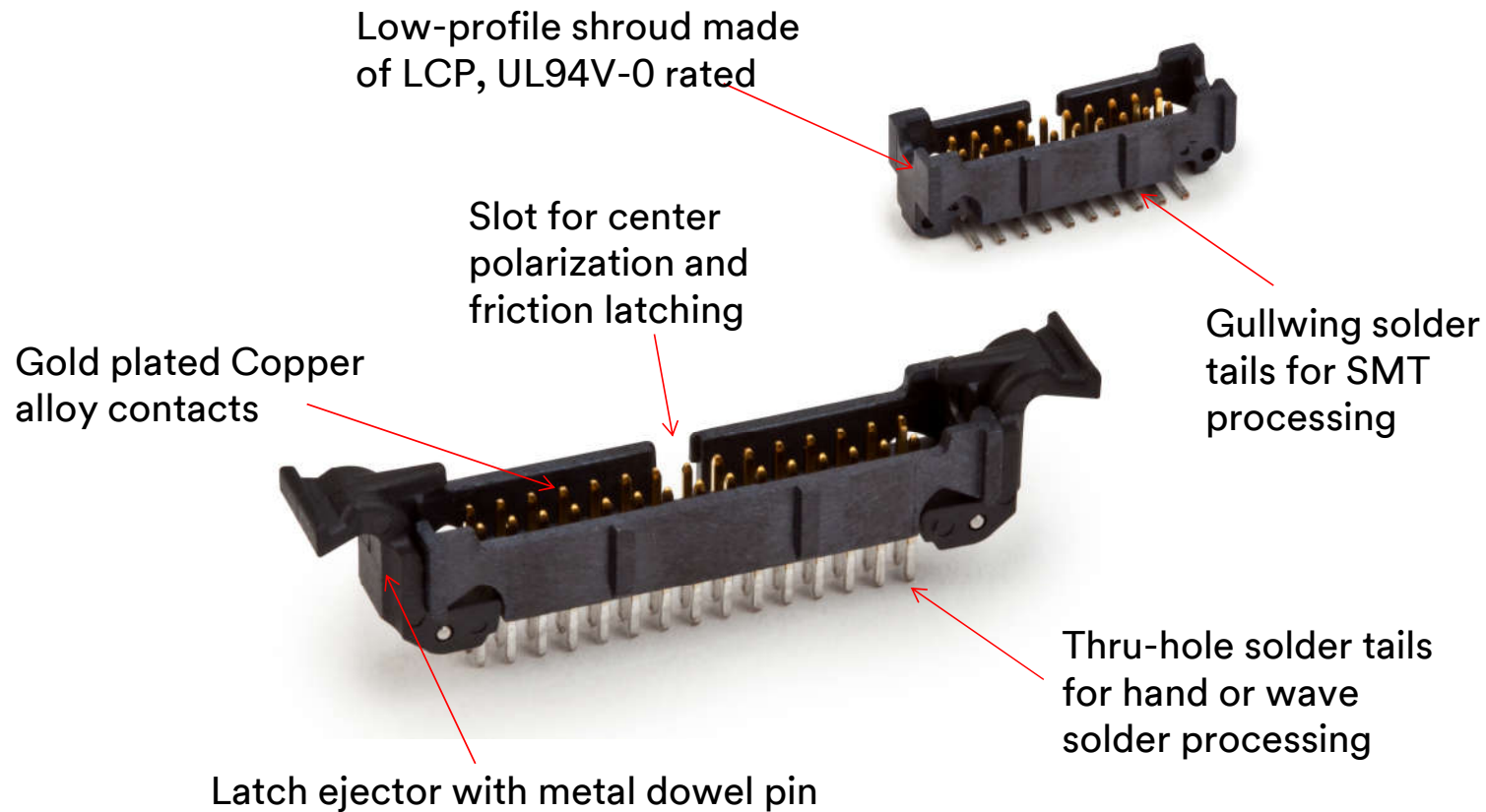
3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series

