

Normalise to 128 x 63.6 mm	8140.8	TPGBB/Cu/Polyimide/CC module													
Item	No. off	Basic x (mm)	Basic y (mm)	Basic area	Less 1	Less 2	Less 3	Actual area	Thickne ss (mm)	Scaled area	Scaled thickness	X0 (mm)	Rad len (%)	Density	Mass (gm)
Module															
Silicon detectors	4	64	63.6	4070	0	0	0	4070	0.285	2.000	0.570	93.6	0.609		
Silicon detectors thermal adhesive	2	0	0	2356	0	0	0	2356	0.075	0.579	0.043	250	0.017		
FE amplifiers (eg CAFE)	12	4	7.2	28.8	0	0	0	29	0.35	0.042	0.015	93.6	0.016		
FE amplifiers thermal adhesive	12	4	7.2	28.8	0	0	0	29	0.075	0.042	0.003	43	0.007		
FE amplifiers (eg ABC)	12	5.5	6.2	34.1	0	0	0	34	0.35	0.050	0.018	93.6	0.019		
FE amplifiers thermal adhesive	12	5.5	6.2	34.1	0	0	0	34	0.075	0.050	0.004	43	0.009		
TPG baseboard (detector)(*1)	1	89.5	63.6	5692	2228.2	0	0	3464	0.38	0.426	0.162	190	0.085		
Baseboard double PEEK insert	1	5	4	20	0	0	0	20	0.75	0.002	0.002	319	0.001		
Baseboard single PEEK insert	1	4	3.83	15	0	0	0	15	0.75	0.002	0.001	319	0.000		
TPG baseboard (cooling-end)	1	60	18	1080	22	0	0	1058	0.38	0.130	0.049	190	0.026		
TPG baseboard (far-end)	1	31	7	217	0	0	0	217	0.38	0.027	0.010	190	0.005		
BeO facing (cooling-end)	2	60	18	1080	0	0	0	1080	0.25	0.265	0.066	144	0.046		
BeO facing (far-end)	2	31	7	217	0	0	0	217	0.25	0.053	0.013	144	0.009		
Glass fan-in	2	3.5	67	235	0	0	0	235	0.25	0.058	0.014	123	0.012		
Fan-ins tracks	2	3.5	67	235	164	0	0	70	0.001	0.017	0.000	89	0.000		
Fan-in adhesive	2	2.5	65	162.5	0	0	0	163	0.075	0.040	0.003	250	0.001		
Other hybrid components	41	2	1.5	3	0	0	0	3	1	0.015	0.015	89	0.017		
Capacitor pad solders	38	1.3	1.1	1.43	0	0	0	1	0.2	0.007	0.001	9.12	0.015		
Resistor pad solders	44	0.5	0.7	0.35	0	0	0	0	0.2	0.002	0.000	9.12	0.004		
Hybrids	2	74.6	21					1566.6	0.2933			84.383	0.134		
Hybrid substrates	2	74.6	21					1566.6	0.39681			186.2	0.082		
Pigtail cable	1	30	24.5					735	0.149			83.62	0.016		
Interconnect cable	1	9	21					189	0.149			95.509	0.004		
Connector pad	1	5	25					125	0.282			95.839	0.005		
Pigtail connector (plastic)	1	24	11	264	106	0	0	158	0.012	0.019	0.000	14.3	0.002		
Connector pad solders	34	1	1	1	0	0	0	1	0.2	0.004	0.001	9.12	0.009		
Hybrid connection solders	0	1	1	1	0	0	0	1	0.2	0.000	0.000	9.12	0.000		
Total =													1.149%		

