Table 1. Key of Aperture Designs

Aperture Design	Color Code	Shape	Icon
A		Standard rectangular	
B		Rounded corner	
C		Rounded corner	
D		Home plate	
E		Inverted "V"	
F		Offset	

Table 2. Key of Aperture Measurements

X (1:1)

Component Type	Aperture Width (A)	Aperture Space (B)	Aperture Length (C)
1206	1.778	1.397	4.191
805	1.397	0.889	2.921
604	0.889	0.762	2.286
402	0.558	0.508	1.676
201	0.381	0.228	0.838
0.65 mm QFP	2.54	0.65	0.394
PLCC	2.07	1.27	0.8
0.65 SOIC	1.905	0.65	0.381

Y (Standard specification)

Component Type	Aperture Width (A)	Aperture Space (B)	Aperture Length (C)
1206	1.678	1.397	4.091
805	1.297	0.889	2.821
604	0.789	0.762	2.186
402	0.458	0.508	1.576
201	0.281	0.228	0.738
0.65 mm QFP	2.44	0.65	0.294
PLCC	1.97	1.27	0.7
0.65 SOIC	1.805	0.65	0.281

Z (Overprint)

Component Type	Aperture Width (A)	Aperture Space (B)	Aperture Length (C)
1206	1.878	1.397	4.291
805	1.497	0.889	3.021
604	0.989	0.762	2.386
402	0.658	0.508	1.776
201	0.481	0.228	0.938
0.65 mm QFP	2.64	0.65	0.494
PLCC	2.17	1.27	0.9
0.65 SOIC	2.005	0.65	0.481

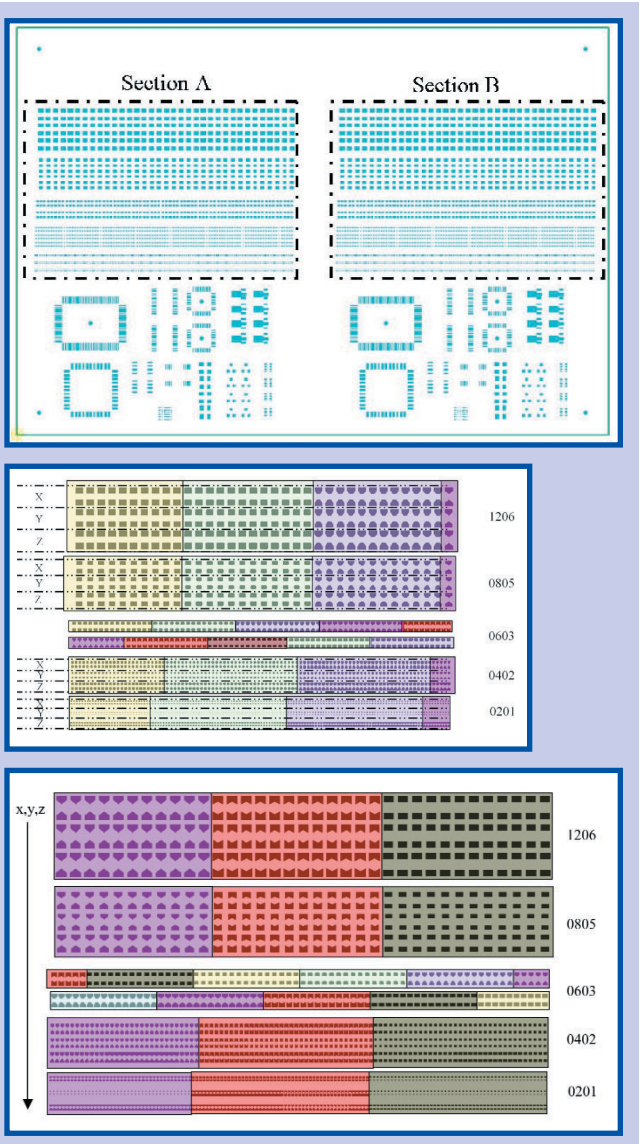

FIGURE 1: Map of aperture designs (top), with Section A (middle) and Section B (bottom) enlarged.

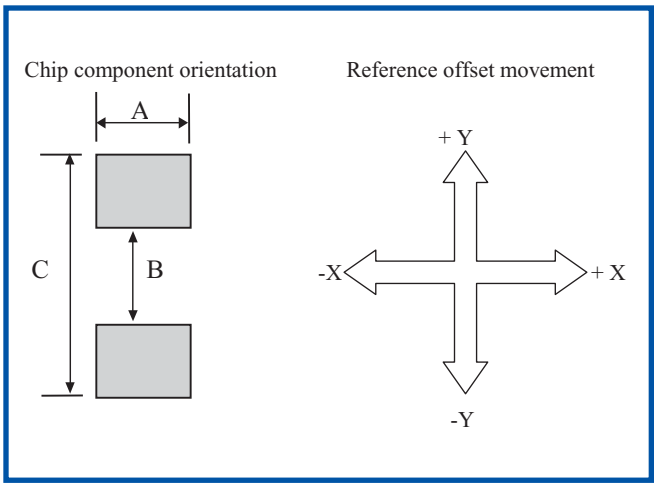

FIGURE 2: Attachment pad dimensioning.

