IND-SPHINX
PCB DRILLS | PCB ROUTERS

PCB Metal Series

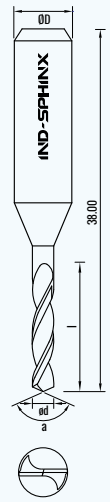
Optimised Tool Design for **PCB Metal Series**

PCB Metal Series

Drill Diamond Coated

D7451
X7451D

ød	l	
0.55	5.50	7.00
0.60	5.50	7.00
0.65	7.00	-
0.70	7.00	-
0.75	7.00	-
0.80	8.00	-
0.85	8.00	-
0.90	8.00	-
1.00	8.00	-
1.10	8.00	-
1.15	8.00	-
1.20	8.00	-
1.25	8.00	-
1.30	8.00	-
1.35	8.00	-
1.40-1.55	8.00	-

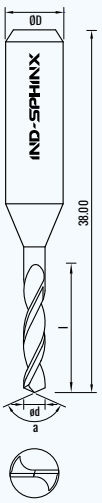


PCB Al | PCB Cu | PCB Brass

Drill Diamond Coated

D7451
X7451D

ød	l
1.65	10.00
1.70	10.00
1.75	10.00
1.80	10.00
1.85	10.00
1.90	10.00
1.95	10.00
2.00	10.00
2.20	10.00
2.30	10.00
2.40	10.00
2.50	10.00
2.60	10.00
2.80	10.00
3.00	10.00
3.175	10.00

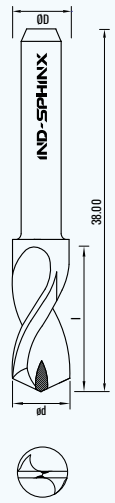


PCB Al | PCB Cu | PCB Brass

Inverse Drill Diamond Coated

D5341
X534D

ød	l
3.20	12.00
3.25	12.00
3.30	12.00
3.35	12.00
3.40	12.00
3.45	12.00
3.50	12.00
3.55	12.00
3.60	12.00
3.65	12.00
3.70	12.00
3.75	12.00
3.80	12.00
3.85	12.00
3.90	12.00
4.00- 6.50	12.00

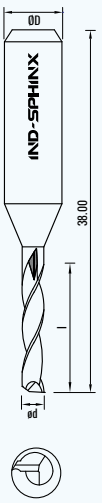


PCB Al | PCB Cu | PCB Brass

Single Flute Router

P9261

ød	l
0.40	2.00
0.50	3.00
0.60	3.00
0.80	3.00
0.90	3.00
1.00	3.00
1.20	4.00
1.40	4.00
1.50	4.00
1.60	5.00
1.80	5.00
2.00	8.00
2.40	8.00
2.50	9.00
3.00	9.00
3.175	9.00



PCB Al | PCB Cu | PCB Brass

Fishtail
Art : P9261

All dimensions are in mm

D : Ø 1/8" (3.175 mm) Common Shank

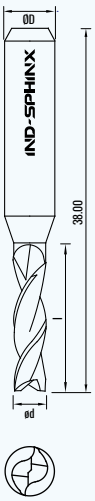
On Request Shank Dia 3mm

PCB Metal Series

2 Flute Router Diamond Coated

D8291
X829R

ød	l	
0.40	-	2.00
0.50	-	2.00
0.60	-	2.00
0.80	-	2.00
1.00	-	3.00
1.20	-	3.00
1.30	-	3.00
1.40	-	3.00
1.50	3.00	5.00
1.60	3.00	5.00
1.80	-	5.00
1.90	-	5.00
2.00	4.00	6.00
2.40	-	6.00
2.50	-	6.00
3.00	-	6.00



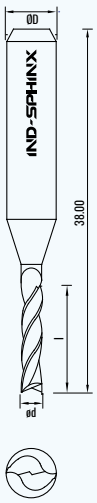
PCB Al | PCB Cu | PCB Brass

Fishtail

2 Flute Router

P8201 / P8261

ød	l	
0.30*	1.00	-
0.40*	1.50	-
0.50* - 0.70	3.00	-
0.80	5.00	-
0.90	5.00	-
1.00	5.00	-
1.10	5.00	8.00*
1.20	5.00	8.00*
1.50	6.00	8.00*
1.60	6.00	8.00*
1.90	6.00	8.00*
2.00	8.00	-
2.40	8.00	-
2.50	8.00	-
3.00*	10.00	-
3.175*	10.00	-