Features

- Low profile box header
 - Helps protect pins with minimum space consumption
 - Vertical and right-angle versions with thru-hole pins
 - Vertical version with gullwing solder tails for surface mount
 - Tape and reel packaging
- Two rows of square pins
 - 1.27mm/0.050" pitch
 - 30μ" gold and gold flash plating options offer
 - Multiple mating/unmating cycle options at different price points
- With or without latch ejectors



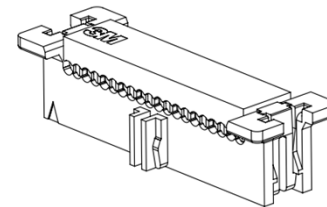
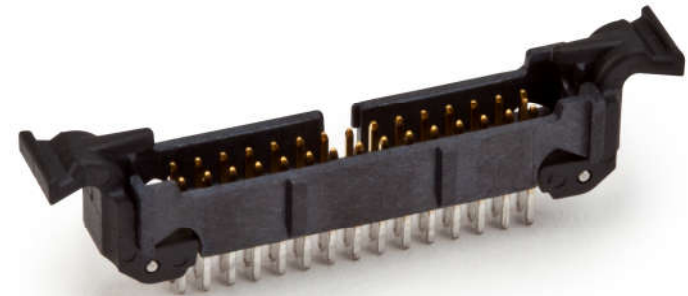
3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series



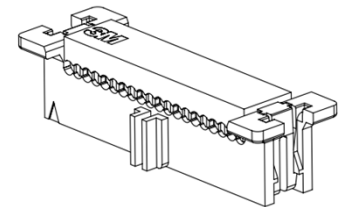
3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series

Latches: Securing and Removal

- 3M header 452 series is available with or without ejector latches
- The assembly method allows the addition of positive latch and ejection functionality with minimal added size.
- Friction latch configurations help increase protection against accidental disconnection, especially in high vibration environments.



