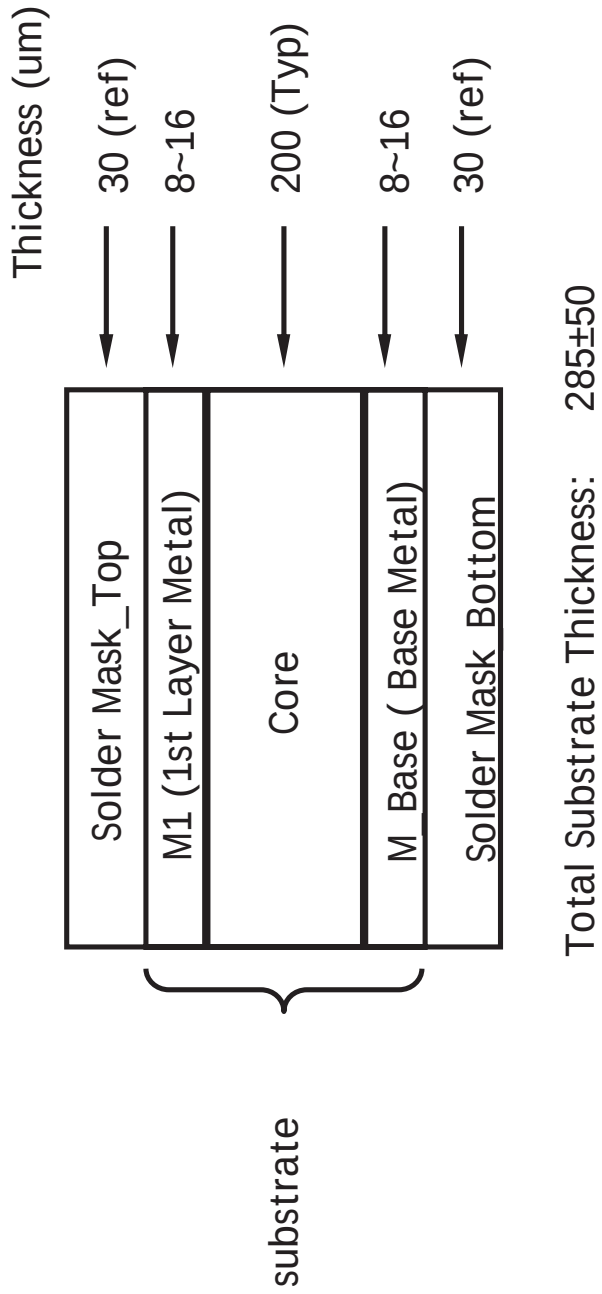

Thickness (um)
30 (ref)
8~16
200 (Typ)
8~16
30 (ref)
Solder Mask_Top
M1 (1st Layer Metal)
Core
M_Base (Base Metal)
Solder Mask_Bottom
substrate
Total Substrate Thickness: 285±50

Figure 1

Characteristics	Unit	Conditioning	Typical Values	Specs
Thermal Stress	SEC	288°C solder dipping	90^	10^
Coefficient of Thermal Expansion				
Z-axis before Tg	in/in/°C	TMA	5x10^-5	N/A
Z-axis after Tg			25x10^-5	

