

Header Part Selection Overview

Interim version

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This document lists various families of headers with 50 mil and 100 mil pitch. The purpose of this overview is to compile the characteristics of parts available on the market with sufficient detail to allow the selection of suitable connectors for the Neo900 Hackerbus and the BeagleBoard-xM interface of the Neo900 v2 prototype.

In order to limit this survey to a reasonable amount of possible items, we only considered parts that were in stock at Digi-Key at the time of the search.¹ We also exclude angled, shrouded, or blade connectors.

This document currently only covers the part of the above search space we consider of prime interest for Hackerbus and the v2 prototype:

Pitch	Rows	Male		Female	
		TH	SMT	TH	SMT
1.27 mm	Single	●	○	●	●
	Dual	●	○	○	●
2.54 mm	Single	○	○	○	○
	Dual	●	○	○	○

(● included in this document. ○ not included. ● partially included.)

¹ Most of the searches were done in early 2015; female through-hole 1.27 mm single row parts were added in January 2016.

1 Conventions

The queries that led to the respective parts are included in this document. In queries, \neg means negation and \star is a wildcard.

Unless explicitly indicated otherwise, all dimensions are in **millimeters**. Please note that parameters in the Digi-Key catalog are not necessarily identical with the ones shown in this document, e.g., because of different interpretation of vendor documentation.

Pin types are indicated as \emptyset (round pin) or \square (square pin) and – if specified - the corresponding size or size range (*minimum/maximum*). In parts that have protruding elements, the respective dimensions are also indicated as *minimum/maximum*. Please note that all dimensions are nominal values that do not include tolerances.

In part names, letters in italics indicate the following codes:

c Number of columns (dual-row only – we always use *n* for single-row)

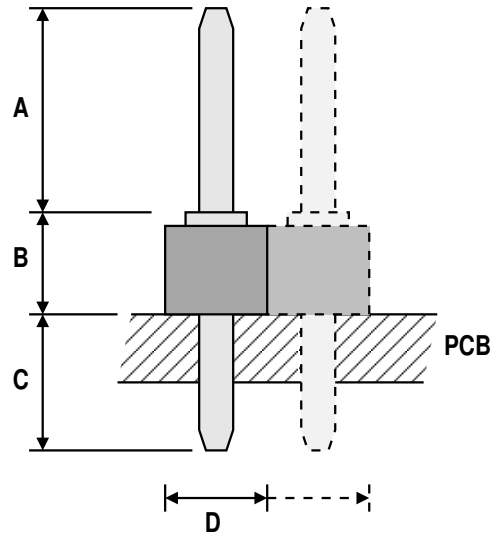
n Number of pins

p Plating / finish / termination code

x Other characteristics of minor relevance

2 Male, through-hole

This is perhaps the best-known type of header. The following drawing shows a cross-section with the key characteristics we examine:



- A** Contact length above the mold. Note that the contacts are chamfered and one should therefore not expect them to make reliable contacts at their very end.
- B** Height above the PCB of the plastic mold, including any stilts or spacers. If the pin has a widened base that extends above the mold, the height of this base is considered to be part of **B** as well.
- C** Contact length below the mold. This part usually passes through the PCB and is soldered on the other side, but other arrangements are possible.
- D** Width of the mold. For double-row headers, this is the width across both rows.

Query A: Digi-Key category “Connectors, Interconnects”, sub-category “Rectangular - Board to Board Connectors - Headers, Male Pins”: 2 047, of which 979 were in stock at the time of the query.

Parameter	Value	Parts
Mounting Type	Through Hole	472
Connector Type	¬ Shrouded	349

Query B: “Connectors, Interconnects”, sub-category “Rectangular Connectors - Headers, Male Pins”: 110 344, of which 28 676 were in stock.

Parameter	Value	Parts
Mounting Type	Through Hole	16 003
Connector Type	¬ Shrouded	12 290

If the “Part status” option is available (2016), we filter the above queries with

Parameter	Value
Part Status	Active

2.1 Male through-hole: 1.27 mm pitch, single row

Proceeding with query A (349 parts):

Parameter	Value	Parts
Pitch	1.27 mm	15

All parts found are dual-row.