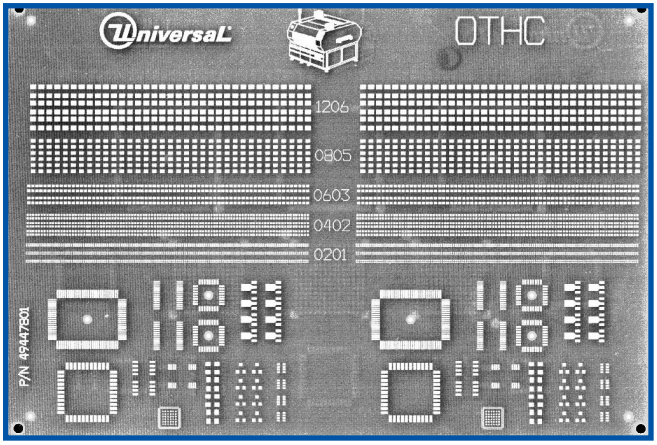

FIGURE 3: Photograph of test board.

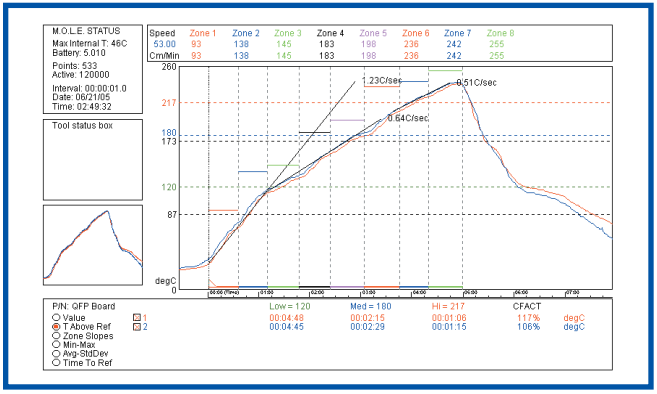

FIGURE 4: Reflow oven profile.

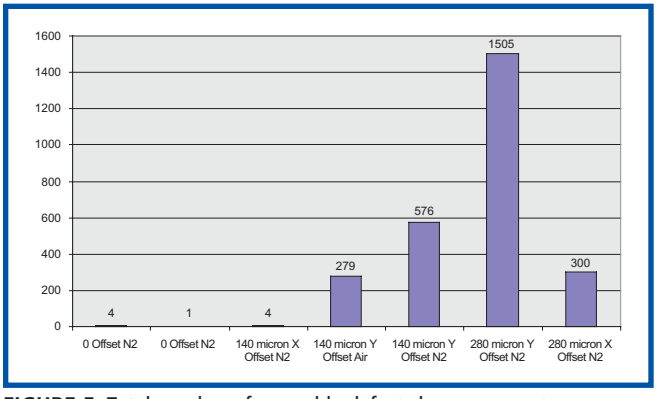

FIGURE 5: Total number of assembly defects by process setup.

Table 3. Pad Geometries

Component Type	Pad Width (A)	Pad Space (B)	Pad Length (C)
1206	1.778	1.397	4.191
0805	1.397	0.889	2.921
0604	0.889	0.762	2.286
0402	0.558	0.508	1.676
0201	0.381	0.228	0.838

Table 4. Log of Print Offsets from Each Run

Print	Material	Side	D / B	Print Direction	Print Offset	Reflow Atmos.
	Part A					
1	A	OTHC	Dummy	Fwd	0	N_2
2	A	OTHC	Dummy	Rev	0	N_2
3	A	OTHC	Build	Fwd	0	N_2
4	A	OTHC	Dummy	Fwd	0	N_2
5	A	OTHC	Dummy	Rev	0	N_2
6	A	OTHC	Build	Fwd	0	N_2
7	A	OTHC	Dummy	Rev	0	N_2
8	A	OTHC	Dummy	Fwd	0	N_2
9	A	OTHC	Build	Rev	+140 µm (x)	N_2
10	A	OTHC	Dummy	Fwd	+140 µm (x)	N_2
11	A	OTHC	Dummy	Rev	+140 µm (x)	N_2
12	A	OTHC	Build	Fwd	+280 µm (x)	N_2
13	A	OTHC	Dummy	Rev	+280 µm (x)	N_2
14	A	OTHC	Dummy	Fwd	+280 µm (x)	N_2
15	A	OTHC	Build	Rev	+140 µm (y)	N_2
16	A	OTHC	Dummy	Fwd	+140 µm (y)	N_2
17	A	OTHC	Dummy	Rev	+140 µm (y)	N_2
18	A	OTHC	Build	Fwd	+280 µm (y)	N_2
19	A	OTHC	Dummy	Rev	+280 µm (y)	N_2
20	A	OTHC	Dummy	Fwd	+280 µm (y)	N_2
21	A	OTHC	Build	Rev	+140 µm (y)	Air