CENTER POLARIZATION
AND FRICTION LATCH

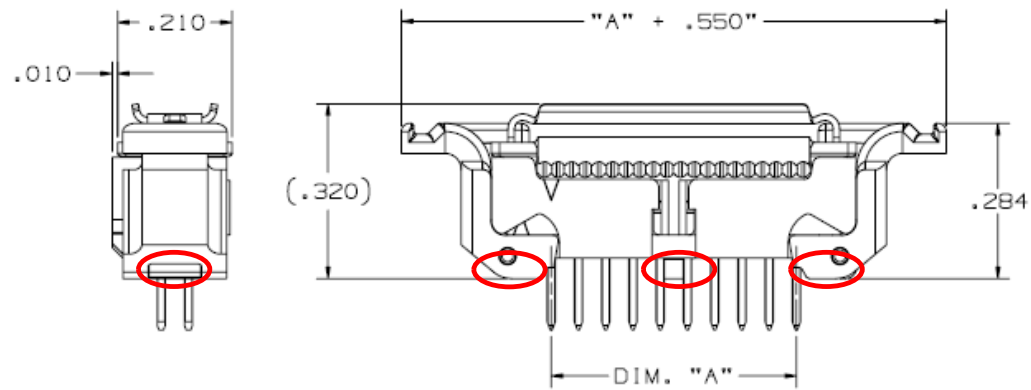


CENTER POLARIZATION
AND NO FRICTION LATCH

3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series

PCB considerations

Integral PCB standoffs help enable pin-in-paste processing



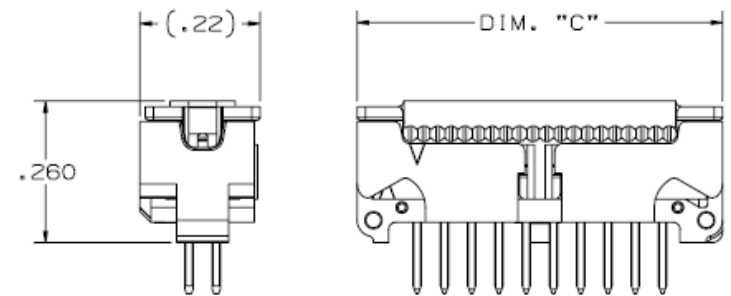
VERTICAL HEADER & SOCKET ASSEMBLY
WITH LOW PROFILE LATCHES & STRAIN RELIEF

3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series

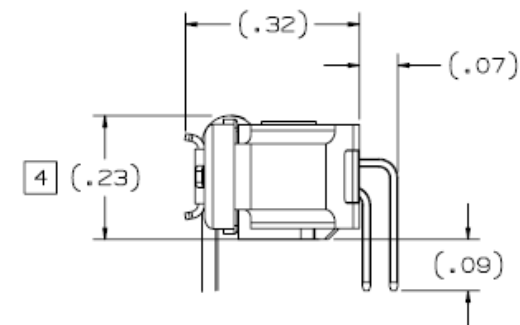
Space savings

When the vertical header is mated with the 3M™ Ribbon Cable Wire Socket Assembly, 451 Series the combined assembly height above the PCB measures just .260" (or .320" with a 3M™ Strain Relief Clip, 3448 Series attached) making it one of the lowest profile wire-to-board systems

In the right-angle configuration* the height above the PCB is just .230".



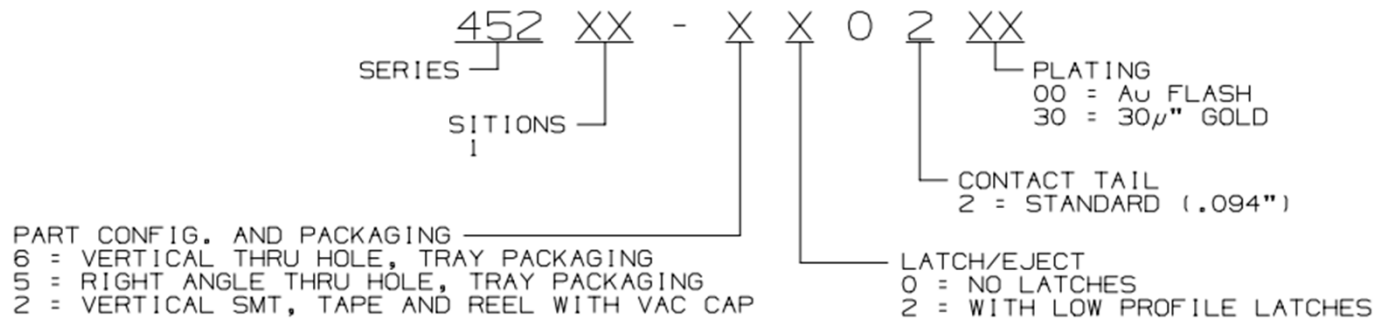
VERTICAL HEADER & SOCKET ASSEMBLY
NO LATCHES NO STRAIN RELIEF



* Without latches and strain relief

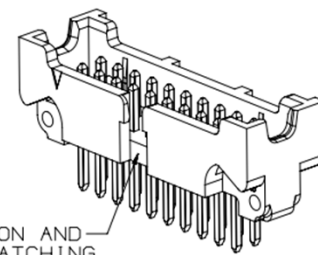
3M™ Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series

