

# FR-4 Thick Panel PCB Material

(Panel Thickness > 0.200")

**Recommended Drill Series:** 100, 150, 430, 480

Drill Size	Diameter (inch)	Feed (inch/min)	Speed (k-rpm)	Retract (inch/min)	Z-Axis Offset (inches)	Max Hits	Chipload (mm/rev)	SFM
0.25mm	0.0098	60	120	800	-0.012	750	0.50	308
#87	0.0100	60	120	800	-0.012	750	0.50	314
#86	0.0105	65	120	800	-0.012	750	0.54	330
#85	0.0110	70	120	900	-0.013	750	0.58	345
#84	0.0115	75	120	900	-0.013	750	0.63	361
0.30mm	0.0118	78	120	1000	-0.013	750	0.65	371
#83	0.0120	80	120	1000	-0.013	750	0.67	377
#82	0.0125	85	120	1000	-0.013	750	0.71	393
#81	0.0130	90	120	1000	-0.013	750	0.75	408
#80	0.0135	95	120	1000	-0.013	1000	0.79	450
0.35mm	0.0138	97	120	1000	-0.013	1000	0.81	450
#79	0.0145	100	119	1000	-0.013	1000	0.84	450
1/64	0.0156	100	110	1000	-0.014	1000	0.91	450
0.40mm	0.0158	100	109	1000	-0.014	1000	0.92	450
#78	0.0160	100	107	1000	-0.014	1000	0.93	450
0.45mm	0.0177	102	97	1000	-0.014	1000	1.05	450
#77	0.0180	103	96	1000	-0.014	1000	1.07	450
0.50mm	0.0197	103	88	1000	-0.015	1000	1.17	450
#76	0.0200	103	87	1000	-0.015	1000	1.18	450
#75	0.0210	103	83	1000	-0.015	1200	1.24	450
0.55mm	0.0217	103	80	1000	-0.015	1200	1.29	450
#74	0.0225	103	78	1000	-0.015	1200	1.32	450
0.60mm	0.0236	104	74	1000	-0.016	1200	1.41	450
#73	0.0240	104	73	1000	-0.016	1200	1.42	450
#72	0.0250	104	70	1000	-0.016	1200	1.49	450
0.65mm	0.0256	104	68	1000	-0.016	1200	1.53	450
#71	0.0260	104	67	1000	-0.016	1200	1.55	450
0.70mm	0.0276	103	63	1000	-0.016	1200	1.63	450
#70	0.0280	103	62	1000	-0.017	1200	1.66	450
#69	0.0292	102	60	1000	-0.017	1200	1.70	450
0.75mm	0.0295	102	59	1000	-0.017	1200	1.73	450
#68	0.0310	102	57	1000	-0.017	1200	1.79	450
1/32	0.0312	101	56	1000	-0.017	1200	1.80	450
0.80mm	0.0315	101	55	1000	-0.017	1200	1.84	450
#67	0.0320	100	54	1000	-0.017	1200	1.85	450
#66	0.0330	100	53	1000	-0.018	1200	1.89	450
0.85mm	0.0335	99	52	1000	-0.018	1200	1.90	450
#65	0.0350	98	50	1000	-0.018	1200	1.96	450
0.90mm	0.0354	98	49	1000	-0.018	1200	2.00	450
#64	0.0360	97	48	1000	-0.018	1200	2.02	450
#63	0.0370	96	47	1000	-0.019	1200	2.04	450
0.95mm	0.0374	95	46	1000	-0.019	1200	2.07	450
#62	0.0380	95	46	1000	-0.019	1200	2.07	450
#61	0.0390	94	45	1000	-0.019	1200	2.09	450
1.00mm	0.0394	94	45	1000	-0.019	1200	2.09	450
#60	0.0400	94	44	1000	-0.019	1200	2.14	450
#59	0.0410	93	43	1000	-0.020	1200	2.16	450
1.05mm	0.0413	93	42	1000	-0.020	1200	2.21	450
#58	0.0420	92	41	1000	-0.020	1200	2.24	450
#57	0.0430	92	40	1000	-0.020	1200	2.30	450
1.10mm	0.0433	92	40	1000	-0.020	1200	2.30	450
1.15mm	0.0453	91	39	1000	-0.021	1200	2.33	450
#56	0.0465	90	38	1000	-0.021	1200	2.37	450
3/64	0.0469	90	37	1000	-0.021	1200	2.43	450
1.20mm	0.0472	90	37	1000	-0.021	1200	2.43	450
1.25mm	0.0492	89	36	1000	-0.021	1200	2.47	450
1.30mm	0.0512	85	34	1000	-0.022	1200	2.50	450
#55	0.0520	85	34	1000	-0.022	1200	2.50	450
1.35mm	0.0531	83	33	1000	-0.022	1200	2.50	450
#54	0.0550	80	32	1000	-0.023	1200	2.50	450
1.40mm	0.0551	80	32	1000	-0.023	1200	2.50	450
1.45mm	0.0571	78	31	1000	-0.023	1200	2.50	450
1.50mm	0.0591	75	30	1000	-0.024	1200	2.50	450
#53	0.0595	73	29	1000	-0.024	1200	2.50	450