Proceeding with query B (12 290 parts):

Parameter	Value	Parts
Pitch	1.27 mm	201
Number of Rows	1	56
Contact Type	Male Pin	21

This yields the following families:

Manufacturer	Part name	Reference	Pin	A	B	C	D
Preci-Dip	850- <i>pp-nnn</i> -10-001101	Catalog	∅ 0.41	3	2.2	2.9	2.2
Mill-Max	850- <i>pp-nnn</i> -10-001000	Catalog	∅ 0.41	3.0	2.21	2.9	2.21
Sullins	GRPB <i>nn</i> 1VWVN-RC	Drawing	□ 0.40	3.00	1.00	2.30	2.14

2.2 Male through-hole: 1.27 mm pitch, dual row

Proceeding with query A (349 parts):

Parameter	Value	Parts
Pitch	1.27 mm	14
Row Spacing	1.27 mm	10

This yields the following families:

Manufacturer	Part name	Reference	Pin	A	B	C	D
Harwin	M50-350 <i>ccpp</i>	Drawing	□ 0.40	3.00	1.00	2.30	3.40

Proceeding with query B (12 290 parts):

Parameter	Value	Parts
Pitch	1.27 mm	201
Number of Rows	2	145
Connector Type	Header Unshrouded	137

This yields the following families:

Manufacturer	Part name	Reference	Pin	A	B	C	D
FCI	20021111-000 nn TpLF	Drawing	□ 0.41	3.05	2.50	2.30	3.43
Würth	6220 nn 21121	Drawing	□ 0.4	3.8	1.5	2.3	3.4
Mill-Max	852- pp - nnn -10-001000	Catalog	∅ 0.41	3.0	2.11	3.0	3.05
Preci-Dip	852- pp - nnn -10-001101	Catalog	∅ 0.41	3	2.1	3	3.25
Samtec	FTS-1 nn -01- p -D	Drawing	□ 0.41	3.05	0.86	2.29	3.43
Samtec	FTS-1 nn -03- p -D	idem	□ 0.41	1.65	0.86	2.29	3.43
Sullins	GRPB nn 2VWVN-RC	Drawing	□ 0.40	3.00	1.00	2.30	3.40

2.3 Male through-hole: 2.54 mm pitch, dual row

Proceeding with query A (258 parts):

Parameter	Value	Parts
Pitch	2.54 mm	218
Row Spacing	2.54 mm	62

This yields the following family:

Manufacturer	Part name	Reference	Pin	A	B	C	D
Samtec	TD-1 nn - p -A	Catalog	∅ 0.46	4.22	3.10	3.96	5.08

Proceeding with query B (11 179 parts):

Parameter	Value	Parts
Pitch	2.54 mm	9,434
Number of Rows	2	4,386

Due to the large number of hits, we – somewhat arbitrarily – limit the results to

Parameter	Value	Parts
Number of Positions	≤ 20	3,335
Contact Mating Length	≤ 5.8 mm	317

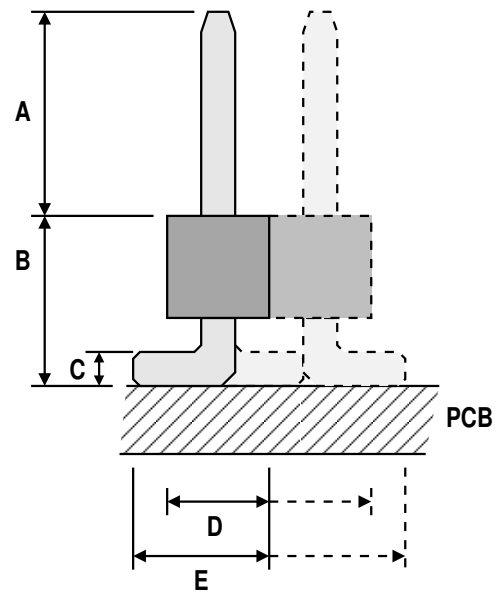
Note: most 2.54 mm headers have a contact length of 5.84 mm. Since this is already too long for any chance of finding a compatible 1.27 mm pair, we limit the search to shorter pins.

Furthermore, we consider only parts that are not a “Value Added Item” and exclude Preci-Dip (which generally seem to mirror Mill-Max). This yields the following families:

Manufacturer	Part name	Reference	Pin	A	B	C	D
3M	9612 <i>nn</i> -6404-AR	Drawing	□ 0.64	5.5	2.5	3.3	5.0
Harwin	M20-976 <i>nnpp</i>	Drawing	□ 0.64	5.80	2.54	3.1	5.08
Mill-Max	435- <i>pp</i> -2 <i>nn</i> -00-160000	Drawing	∅ 0.46	3.18	1.78	2.64	5.08
Mill-Max	802- <i>pp</i> -0 <i>nn</i> -10-001000	Drawing	∅ 0.61	4.95	3.18	3.0	5.08
Mill-Max	802- <i>pp</i> -0 <i>nn</i> -10-002000	Drawing	∅ 0.61	3.61	3.18	3.0	5.08
Mill-Max	802- <i>pp</i> -0 <i>nn</i> -62-001000	Drawing	∅ 0.76	4.85	2.79	3.65	5.08
Samtec	TLW-1 <i>cc</i> -05- <i>p</i> -D	Catalog	□ 0.64	2.67	1.52	4.32	5.03
Samtec	TLW-1 <i>cc</i> -06- <i>p</i> -D	Catalog	□ 0.64	2.67	1.52	3.43	5.03
Samtec	TSW-1 <i>cc</i> -05- <i>p</i> -D	Catalog	□ 0.64	2.67	2.54	3.30	5.08