Ordering Information

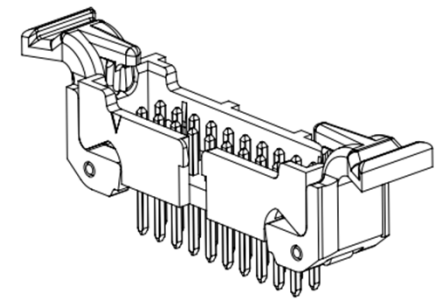


PERFORMANCE:	
CURRENT RATING:	1.0A, UL 04P-50P, NOT FOR CURRENT INTERRUPTION
	1.0A, CUL 04P-30P, NOT FOR CURRENT INTERRUPTION
	0.75A, CUL 32P-50P, NOT FOR CURRENT INTERRUPTION
	0.75A, ALL LINES ENERGIZED 30°C TEMP RISE PER EIA 364-70
	1.50A, 6 LINES ENERGIZED 30°C TEMP RISE PER EIA 364-70
UL & CUL VOLTAGE RATING:	125V _{ac}
INSULATION RESISTANCE:	> 1 × 10 ⁹ Ohms AT 500 VDC
WITHSTANDING VOLTAGE:	1250V _{ac} AT SEA LEVEL
OPERATING TEMPERATURE:	-65°C to +125°C
UL & CUL OPERATING TEMPERATURE:	+130°C
PROCESSING TEMPERATURE:	260°C
LEAD-FREE SOLDERABLE:	YES
MOISTURE SENSITIVITY LEVEL:	MSL1 PER J-STD-020

FOR INFORMATION ONLY. NOT FOR DIMENSIONING.