*1) Old shape. New shape will add 0.016% Radiation length

Normalise to 128 x 63.6 mm= 8140.8																
Cu/Polyimide hybrid 17.5µm Copper, version3																
Item	No. off	Basic x (mm)	Basic y (mm)	Basic area	Less 1	Less 2	Less 3	Actual area	Thickne ss (mm)	Scaled area	Scaled thickness	X0 (mm)	Rad len (%)	Density (g/cm^3)	Mass (gm)	Measured weight (gm)
Main hybrids (2-in-1)	2	74.6	21					1566.6	0.2933			84.383	0.134		1.942	
Gold flash	2	74.6	21	1566.6	828	0	0	739	0.0003	0.181	0.000	3.35	0.002	19.3	0.009	
Nickel plating	2	74.6	21	1566.6	828	0	0	739	0.003	0.181	0.001	14.7	0.004	8.845	0.039	
Photoresist (20µ) layer	2	74.6	21	1566.6	671	0	0	895	0.02	0.220	0.004	286	0.002	1.42	0.051	
Copper+TH-plating layer (L1) (50% hash)	2	74.6	21	1566.6	828	425	0	314	0.032	0.077	0.002	14.3	0.017	8.96	0.180	
Polyimide+adhesive (25µ+25µ) layers	2	74.6	21	1566.6	0	0	0	1567	0.05	0.385	0.019	286	0.007	1.42	0.222	
Copper tracking (L2: 17.5um)	2	74.6	21	1566.6	1268	0	0	298	0.0175	0.073	0.001	14.3	0.009	8.96	0.094	
Polyimide (25µ) layer	2	74.6	21	1566.6	0	0	0	1567	0.025	0.385	0.010	286	0.003	1.42	0.111	
Copper gnd planes (L3: 17.5um)	2	74.6	21	1566.6	112	0	0	1455	0.0175	0.357	0.006	14.3	0.044	8.96	0.456	
Polyimide+adhesive (25µ+25µ) layers	2	74.6	21	1566.6	13	0	0	1554	0.05	0.382	0.019	286	0.007	1.42	0.221	
Copper+TH-plating layer (L4) (50% hash)	2	74.6	21	1566.6	112	836	0	618	0.032	0.152	0.005	14.3	0.034	8.96	0.355	
Polyimide cover+adhesive (13µ+33µ) layer	2	74.6	21	1566.6	0	0	0	1567	0.046	0.385	0.018	286	0.006	1.42	0.205	
Pig tail	1	30	24.5					735	0.149			83.62	0.016		0.254	
Polyimide+adhesive (25µ+25µ) layers	1	30	24.5	735.0	42	0	0	693	0.05	0.085	0.004	286	0.001	1.42	0.049	
Copper tracking	1	30	24.5	735.0	192	0	0	543	0.012	0.067	0.001	14.3	0.006	8.96	0.058	
Polyimide plane	1	30	24.5	735.0	42	0	0	693	0.025	0.085	0.002	286	0.001	1.42	0.025	
Copper gnd plane	1	30	24.5	735.0	87	0	0	648	0.012	0.080	0.001	14.3	0.007	8.96	0.070	
Polyimide/adhesive (25µ+25µ) layers	1	30	24.5	735.0	0	0	0	735	0.05	0.090	0.005	286	0.002	1.42	0.052	
Connector pad	1	5	25					125	0.2823			95.839	0.005		0.073	
Gold flash	1	5	25	125.0	80	0	0	45	0.0003	0.006	0.000	3.35	0.000	19.3	0.000	
Nickel plating	1	5	25	125.0	80	0	0	45	0.003	0.006	0.000	14.7	0.000	8.845	0.001	
Photoresist (20µ) layer	0	5	25	125.0	0	0	0	125	0.02	0.000	0.000	286	0.000	1.42	0.000	
Copper+TH plating layer (L1)	1	5	25	125.0	80	0	0	45	0.032	0.006	0.000	14.3	0.001	8.96	0.013	
Polyimide/adhesive (25µ+25µ) layers	1	5	25	125.0	0	0	0	125	0.05	0.015	0.001	286	0.000	1.42	0.009	
Copper tracking (L2)	1	5	25	125.0	105	0	0	20	0.012	0.002	0.000	14.3	0.000	8.96	0.002	
Polyimide layer	1	5	25	125.0	0	0	0	125	0.025	0.015	0.000	286	0.000	1.42	0.004	
Copper gnd plane (L3)	1	5	25	125.0	75	0	0	50	0.012	0.006	0.000	14.3	0.001	8.96	0.005	
Polyimide/adhesive (25µ+25µ) layers	1	5	25	125.0	0	0	0	125	0.05	0.015	0.001	286	0.000	1.42	0.009	
Copper+TH plating layer (L4)	1	5	25	125.0	80	0	0	45	0.032	0.006	0.000	14.3	0.001	8.96	0.013	
Polyimide cover+adhesive (13µ+33µ) layer	2	5	25	125.0	0	0	0	125	0.046	0.031	0.001	286	0.000	1.42	0.016	
Interconnect	1	9	21					189	0.149			95.509	0.004		0.065	
Polyimide+adhesive (25µ+25µ) layers	1	9	21	189.0	0	0	0	189	0.05	0.023	0.001	286	0.000	1.42	0.013	2.334
Copper tracking	1	9	21	189.0	72	0	0	117	0.012	0.014	0.000	14.3	0.001	8.96	0.013	
Polyimide layers	1	9	21	187.1	0	0	0	187	0.025	0.023	0.001	286	0.000	1.42	0.007	
Copper gnd plane	1	9	21	189.0	14	0	0	176	0.012	0.022	0.000	14.3	0.002	8.96	0.019	
Polyimide+adhesive (25µ+25µ) layers	1	9	21	189.0	0	0	0	189	0.05	0.023	0.001	286	0.000	1.42	0.013	
Substrate	2	74.6	21					1566.6	0.34681			205.05	0.065		2.725	
CC	2	74.6	21	1566.6	0	0	0	1567	0.3	0.385	0.115	218.1	0.053	1.95243	1.835	
CC "step"	4	4	21	84.0	0	0	0	84	0.5	0.041	0.021	218.1	0.009	1.95243	0.328	
Parylene (10 um)	4	74.6	21	1566.6	0	0	0	1567	0.01	0.770	0.008	286	0.003	8.96	0.561	
Gold flush (0.2 um)	4	74.6	21	1566.6	0	0	0	1567	0	0.770	0.000	3.35	0.000	19.3	0.000	
CC-hybrid glue	2	74.6	21					1566.6	0.05			113.7	0.017		0.405	
Silver loaded (75wt%) film (4% area)	2	74.6	21	1566.6	1505	0	0	62	0.05	0.015	0.001	42.767	0.002	3.6842105	0.023	
Alumina loaded (75wt%) film (96% area)	2	74.6	21	1566.6	62	0	0	1505	0.05	0.370	0.018	121.98	0.015	2.5393701	0.382	
												Total =	0.240%		5.464	
												X0 scaled by mass =	0	<<<<	Actual mass	