3 Male, SMT

The following drawing shows a cross-section with the key characteristics we consider:

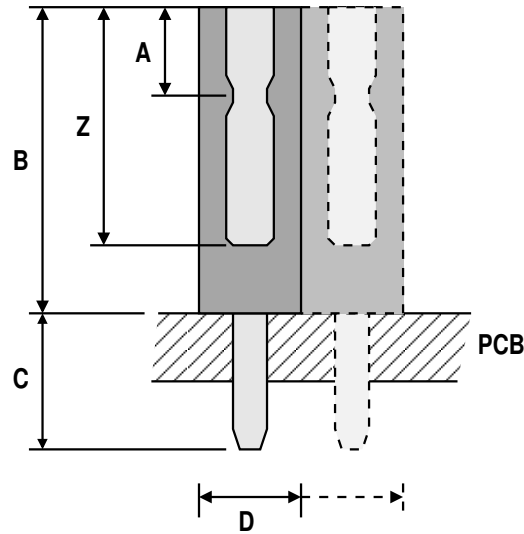


- A Contact length above the mold.
- B Height above the PCB of the top of the plastic mold.
- C Height of the solder pads.
- D Width of the mold. For double-row headers, this is the width across both rows.
- E Width of the entire component, including pads.

TO DO

4 Female, through-hole

The following drawing shows a cross-section with the key characteristics we consider:



A Distance of contact point from the top of the component.

B Height above the PCB of the top of the component.

C Contact length below the mold.

D Width of the mold. For double-row headers, this is the width across both rows.

Z Maximum insertion depth. Omitted if pins can enter or exit at the bottom.

Query A: Digi-Key category “Connectors, Interconnects”, sub-category “Rectangular - Board to Board Connectors - Headers, Receptacles, Female Sockets”: 7 080, of which 2 521 were in stock.

Parameter	Value	Parts
Mounting Type	Through Hole	1 735
Termination	Solder	1 628

Query B: “Connectors, Interconnects”, sub-category “Rectangular Connectors - Headers, Receptacles, Female Sockets”: 37 044, of which 9 342 were in stock.

Parameter	Value	Parts
Mounting Type	Through Hole *	6 952
Mounting Type	¬ Right Angle	5 217
Packaging	¬ TR	5 193
Contact Type	Female Socket, Forked	5 187
Positions Loaded	All	5 185

4.1 Female through-hole: 1.27 mm pitch, single row

There are no single-row 1.27 mm pitch parts for query A.

Proceeding with query B (5 185 parts):

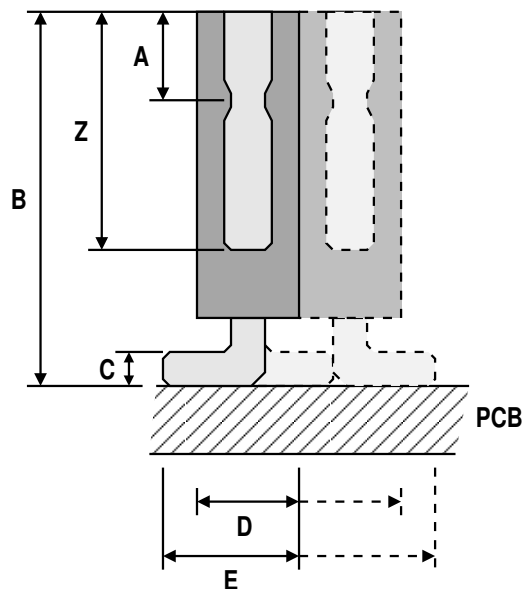
Parameter	Value	Parts
Pitch	1.27 mm	103
Number of Rows	1	31

Manufacturer	Part name	Ref	Pin	A	B	C	D	Z
TE/AMP	5-104192- <i>b</i>	Drw	□	?	8.89	2.54	2.49	?
Mill-Max	851- <i>pp-nnn</i> -10-001000	Cat	∅ 0.38/0.51	1.91	4.09	2.51	2.21	3.05
Preci-Dip	851- <i>pp-nnn</i> -10-001101	Cat	∅ 0.38/0.50	2.5	4.1	2.3	2.2	3.45
Preci-Dip	851- <i>pp-nnn</i> -10-001101	Cat	∅ 0.38/0.50	2.5	8.8	2.3	2.2	3.7
Sullins	LPPB <i>nn1ppp</i> N-RC	Drw	□ 0.4	2.05	4.50	3.00	2.20	?

Note: drawings of Preci-Dip parts are of extremely poor quality and some dimensions may therefore be incorrect.

5 Female, SMT

The following drawing shows a cross-section with the key characteristics we consider:



A Distance of contact point from the top of the component.