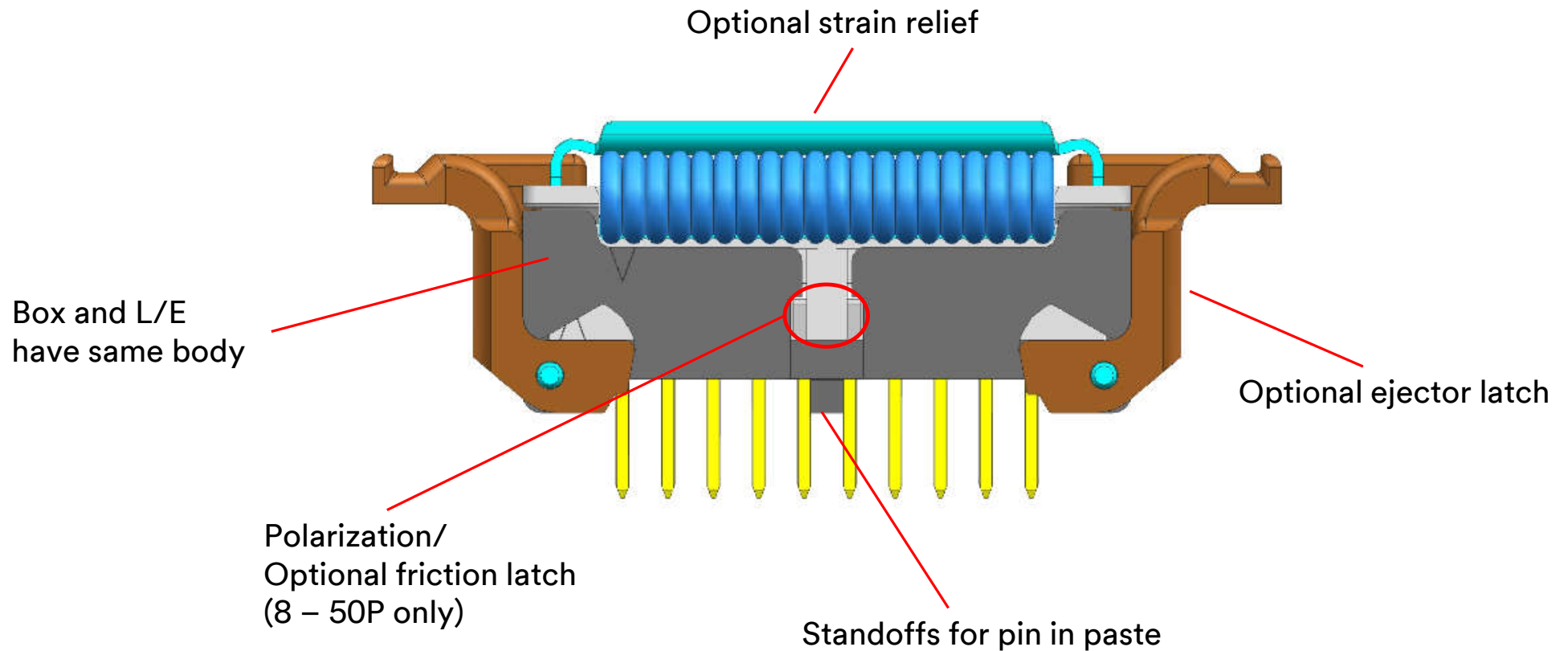
POLARIZATION AND
 FRICTION LATCHING
 POSITIONS 8 AND
 HIGHER ONLY



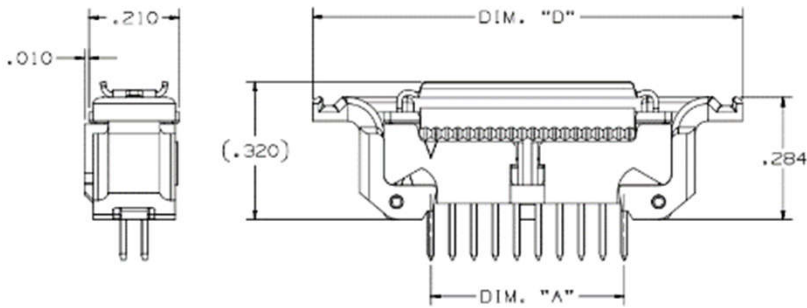
WITH LATCH/EJECT

**Mated Pair: 3M™ Cable Socket
and Header, 451/452 series**

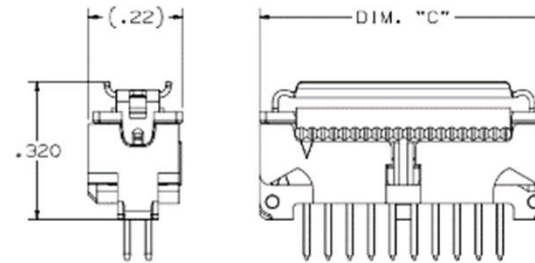
Mated Pair: 3M™ Cable Socket and Header, 451/452 series



Mated Pair: 3M™ Cable Socket and Header, 451/452 series

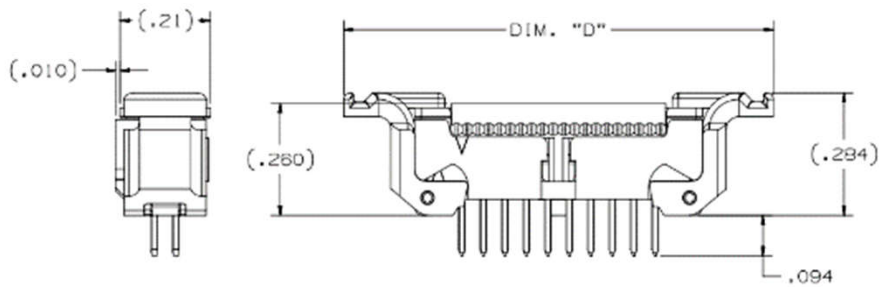


VERTICAL HEADER & SOCKET ASSEMBLY
WITH LOW PROFILE LATCHES & STRAIN RELIEF

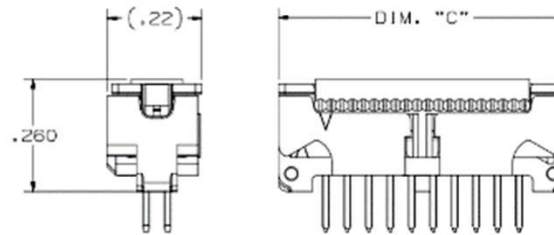


VERTICAL HEADER & SOCKET ASSEMBLY
NO LATCHES WITH STRAIN RELIEF

No. Positions	Dim "A"	Dim "C"	Dim "D"
4	.050	.270	.600
6	.100	.320	.650
8	.150	.370	.700
10	.200	.420	.750
12	.250	.470	.800
14	.300	.520	.850
16	.350	.570	.900
20	.450	.670	1.00
26	.600	.820	1.150
30	.700	.920	1.250
40	.950	1.170	1.500
50	1.200	1.420	1.750