Note: TMA means ThermoMechanical Analysis

Figure 2

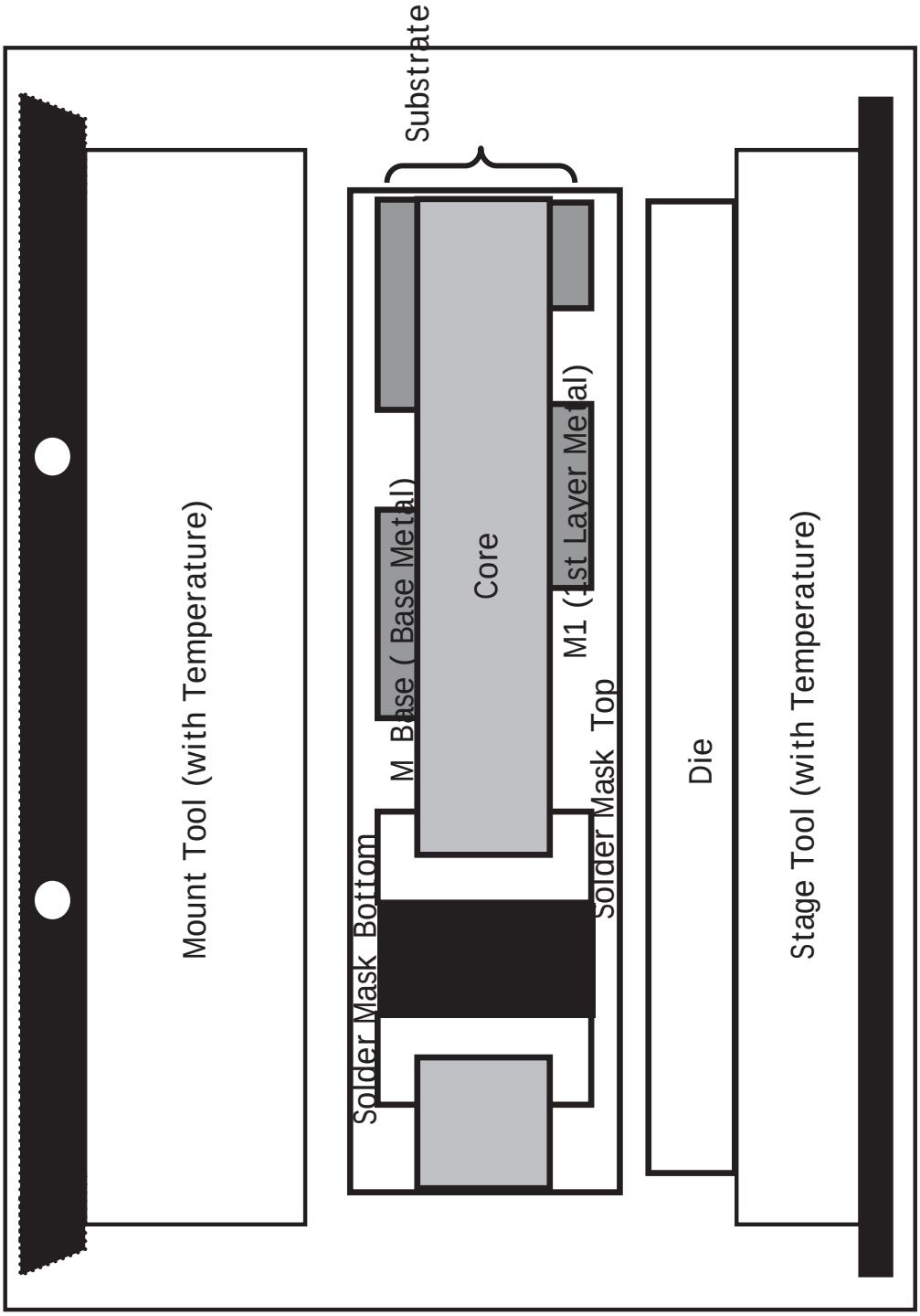

Mount Tool (with Temperature)
Substrate
Solder Mask Bottom
M Base (Base Metal)
Core
M1 (1st Layer Metal)
Solder Mask Top
Die
Stage Tool (with Temperature)

Figure 3

LEG	Pattern	MACHINE PARAMETER			OUTPUT VARIABLE RESPONSE		REMARKS
		Bond Temp (°C)	Bond Time (sec)	Bond Force (kgf)	Die Shear(kgf, AVE)	Die Drop / Peel-off (YES/NO)	
1	---	100	2	2	N/A	YES (@ Time Zero)	FAILED
2	--+	100	2	10	N/A	YES (@ Time Zero)	FAILED
3	-+-	100	10	2	N/A	YES (@ Time Zero)	FAILED
4	-++	100	10	10	N/A	YES (@ Time Zero)	FAILED
5	+--	200	2	2	N/A	YES (@ Time Zero)	FAILED
6	+-+	200	2	10	N/A	YES (@ Time Zero)	FAILED
7A	++-	200	10	2	15.64	YES (3/90 Die Dropped during Wire Bond; 4/87 Die Dropped before Mold; 26/83 Die Peeled-Off after MOLD)	FAILED, Refer to Attachment C
7B					15.21	YES (36/90 Die Peeled-Off after MOLD)	
8A	+++	200	10	10	15.89	NO (0/90 units)	PASSED, Refer to Attachment D
8B					15.73	NO (0/90 units)	

Figure 4A

LEG	Pattern	MACHINE PARAMETER			OUTPUT VARIABLE RESPONSE		REMARKS
		Bond Temp (°C)	Bond Time (sec)	Bond Force(kgf)	Die Shear(kgf, AVE)	Die Drop / Peel-off (YES/NO)	
1	---	150	1	1	N/A	YES (47/90 units)	FAILED
2	--+	150	5	10	6.59	NO (0/90 units)	Too High Bond Force
3	-+*	150	10	5	5.51	NO (0/90 units)	UPH constraint
4	*-+	175	1	10	6.45	NO (0/90 units)	Too High Bond Force
5	***	*175*	*5*	*5*	*10.13*	*NO (0/90 units)*	*PASSED*
6	*+-	175	10	1	5.17	NO (0/90 units)	Low Die Shear
7	+-*	200	1	5	8.91	NO (0/90 units)	Die Max Temp Capability
8	+*-	200	5	1	4.33	NO (0/90 units)	Low Die Shear
9	+++	200	10	10	12.25	NO (0/90 units)	Die Max Temp Capability