B Height above the PCB of the top of the component.

C Height of the solder pads.

D Width of the mold. For double-row headers, this is the width across both rows.

E Width including pads. Note that E is sometimes smaller than D.

Z Maximum insertion depth. Omitted if pins can enter or exit at the bottom.

Query A: Digi-Key category “Connectors, Interconnects”, sub-category “Rectangular - Board to Board Connectors - Headers, Receptacles, Female Sockets”: 7 107, of which 2 528 were in stock.

Parameter	Value	Parts
Mounting Type	Surface Mount	524
Packaging	¬ Digi-Reel, ¬ TR	481

Query B: “Connectors, Interconnects”, sub-category “Rectangular Connectors - Headers, Receptacles, Female Sockets”: 36 198, of which 9 429 were in stock.

Parameter	Value	Parts
Mounting Type	Surface Mount; Surface Mount, Through Board	1 868
Packaging	¬ Digi-Reel, ¬ TR	1 549
Contact Type	Female Socket ★	1 497

5.1 Female SMT: 1.27 mm pitch, single row

Proceeding with query A (481 parts):

Parameter	Value	Parts
Pitch	1.27 mm	221

All parts found have two or more rows.

Proceeding with query B (1 497 parts):

Parameter	Value	Parts
Pitch	1.27 mm	166
Number of Rows	1	16

This yields the following families:

Manuf.	Part name	Ref	Pin	A	B	C	D	E	Z
Mill-Max	399- <i>pp-0nn-21-300000</i>	Cat	∅ 0.38/0.56	1.91	3.0	0.51	2.21	1.83	2.54
Mill-Max	851- <i>pp-0nn-30-001000</i>	Cat	∅ 0.38/0.51	1.91	5.26	?	2.21	3.02	3.05
Preci-Dip	851- <i>pp-<u>nnn</u>-30-001191</i>	Cat	∅ 0.35/0.50	?	5.15	0.44	2.2	3.4	?
Preci-Dip	851- <i>pp-<u>nnn</u>-30-001101</i>	Cat	∅ 0.35/0.50	2.5	5.15	0.33	2.2	3.4	3.45
Sullins	LPPB <i>nn1NFSx-RC</i>	Drw	□ 0.40	2.05	4.65	0.15	2.20	3.10	2.05

Note: documentation of the Preci-Dip 851-*pp-nnn-30-001101* and -001191 is only partially readable.

5.2 Female SMT: 1.27 mm pitch, dual row

Proceeding with query A (484 parts):

Parameter	Value	Parts
Pitch	1.27 mm	223
Number of Rows	2	211
Row spacing	1.27 mm	201
Features	¬ Board Lock	181
Color	Black	173

This yields the following families:

Manufacturer	Part name	Reference	Pin	A	B	C	D	E	Z
Samtec	CLP-1 <i>cc-02-p-D</i>	Drawing	□	≈0.75	2.28	?	3.05	4.32	–
Harwin	M50-310 <i>ccpp</i>	Drawing	□	1.00	4.60	0.15	3.10	4.80	?
Harwin	M50-312 <i>ccpp</i>	Drawing	□	1.43	3.60	0.15	3.10	4.50	?
Harwin	M50-315 <i>ccpp</i>	Drawing	?	1.20	2.20	0.15	3.40	4.50	–
Harwin	M50-430 <i>ccpp</i>	Drawing	□	1.09	4.60	0.20	3.10/3.60	4.80	?

Proceeding with query B (1 496 parts):

Parameter	Value	Parts
Pitch	1.27 mm	166
Number of Rows	2	150
Features	\neg Board Lock	143

This yields the following families:

Manuf.	Part name	Ref	Pin	A	B	C	D	E	Z
Harting	1521 <i>nnn</i> x601 <i>xxx</i>	Drw	□	?	6.25	?	?	? 7.4	?
FCI	20021321- <i>x0xnnxxLF</i>	Drw	□	\approx 1.2	4.50	?	3.00	4.50	?
Mill-Max	853- <i>pp-nnn-30-001000</i>	Cat	\varnothing 0.38/0.51	1.91	5.26	?	3.05	4.29	3.05
Samtec	FLE-1 <i>cc-01-p-DV</i>	Drw	□	\approx 1.2	4.55	?	3.33	4.59	–
Sullins	LPPB <i>cc2NFSx-RC</i>	Drw	□ 0.40	2.05	4.65	0.15	3.10	4.50	–
Sullins	SFH31-NP <i>pB-Dcc-SP-x</i>	Drw	□	2.00	4.40	0.15	3.10/3.60	4.50	–
Samtec	SFML-1 <i>cc-x2-p-D</i>	Drw	□	\approx 2.6	4.70	0.13	3.05/3.68	4.19	4.06

Products taller than 9 mm (Harting) were excluded.