

Appendix A

Bonding Parameters

A.1 Flip Chip Bonding Parameters

Temperature for Arm and Chuck		Force	
Parameter	Value	Parameter	Value
t_1	5s	t_4	5s
t_2	5s	t_5	5s
t_3	5s	t_6	6s
tT_1	1200s	tF_1	1200
tT_2	10s	tF_2	1200
T_1	250 ⁰ C	F_1	1000g
T_2	300 ⁰ C	F_2	2400g
T_3	250 ⁰ C		

Table A-1) Parameters for flip chip bonding using gold (Au) stud bumps

Temperature for Arm and Chuck		Force	
Parameter	Value	Parameter	Value
T_1	30s	T_4	30s
T_2	30s	T_5	30s
T_3	30s	T_6	30s
tT_1	1200s	tF_1	1200
tT_2	10s	tF_2	1200
T_1	281 ⁰ C	F_1	5g
T_2	281 ⁰ C	F_2	10g
T_3	281 ⁰ C		

Table A-2) Parameters for flip chip bonding using Gold-Tin (AuSn) solder bumps

Temperature for Arm and Chuck		Force	
Parameter	Value	Parameter	Value
T_1	5s	T_4	5s
T_2	5s	T_5	5s
T_3	5s	T_6	5s
tT_1	1200s	tF_1	1200
tT_2	1200s	tF_2	1200
T_1	50 ⁰ C	F_1	1000g
T_2	95 ⁰ C	F_2	4000g
T_3	50 ⁰ C		

Table A-3) Parameters for flip chip bonding using ACF method

A.2 Gold Stud Bump Bonding parameters (Power, Time and Force)

Bonding Parameter	Value
Power	1-2
Time	2-5
Force	1-2 (40g)

Table A-4) Bonding parameters used to form gold stud bumps of height 65 μ m and diameter 50 μ m using manual ball bonder – K&S 4124

Key Parameters	Ball Bump (using 17 μ m wire)
Bond Time (mSec)	85
Ultrasonic Power (mWatts)	65
Bond Force (g)	65
Tail Length Extension (μ m)	254
EFO Spark Gap (μ m)	305

Table A-5) Gold stud bump parameters using the automatic ball bonder - K&S 1488

A.3 Ultrasonic Flip Chip Bonding Parameters

	Value
Force	Test chip: 15N, Photodetector: 8N, VCSEL: 2N
Power	1500mW
Time	800mSec
Background Temperature	150 ⁰ C (Maximum)

Table A-6) Ultrasonic flip chip bonding parameters used for attachment of Test chips, Photodetectors and VCSEL onto test modules