Note: This information is based on 120K RPM Spindle Capability. Please use maximum spindle speed if listed RPM is unattainable

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Drill Size	Diameter (inch)	Feed (inch/min)	Speed (k-rpm)	Retract (inch/min)	Z-Axis Offset (inches)	Max Hits	Chipload (mm/rev)	SFM
1.55mm	0.0610	73	29	1000	-0.024	1200	2.50	450
1/16	0.0625	70	28	1000	-0.025	1200	2.50	450
1.60mm	0.0630	70	28	1000	-0.025	1200	2.50	450
#52	0.0635	70	28	1000	-0.025	1200	2.50	450
1.65mm	0.0650	68	27	1000	-0.025	1200	2.50	450
1.70mm	0.0669	65	26	1000	-0.026	1200	2.50	450
#51	0.0670	65	26	1000	-0.026	1200	2.50	450
1.75mm	0.0689	63	25	1000	-0.026	1200	2.50	450
#50	0.0700	63	25	1000	-0.026	1200	2.50	450
1.80mm	0.0709	63	25	1000	-0.027	1200	2.50	450
1.85mm	0.0728	60	24	1000	-0.027	1200	2.50	450
#49	0.0730	60	24	1000	-0.027	1200	2.50	450
1.90mm	0.0748	58	23	1000	-0.027	1200	2.50	450
#48	0.0760	58	23	1000	-0.028	1200	2.50	450
1.95mm	0.0768	58	23	1000	-0.028	1200	2.50	450
5/64	0.0781	55	22	1000	-0.028	1200	2.50	450
#47	0.0785	55	22	1000	-0.028	1200	2.50	450
2.00mm	0.0787	55	22	1000	-0.028	1200	2.50	450
2.05mm	0.0807	55	22	1000	-0.029	1200	2.50	450
#46	0.0810	53	21	1000	-0.029	1200	2.50	450
#45	0.0820	53	21	1000	-0.029	1200	2.50	450
2.10mm	0.0827	53	21	1000	-0.029	1200	2.50	450
2.15mm	0.0846	53	21	1000	-0.030	1200	2.50	450
#44	0.0860	50	20	1000	-0.030	1200	2.50	450
2.20mm	0.0866	50	20	1000	-0.030	1200	2.50	453
2.25mm	0.0886	50	20	1000	-0.031	1200	2.50	464
#43	0.0890	50	20	1000	-0.031	1200	2.50	466
2.30mm	0.0906	50	20	1000	-0.031	1200	2.50	474
2.35mm	0.0925	50	20	1000	-0.032	1200	2.50	484
#42	0.0935	50	20	1000	-0.032	1200	2.50	489
3/32	0.0938	50	20	1000	-0.032	1200	2.50	491
2.40mm	0.0945	50	20	1000	-0.032	1200	2.50	495