Table 5. Solder Paste

Material Label	Alloy Type	Metal Content (%)
A	Sn96.5Ag3.0Cu0.5	89

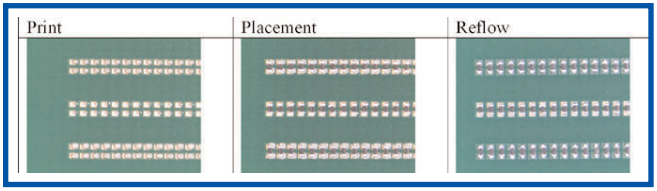

FIGURE 6: Photograph showing the complete 0201 process flow (140 µm +ve x with nitrogen).

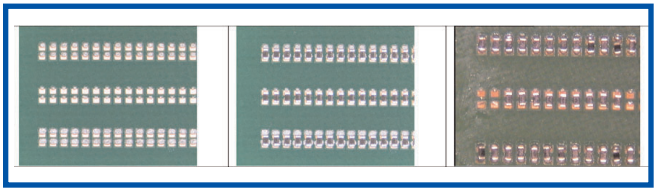

FIGURE 8: Photograph of the complete 0201 process flow (140 µm +ve y with air).

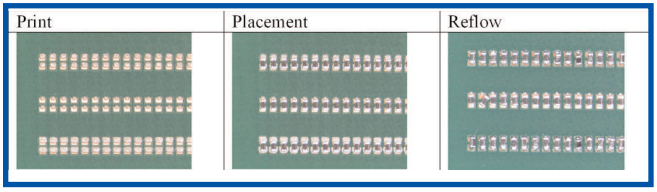

FIGURE 7: Photograph of the complete 0201 process flow (140 µm +ve y with nitrogen).

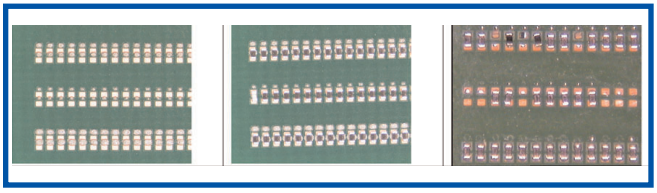

FIGURE 9: Photograph ofthe complete 0201 process flow (280 µm +ve y with nitrogen).

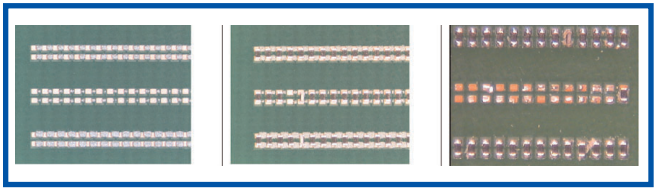

FIGURE 10: Photograph of the complete 0201 process flow (280 µm +ve x with nitrogen).

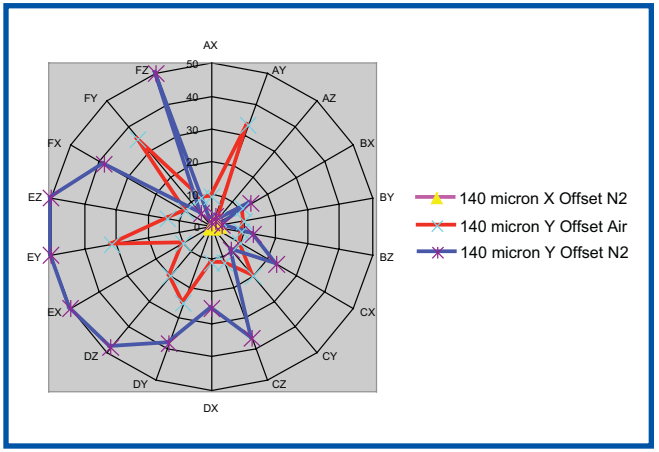

FIGURE 11: Assembly defects by aperture design (140 µm offsets only).

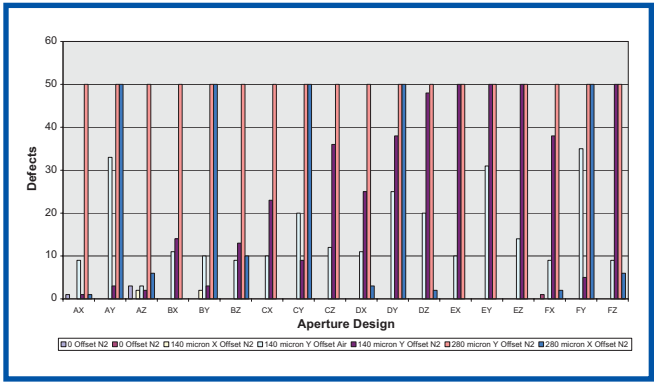

FIGURE 12: Assembly defects by aperture design (all offsets shown).