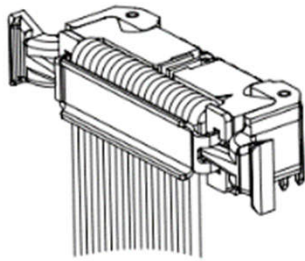


VERTICAL HEADER & SOCKET ASSEMBLY
WITH LATCHES NO STRAIN RELIEF

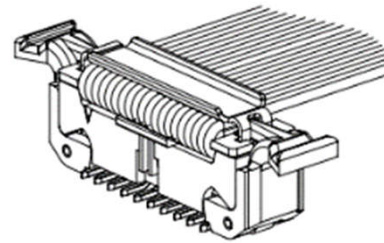


VERTICAL HEADER & SOCKET ASSEMBLY
NO LATCHES NO STRAIN RELIEF

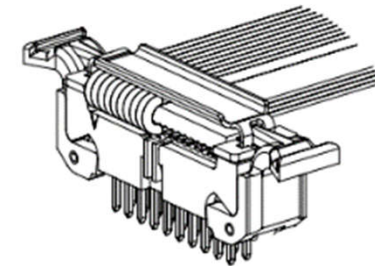
Mated Pair: 3M™ Cable Socket and Header, 451/452 series



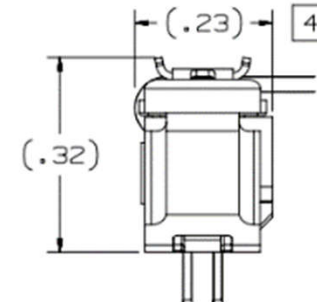
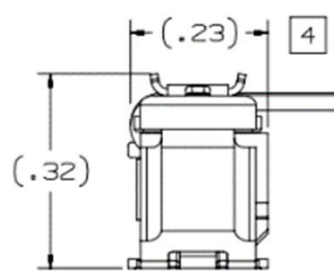
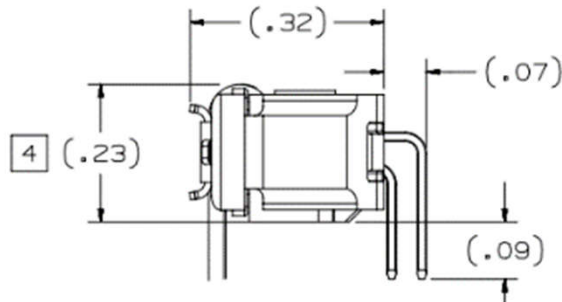
RIGHT ANGLE ASSEMBLY
452XX-5X02



SURFACE MOUNT ASSEMBLY
452XX-2X02



VERTICAL ASSEMBLY
452XX-6X02

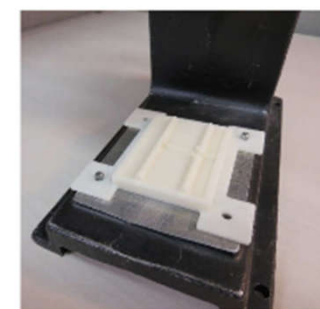
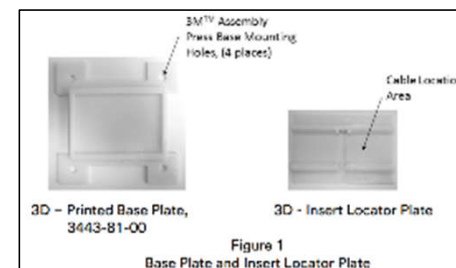