#41	0.0960	50	20	1000	-0.032	1200	2.50	502
2.45mm	0.0965	50	20	1000	-0.033	1200	2.50	505
#40	0.0980	50	20	1000	-0.033	1200	2.50	513
2.50mm	0.0984	50	20	1000	-0.033	1200	2.50	515
#39	0.0995	50	20	1000	-0.033	1200	2.50	521
2.55mm	0.1004	50	20	1000	-0.033	800	2.50	525
#38	0.1015	50	20	1000	-0.034	800	2.50	531
2.60mm	0.1024	50	20	1000	-0.034	800	2.50	536
#37	0.1040	50	20	1000	-0.034	800	2.50	544
2.65mm	0.1043	50	20	1000	-0.034	800	2.50	546
2.70mm	0.1063	50	20	1000	-0.035	800	2.50	556
#36	0.1065	50	20	1000	-0.035	800	2.50	557
2.75mm	0.1083	50	20	1000	-0.035	800	2.50	567
7/64	0.1094	50	20	1000	-0.036	800	2.50	573
#35	0.1100	50	20	1000	-0.036	800	2.50	576
2.80mm	0.1102	50	20	1000	-0.036	800	2.50	577
#34	0.1110	50	20	1000	-0.036	800	2.50	581
2.85mm	0.1122	50	20	1000	-0.036	800	2.50	587
#33	0.1130	50	20	1000	-0.036	800	2.50	591
2.90mm	0.1142	50	20	1000	-0.037	800	2.50	598
#32	0.1160	50	20	1000	-0.037	800	2.50	607
2.95mm	0.1161	50	20	1000	-0.037	800	2.50	608
3.00mm	0.1181	50	20	1000	-0.038	800	2.50	618
#31	0.1200	50	20	1000	-0.038	800	2.50	628
3.05mm	0.1201	50	20	1000	-0.038	800	2.50	629
3.10mm	0.1220	50	20	1000	-0.038	800	2.50	638
3.15mm	0.1240	50	20	1000	-0.039	800	2.50	649
1/8	0.1250	50	20	1000	-0.039	800	2.50	654
3.20mm	0.1260	48	20	1000	-0.018	600	2.40	659
3.25mm	0.1280	48	20	1000	-0.018	600	2.40	670
#30	0.1285	48	20	1000	-0.019	600	2.40	672
3.30mm	0.1299	48	20	1000	-0.019	600	2.40	680
3.35mm	0.1319	48	20	1000	-0.019	600	2.40	690
3.40mm	0.1339	48	20	1000	-0.019	600	2.40	701
3.45mm	0.1358	48	20	1000	-0.019	600	2.40	711
#29	0.1360	48	20	1000	-0.019	600	2.40	712
3.50mm	0.1378	48	20	1000	-0.019	600	2.40	721
3.55mm	0.1398	48	20	1000	-0.019	600	2.40	732
#28	0.1405	45	20	1000	-0.019	600	2.25	735
9/64	0.1406	45	20	1000	-0.019	600	2.25	736