Figure 4B

Figure 5

	Parameter Setting						
Substrate Condition	Bare Substrate	Substrate with Soldermask (without oven baking)			Substrate with Soldermask (with oven baking)		
Bond Temp	100 - 475°C	200°C			200°C		
Bond Force	1 kgf - 10 kgf	10 kgf			10 kgf		
Bond Time	1-10secs	10secs			10secs		
sample	FAILED: No Die to Substrate Adhesion observed on all different parameter combination	Die Shear Specs: 2.5kgf min		Drop/Peel-Off Die / Die Crack	Die Shear Specs: 2.5kgf min		Drop/Peel-Off Die / Die Crack
		at Time 0	After 24hrs Staging		at Time 0	After 24hrs Staging	
1		16.30	15.30	N	9.55	2.75	N
2		15.45	15.90	N	8.85	0.00	Y
3		15.60	15.50	N	7.75	0.00	Y
4		15.50	15.15	N	8.90	0.00	Y
5		15.50	16.00	N	8.45	8.15	N
6		15.65	15.15	N	8.15	0.65	Y
7		15.50	15.15	N	7.60	2.75	N
8		15.20	15.90	N	7.75	0.50	N
9		16.90	17.10	N	8.50	0.00	Y
10		15.75	15.55	N	7.70	0.00	Y
11		15.00	15.10	N	7.85	0.00	Y
12		17.40	15.25	N	9.10	0.00	Y
13		16.05	15.60	N	7.70	0.00	Y
14		15.60	15.05	N	7.95	0.00	Y
15		15.70	15.55	N	8.35	7.70	N
16		15.73	16.40	N	8.70	0.10	N
17		15.30	15.30	N	9.10	0.95	N
18		15.10	15.25	N	7.60	0.00	Y
19		15.20	16.55	N	8.85	0.00	Y
20		15.90	16.25	N	8.35	1.55	N
21		16.30	15.65	N	7.80	0.45	N
22		16.95	15.35	N	8.55	4.80	N
23		16.55	15.10	N	7.45	2.15	N
24		15.00	15.75	N	7.60	7.30	N
25		15.90	15.25	N	7.70	0.00	Y
26		15.50	15.25	N	9.15	0.00	Y
27		15.10	16.35	N	8.35	0.00	Y
28		15.23	17.10	N	7.60	0.00	Y
29		15.30	17.25	N	8.75	0.40	N
30		15.75	15.00	N	7.75	0.85	N
min		15.00	15.00	PASSED	7.45	0.00	FAILED
max		17.40	17.25		9.55	8.15	
ave		15.73	15.70		8.25	1.37	

LEG	CONDITION	PARAMETER			DIE SHEAR (kgf, ave)	Die Drop / Peel-Off (YES/NO)
		Bond Temp (°C)	Bond Time (sec)	Bond Force (kgf)		
A	preHeat/preBake: OFF	175	10	5	11.08	0/90
B		175	5	5	10.13	0/90
C	preHeat/preBake: ON	175	10	5	7.93	0/90
D		175	5	5	7.59	0/90
E	preHeat/preBake: ON Laminator: ON	175	10	5		21/90
F		175	5	5		27/90

Figure 6

Key Parameters	Setting					
Bond Temp	200°C			200°C		
Bond Force	10 kgf (maximum)			2 kgf		
Bond Time	10secs (maximum)			1sec		
sample	Die Shear Response 2.5kgf min		Die Crack (Y/N)	Die Shear Response 2.5kgf min		Die Crack (Y/N)
	at Time 0	After 24hrs Staging		at Time 0	After 24hrs Staging	
1	16.30	15.30	N	9.55	8.75	N
2	15.45	15.90	N	8.85	9.15	N
3	15.60	15.50	N	7.75	7.65	N
4	15.50	15.15	N	8.90	7.90	N
5	15.50	16.00	N	8.45	8.15	N
6	15.65	15.15	N	8.15	7.65	N
7	15.50	15.15	N	7.60	7.75	N
8	15.20	15.90	N	7.75	8.50	N
9	16.90	17.10	N	8.50	7.10	N
10	15.75	15.55	N	7.70	7.85	N
11	15.00	15.10	N	7.85	9.15	N
12	17.40	15.25	N	9.10	8.70	N
13	16.05	15.60	N	7.70	8.95	N
14	15.60	15.05	N	7.95	7.35	N
15	15.70	15.55	N	8.35	7.70	N
16	15.73	16.40	N	8.70	8.10	N
17	15.30	15.30	N	9.10	7.95	N
18	15.10	15.25	N	7.60	8.35	N
19	15.20	16.55	N	8.85	7.20	N
20	15.90	16.25	N	8.35	7.55	N
21	16.30	15.65	N	7.80	7.45	N
22	16.95	15.35	N	8.55	8.80	N
23	16.55	15.10	N	7.45	9.15	N
24	15.00	15.75	N	7.60	9.30	N
25	15.90	15.25	N	7.70	8.55	N
26	15.50	15.25	N	9.15	7.60	N
27	15.10	16.35	N	8.35	8.35	N
28	15.23	17.10	N	7.60	8.00	N
29	15.30	17.25	N	8.75	9.40	N
30	15.75	15.00	N	7.75	8.85	N
min	15.00	15.00		7.45	7.10	
max	17.40	17.25		9.55	9.40	
ave	15.73	15.70		8.25	8.23	

Figure 7