Mated Pair: 3M™ Cable Socket and Header, 451/452 series

Tooling and Accessories

3M™ Connector Part No.	3M™ Locator Plate No.	3M™ Platen part No.	3436-1K Shut Height Setting	
			3M™ Assembly Press 3640 / 3316	3M™ Assembly Press 3335
45104	3443-81-04	3442-9	7	7.5
45106	3443-81-06	3442-9	7	7.5
45108	3443-81-08	3442-9	7	7.5
45110	3443-81-10	3442-9	7	7.5
45112	3443-81-12	3442-9	7	7.5
45114	3443-81-14	3442-9	7	7.5
45116	3443-81-16	3442-9	7	7.5
45120	3443-81-20	3442-9	7	7.5
45126	3443-81-26	3442-9	7	7.5
45130	3443-81-30	3442-9	7	7.5
45134	3443-81-34	3442-9	7	7.5
45140	3443-81-40	3442-9	7	7.5
45150	3443-81-50	3442-9	7	7.5

3M™ Heavy-Duty Assembly Press, 3335



Sales and Marketing

Sales and Marketing

Market Segments/Applications

Industrial



- Factory automation
- Solar
- Weighing systems
- Heating systems
- Security systems
- Access controls
- Industrial lighting
- Advertising displays

Transportation



- Car stereo systems
- Navigation systems
- In vehicle entertainment
- Dashboard applications
- Air-conditioning

Medical



- Test and measurement devices
- Portable heart monitoring
- Patient monitor
- Blood analyzer
- Testers

Miscellaneous



- Television and set top boxes
- Office equipment
- Vending machines
- Smart card readers
- Appliances
- Communications equipment
- Small consumer electronics

Almost anywhere signal based control is a requirement and space is a premium

Medical Disclaimer

No Medical Use: 3M Electronics Materials Solutions Division products are industrial products manufactured to industrial specifications in compliance with ISO 9001:2000 and certain other recognized industrial quality standards. These products, however, are not certified to or manufactured in accordance with current good manufacturing practice (CGMP) requirements for medical devices or pharmaceuticals (see, e.g., 21 C.F.R. 820.1 et seq. and 21 C.F.R. 210.1 et seq.) or other similar quality systems, regulations, or standards ("Standards"), including international Standards, that may be expected or required for medical or pharmaceutical applications.

Automotive Disclaimer

Automotive Applications: This product is an industrial product and has not been designed or tested for use in certain automotive applications, including, but not limited to, automotive electric powertrain battery or high voltage applications. This product does not fully adhere to typical automotive design or quality system requirements, such as IATF 16949 or VDA 6.3. This product may not be manufactured in an IATF certified facility and may not meet a Ppk of 1.33 for all properties. The product may not undergo an automotive production part approval process (PPAP). Customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's automotive application and for conducting incoming inspections before use of the product. Failure to do so may result in injury, death, and/or harm to property. No written or verbal statement, report, data or recommendation by 3M related to automotive use of the product shall have any force or effect unless in an agreement signed by the Technical Director of 3M's Automotive Division. Customer assumes all responsibility and risk if customer chooses to use this product in an automotive electric powertrain battery or high voltage application, and 3M will not be liable for any loss or damage arising from or related to the 3M product or customer's use of the product, whether direct, indirect, special, incidental, or consequential (including, but not limited to, lost profits or business opportunity or recall costs), regardless of the legal or equitable theory asserted, including, but not limited to, warranty, contract, negligence, or strict liability. In no event shall 3M be liable for any damages in excess of the purchase price paid for the product. NOTWITHSTANDING ANY OTHER STATEMENT TO THE CONTRARY, 3M MAKES NO REPRESENTATIONS, WARRANTIES OR CONDITIONS WHATSOEVER, EXPRESS OR IMPLIED, REGARDING THE PRODUCT IF USED IN AN AUTOMOTIVE ELECTRIC POWERTRAIN BATTERY OR HIGH VOLTAGE APPLICATION, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY ON PERFORMANCE, LONGEVITY, SUITABILITY, COMPATIBILITY, OR INTEROPERABILITY, OR ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE

Sales and Marketing

Sales Tools

Available:

- Order samples from 3M sales
- Product pages
 - [451 Series](#)
 - [452 Series](#)
- [Specification Guide](#)
- Technical data sheets
 - [451 Series](#)
 - [452 Series](#)
- [Signal Integrity Report](#)
- [Banner Ad](#)
- [Flyer](#)