Note: This information is based on 120K RPM Spindle Capability. Please use maximum spindle speed if listed RPM is unattainable

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Drill Size	Diameter (inch)	Feed (inch/min)	Speed (k-rpm)	Retract (inch/min)	Z-Axis Offset (inches)	Max Hits	Chipload (mm/rev)	SFM
3.60mm	0.1417	45	20	1000	-0.019	600	2.25	742
3.65mm	0.1437	45	20	1000	-0.020	600	2.25	752
#27	0.1440	45	20	1000	-0.020	600	2.25	754
3.70mm	0.1457	45	20	1000	-0.020	600	2.25	762
#26	0.1470	40	20	1000	-0.020	600	2.00	769
3.75mm	0.1476	40	20	1000	-0.020	600	2.00	772
#25	0.1495	40	20	1000	-0.020	600	2.00	782
3.80mm	0.1496	40	20	1000	-0.020	600	2.00	783
3.85mm	0.1516	40	20	1000	-0.020	600	2.00	793
#24	0.1520	40	20	1000	-0.020	400	2.00	795
3.90mm	0.1535	40	20	1000	-0.020	400	2.00	803
#23	0.1540	40	20	1000	-0.020	400	2.00	806
3.95	0.1555	40	20	1000	-0.020	400	2.00	814
5/32	0.1562	40	20	1000	-0.020	400	2.00	817
#22	0.1570	40	20	1000	-0.020	400	2.00	822
4.00mm	0.1575	40	20	1000	-0.020	400	2.00	824
#21	0.1590	35	20	1000	-0.021	400	1.75	832
4.05mm	0.1594	35	20	1000	-0.021	400	1.75	834
#20	0.1610	35	20	1000	-0.021	400	1.75	843
4.10mm	0.1614	35	20	1000	-0.021	400	1.75	845
4.15mm	0.1634	35	20	1000	-0.021	400	1.75	855
4.20mm	0.1654	35	20	1000	-0.021	400	1.75	866
#19	0.1660	35	20	1000	-0.021	400	1.75	869
4.25mm	0.1673	35	20	1000	-0.021	400	1.75	876
4.30mm	0.1693	35	20	1000	-0.021	400	1.75	886
#18	0.1695	35	20	1000	-0.021	400	1.75	887
4.35mm	0.1713	30	20	1000	-0.021	400	1.50	896
11/64	0.1719	30	20	1000	-0.021	400	1.50	900
#17	0.1730	30	20	1000	-0.021	250	1.50	905
4.40mm	0.1732	30	20	1000	-0.021	250	1.50	906
4.45mm	0.1752	30	20	1000	-0.022	250	1.50	917
#16	0.1770	30	20	1000	-0.022	250	1.50	926
4.50mm	0.1772	30	20	1000	-0.022	250	1.50	927
4.55mm	0.1792	30	20	1000	-0.022	250	1.50	938
#15	0.1800	30	20	1000	-0.022	250	1.50	942
4.60mm	0.1811	30	20	1000	-0.022	250	1.50	948
#14	0.1820	30	20	1000	-0.022	250	1.50	952
4.65mm	0.1831	30	20	1000	-0.022	250	1.50	958
#13	0.1850	30	20	1000	-0.022	250	1.50	968
4.70mm	0.1850	30	20	1000	-0.022	250	1.50	968
4.75mm	0.1870	30	20	1000	-0.022	250	1.50	979
3/16	0.1875	30	20	1000	-0.022	250	1.50	981
4.80mm	0.1890	30	20	1000	-0.023	250	1.50	989
#12	0.1890	25	20	1000	-0.023	250	1.25	989
4.85mm	0.1909	25	20	1000	-0.023	250	1.25	999
#11	0.1910	25	20	1000	-0.023	250	1.25	1000
4.90mm	0.1929	25	20	1000	-0.023	250	1.25	1010
#10	0.1935	25	20	1000	-0.023	250	1.25	1013
4.95mm	0.1949	25	20	1000	-0.023	250	1.25	1020
#9	0.1960	25	20	1000	-0.023	250	1.25	1026
5.00mm	0.1968	25	20	1000	-0.023	250	1.25	1030
5.05mm	0.1988	25	20	1000	-0.023	250	1.25	1040
#8	0.1990	25	20	1000	-0.023	250	1.25	1041
5.10mm	0.2008	25	20	1000	-0.023	200	1.25	1051
#7	0.2010	25	20	1000	-0.023	200	1.25	1052
5.15mm	0.2028	25	20	1000	-0.023	200	1.25	1061
13/64	0.2031	25	20	1000	-0.023	200	1.25	1063
#6	0.2040	25	20	1000	-0.024	200	1.25	1068
5.20mm	0.2047	25	20	1000	-0.024	200	1.25	1071
#5	0.2055	25	20	1000	-0.024	200	1.25	1075
5.25mm	0.2067	25	20	1000	-0.024	200	1.25	1082
5.30mm	0.2087	25	20	1000	-0.024	200	1.25	1092
#4	0.2090	25	20	1000	-0.024	200	1.25	1094
5.35mm	0.2106	25	20	1000	-0.024	200	1.25	1102
5.40mm	0.2126	20	20	1000	-0.024	200	1.00	1113
#3	0.2130	20	20	1000	-0.024	200	1.00	1115
5.45mm	0.2146	20	20	1000	-0.024	200	1.00	1123
5.50mm	0.2165	20	20	1000	-0.024	200	1.00	1133
5.55mm	0.2185	20	20	1000	-0.024	200	1.00	1143
7/32	0.2188	20	20	1000	-0.024	200	1.00	1145
5.60mm	0.2205	20	20	1000	-0.025	200	1.00	1154
#2	0.2210	20	20	1000	-0.025	200	1.00	1157