PCB Al

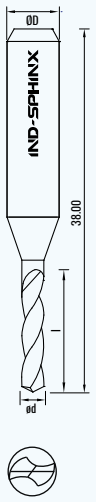
Safe End — Art : P8201*

Fishtail — Art : P8261

2 Flute Aluminium Router

P024 DLC COAT

ød	l	
0.40*	2.00	-
0.50*	2.50	-
0.60*	3.00	-
0.70*	3.00	-
0.80*	3.00	-
1.00	4.00	-
1.20	4.00	-
1.40*	4.00	-
1.50	5.00	-
1.60	5.00	-
1.80*	6.00	-
2.00	7.00	-
2.40	7.00	-
2.50*	8.00	-
3.00	8.00	10.00
3.175*	8.00	-



PCB Al

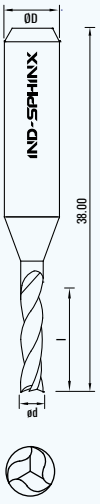
Drill Point — Art : P024

Safe End — Art : P4221*

3 Flute Router

P4361

ød	l	
0.60	3.00	5.00
0.70	3.00	-
0.80	3.00	-
0.90	3.00	-
1.00	5.00	7.50
1.20	5.00	-
1.30	5.00	-
1.40	5.00	-
1.50	7.00	-
1.60	7.00	-
1.80	7.00	-
2.00	9.00	-
2.40	9.00	-
2.50	9.00	-
3.00	10.00	-
3.175	10.00	-



PCB Al

Fishtail — Art : P4361

Safe End — Art : P4351*

On request : Inch sizes / Special dimensions

* : Non stock items / Articles

DRILLING

Recommended Parameters for D7451 & D5341

Material : Aluminum & Copper **Cutting speed :** 120 m/ min **Spindle speed (N) :** 125,000 Max.

DIAMETER		CHIP LOAD		INFEED		RPM	RETRACT FEED	
mm	Inch	µm	mil	m/min.	IPM	N	m/min	IPM
0.55	0.0217	19.0	0.75	2.70	106.0	125000	9.0	354.0
0.60	0.0236	22.0	0.87	2.80	110.0	125000	10.0	394.0
0.65	0.0256	24.0	0.94	2.90	114.0	122000	10.0	394.0
0.70	0.0276	26.0	1.02	3.00	118.0	114000	10.0	394.0
0.75	0.0295	28.0	1.10	3.00	118.0	108000	10.0	394.0
0.80	0.0315	30.0	1.18	3.00	118.0	100000	10.0	394.0
0.85	0.0335	32.0	1.26	3.00	118.0	95000	10.0	394.0
0.90	0.0354	34.0	1.34	3.10	122.0	90000	10.0	394.0
0.95	0.0374	37.0	1.46	3.10	122.0	85000	10.0	394.0
1.00	0.0394	40.0	1.57	3.20	126.0	80000	10.0	394.0
1.05	0.0413	40.0	1.57	3.00	118.0	76000	10.0	394.0
1.10	0.0433	40.0	1.57	2.90	114.0	72000	10.0	394.0
1.15	0.0453	40.0	1.57	2.80	110.0	69000	10.0	394.0
1.20	0.0472	40.0	1.57	2.60	102.0	66000	10.0	394.0
1.25	0.0492	40.0	1.57	2.60	102.0	63000	10.0	394.0
1.30	0.0512	46.0	1.81	2.80	110.0	61000	10.0	394.0
1.35	0.0531	46.0	1.81	2.70	106.0	59000	10.0	394.0
1.40	0.0551	46.0	1.81	2.60	102.0	57000	10.0	394.0
1.45 - 1.60	0.0571 - 0.0630	45.0	1.77	2.30	91.0	52000	10.0	394.0
1.65 - 1.80	0.0650 - 0.0709	45.0	1.77	2.10	83.0	47000	10.0	394.0
1.85 - 2.00	0.0728 - 0.0787	45.0	1.77	2.00	79.0	42000	10.0	394.0
2.05 - 2.30	0.0807 - 0.0906	50.0	1.97	1.80	71.0	36000	10.0	394.0
2.35 -2.60	0.0925 - 0.1024	55.0	2.17	1.80	71.0	32000	10.0	394.0
2.65 - 2.90	0.1043 - 0.1142	55.0	2.17	1.60	63.0	30000	10.0	394.0
2.95 - 3.15	0.1161 - 0.1240	55.0	2.17	1.40	55.0	26000	10.0	394.0
3.175 - 3.95	0.1250 - 0.1555	40.0	1.57	1.00	39.0	25000	10.0	394.0
4.00 - 4.95	0.1575 - 0.1949	32.0	1.26	0.80	31.0	25000	10.0	394.0
5.00 - 5.95	0.1969 - 0.2343	24.0	0.94	0.60	24.0	25000	10.0	394.0
6.00 - 6.40	0.2362 - 0.2520	20.0	0.79	0.50	20.0	25000	10.0	394.0

Tabulated parameters provide guidelines to act as starting points for optimising speeds and feed at user end