Coming Soon:

- Product Videos
- Banner/Social Ads



3M Wire-to-Board System

Summary:

3M Shrouded Boardmount Header 452 series and 3M Ribbon Cable Socket Assembly 451 series are a complete end-to-end interconnect system for wire-to-board applications using .025" ribbon cable

Two-part system:

- 3M Ribbon Cable Wire Socket Assembly 1.27 mm (0.050") Pitch 451 Series
- 3M Shrouded Boardmount Header, 1.27mm (0.050") Pitch, 452 Series

Space Savings:

- 1.27 mm/.050 in grid system saves space on the PCB
- Compared to .100 in/2.54 mm and 2 mm alternatives

Performance:

- Helps deliver on performance, reliability and cost savings
- Accessories help increase reliability of the connection in use



Automotive Disclaimer

Automotive Applications: This product is an industrial product and has not been designed or tested for use in certain automotive applications, including, but not limited to, automotive electric powertrain battery or high voltage applications. This product does not fully adhere to typical automotive design or quality system requirements, such as IATF 16949 or VDA 6.3. This product may not be manufactured in an IATF certified facility and may not meet a Ppk of 1.33 for all properties. The product may not undergo an automotive production part approval process (PPAP). Customer is solely responsible for evaluating the product and determining whether it is appropriate and suitable for customer's automotive application and for conducting incoming inspections before use of the product. Failure to do so may result in injury, death, and/or harm to property. No written or verbal statement, report, data or recommendation by 3M related to automotive use of the product shall have any force or effect unless in an agreement signed by the Technical Director of 3M's Automotive Division. Customer assumes all responsibility and risk if customer chooses to use this product in an automotive electric powertrain battery or high voltage application, and 3M will not be liable for any loss or damage arising from or related to the 3M product or customer's use of the product, whether direct, indirect, special, incidental, or consequential (including, but not limited to, lost profits or business opportunity or recall costs), regardless of the legal or equitable theory asserted, including, but not limited to, warranty, contract, negligence, or strict liability. In no event shall 3M be liable for any damages in excess of the purchase price paid for the product.

NOTWITHSTANDING ANY OTHER STATEMENT TO THE CONTRARY, 3M MAKES NO REPRESENTATIONS, WARRANTIES OR CONDITIONS WHATSOEVER, EXPRESS OR IMPLIED, REGARDING THE PRODUCT IF USED IN AN AUTOMOTIVE ELECTRIC POWERTRAIN BATTERY OR HIGH VOLTAGE APPLICATION, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY ON PERFORMANCE, LONGEVITY, SUITABILITY, COMPATIBILITY, OR INTEROPERABILITY, OR ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE

Medical Disclaimer

No Medical Use: 3M Electronics Materials Solutions Division products are industrial products manufactured to industrial specifications in compliance with ISO 9001:2000 and certain other recognized industrial quality standards. These products, however, are not certified to or manufactured in accordance with current good manufacturing practice (CGMP) requirements for medical devices or pharmaceuticals (see, e.g., 21 C.F.R. 820.1 et seq. and 21 C.F.R. 210.1 et seq.) or other similar quality systems, regulations, or standards (“Standards”), including international Standards, that may be expected or required for medical or pharmaceutical applications.

IMPORTANT NOTICE

Regulatory: For regulatory information about these products, contact your 3M representative.

Technical Information: The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use: Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

Warranty, Limited Remedy, and Disclaimer: Unless an additional warranty is specifically stated on the applicable 3M product packaging or product literature, 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. **3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE.** If the 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability: Except where prohibited by law, 3M will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

Electronics Materials Solutions Division

3M Center, Building 224-3N-11

St. Paul, MN 55144-1000

1-800-251-8634 phone

651-778-4244 fax

www.3M.com/electronics

3M is a trademark of 3M Company.

Please recycle.

©3M 2022. All rights reserved.