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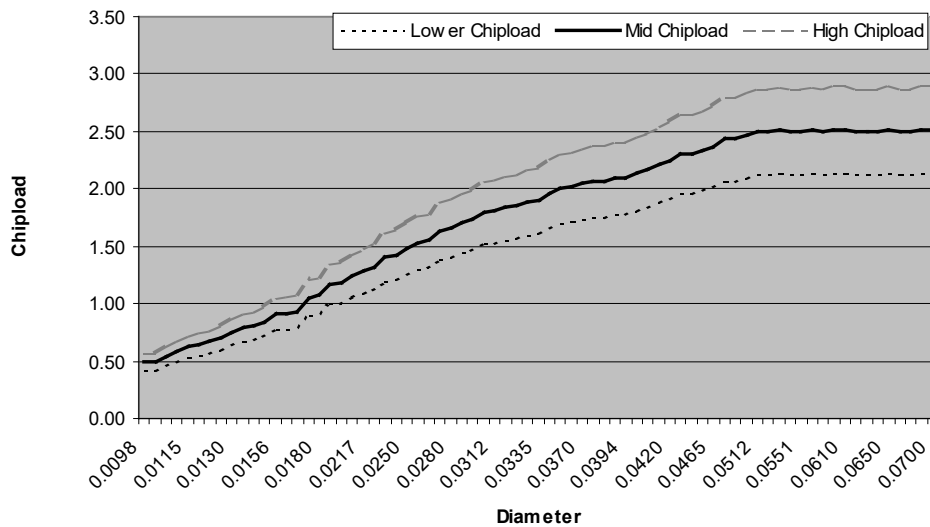
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Drill Size	Diameter (inch)	Feed (inch/min)	Speed (k-rpm)	Retract (inch/min)	Z-Axis Offset (inches)	Max Hits	Chipload (mm/rev)	SFM
5.65mm	0.2224	20	20	1000	-0.025	200	1.00	1164
5.70mm	0.2244	20	20	1000	-0.025	200	1.00	1174
5.75mm	0.2264	20	20	1000	-0.025	200	1.00	1185
#1	0.2280	20	20	1000	-0.025	200	1.00	1193
5.80mm	0.2283	20	20	1000	-0.025	200	1.00	1195
5.85mm	0.2302	20	20	1000	-0.025	200	1.00	1205
5.90mm	0.2323	20	20	1000	-0.025	200	1.00	1216
A	0.2340	20	20	1000	-0.025	200	1.00	1225
5.95mm	0.2343	20	20	1000	-0.026	200	1.00	1226
15/64	0.2344	20	20	1000	-0.026	200	1.00	1227
6.00mm	0.2362	20	20	1000	-0.026	200	1.00	1236
B	0.2380	20	20	1000	-0.026	200	1.00	1246
6.05mm	0.2382	20	20	1000	-0.026	200	1.00	1247
6.10mm	0.2402	20	20	1000	-0.026	200	1.00	1257
C	0.2420	20	20	1000	-0.026	200	1.00	1266
6.15mm	0.2421	20	20	1000	-0.026	200	1.00	1267
6.20mm	0.2441	20	20	1000	-0.026	200	1.00	1277
D	0.2460	20	20	1000	-0.026	200	1.00	1287
6.25mm	0.2461	20	20	1000	-0.026	200	1.00	1288
6.30mm	0.2480	20	20	1000	-0.026	200	1.00	1298
6.35mm	0.2500	20	20	1000	-0.027	200	1.00	1308
6.40mm	0.2520	20	20	1000	-0.027	200	1.00	1319
6.50mm	0.2559	20	20	1000	-0.027	200	1.00	1339
F	0.2570	20	20	1000	-0.027	200	1.00	1345
6.60mm	0.2598	20	20	1000	-0.027	200	1.00	1360

In some cases, there may be an opportunity to increase the chipload based on the application's robustness. Variables such as machine technology and condition, stack support materials, and Kyocera design selection may allow the increased throughput with higher chiploads. Multiply the recommended chipload by 1.15 to reach the higher chipload.

If the application is not as robust due to heavy glass, high copper content, tight annular ring requirements, or similar, multiply the recommended chipload by 0.85.

Chiploads for FR-4 Thick Panel



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