RECOMMENDATIONS :

- Spindle run-out should be less than 0.005mm, especially in case of micro drilling (≤ drill dia 0.50mm)
- Keep vacuum pressure more than 80 millibar (816 mm of water)
- Back-up penetration should be controlled as per recommended limits
- Use an entry material (e.g. Phenolic paper) approx. 0.50mm thick
- Use Minimal Quantity Lubrication like Ethanol / Oil emulision, if possible
- Reduce spindle speed and feed rate, ~ 20% for Copper applications
- Reduce spindle speed ~ 20% for Ceramic dielectric
- For > drill Ø4.50 mm pre drilling is recommended; ~ 25% of the drill diameter

PCB Metal Series

ROUTING

Recommended Parameters for P9261, P8201/P8261 , P4361 & P8291

Material : Aluminum | **Cutting speed :** 65-250 m/min | **Spindle speed (N) :** 80,000 Max.

DIAMETER	CHIP LOAD		INFEED		RPM	RETRACT FEED	
mm	µm	mil	m/min.	IPM	N	m/min	IPM
0.30	0.8	0.03	0.08	2.3	70000	0.2	8.0
0.40	0.8	0.03	0.08	2.3	70000	0.2	8.0
0.50	1.0	0.04	0.08	2.7	70000	0.2	8.0
0.60	1.0	0.04	0.08	3.0	70000	0.2	8.0
0.70	1.0	0.07	0.12	5.0	70000	0.2	8.0
0.80	2.0	0.08	0.16	6.0	70000	0.2	8.0
0.90	2.0	0.08	0.16	6.0	70000	0.2	8.0
1.00	3.0	0.13	0.24	9.0	70000	0.2	8.0
1.10	4.0	0.16	0.29	11.0	72000	0.4	16.0
1.20	4.0	0.16	0.26	10.0	66000	0.4	16.0
1.30	5.0	0.20	0.31	12.0	61000	0.5	20.0
1.40	6.0	0.24	0.34	13.0	57000	0.5	20.0
1.50	6.0	0.24	0.32	13.0	53000	0.5	20.0
1.60	7.0	0.28	0.35	14.0	50000	0.5	20.0
1.80	10.0	0.39	0.44	17.0	44000	0.5	20.0
1.90	12.0	0.47	0.50	20.0	42000	0.5	20.0
2.00	14.0	0.55	0.56	22.0	40000	0.8	31.0
2.50	18.0	0.71	0.58	23.0	32000	0.8	31.0
3.00	21.0	0.83	0.57	22.0	27000	0.8	31.0
3.10	22.0	0.87	0.57	23.0	26000	0.8	31.0
3.175	22.0	0.87	0.55	22.0	25000	0.8	31.0

Tabulated parameters provide guidelines to act as starting points for optimising speeds and feed at user end

ROUTING

Recommended Parameters for P024 / P4221

Material : Aluminum | **Cutting speed :** 100-250 m/min | **Spindle speed (N) :** 80,000 Max.

DIAMETER	CHIP LOAD	X-Y TABLE FEED	Z-FEED RATE PRE DRILLED	RPM	ROUTING DEPTH	DEPTH IN TO BACK UP
mm	µm	m/min.	m/min.	N	mm	mm
0.40	0.6	0.05	0.2	80000	0.50	0.3
0.60	1.3	0.10	0.4	80000	0.50	0.3
0.80	2.5	0.20	0.6	80000	1.00	0.4
1.00	4.3	0.30	0.8	70000	1.20	0.6
1.20	5.2	0.30	0.8	58000	1.50	0.6
1.40	8.0	0.40	0.8	50000	1.50	0.6
1.50	8.7	0.40	1.0	46000	2.00	0.8
1.60	9.1	0.40	1.2	44000	2.00	0.8
1.80	10.3	0.40	1.2	39000	2.20	0.8
2.00	11.4	0.40	1.2	35000	2.50	0.8
2.40	17.2	0.50	1.2	29000	3.00	0.8
2.50	17.9	0.50	1.2	28000	3.00	0.8
3.00	30.4	0.70	1.2	23000	3.00	1.0
3.175	31.8	0.70	1.2	22000	3.00	1.0

Tabulated parameters provide guidelines to act as starting points for optimising speeds and feed at user end

RECOMMENDATIONS :

- Always keep stack height maximum 85% of effective flute length
- Spindle run-out should be less than 0.005mm, especially in case of micro routing (≤ dia 1.20mm)
- Keep vacuum pressure more than 80 millibar (816 mm of water).
- Back-up should be pre routed with channels, it will help to evacuate chips easily from routing path
- Use Minimal Quantity Lubrication like Ethanol / Oil emulsion if possible

PCB
Metal Series

IND-SPHINX

PCB DRILLS | PCB ROUTERS

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