Is “Electronics Packaging” Possible for Small Business in the USA?

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IPC – Association Connecting Electronics Industries®

Electronics Manufacturing Steps

- Interactive design of chips, boards, and systems
- Wafer fabrication -
- Die packaging – including outsourced semiconductor assembly and test (OSATs)
- Printed circuit board fabrication
- Circuit board assembly
- Final “system build” and operational testing

Business Size/Capital Intensity

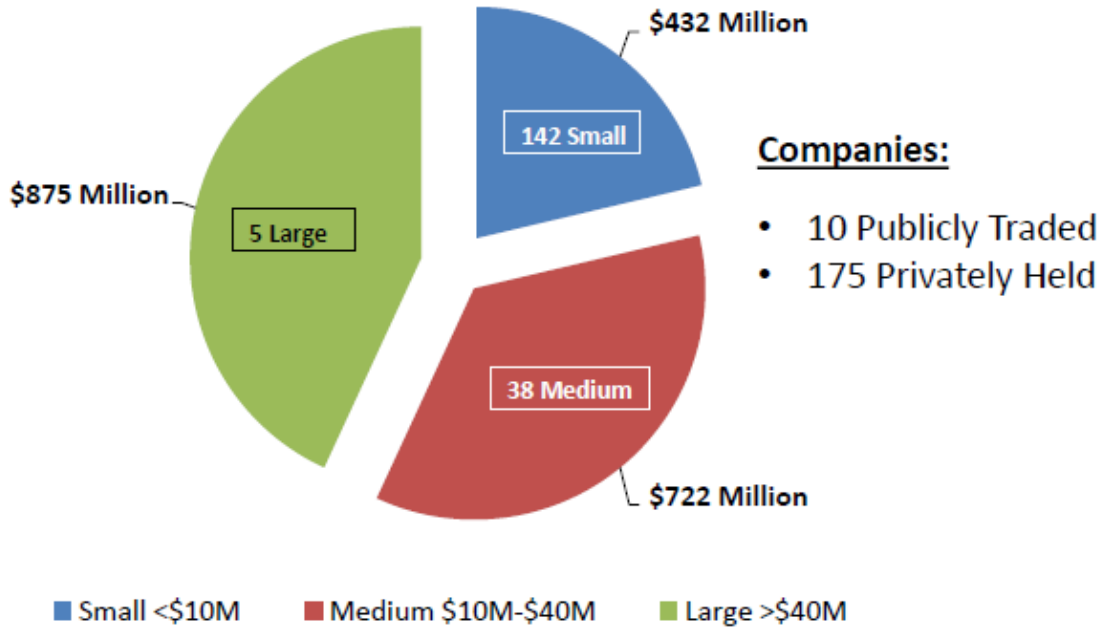
Step	Large	Medium	Small
Design	x	x	x
Wafer fab	XX		
Die Package	x		
Board Fab		x	X
Board Assembly	x	x	x
System Assembly	x		

Board Fabrication Shop Revenue/Size in the USA

BIS/OTE **U.S. Bare Printed Circuit Board Industry Assessment**

Bare PCB Sales 2015 – By Company Size

Bare PCB Sales by Company Size – Total $2.03 Billion in 2015



Companies:

- 10 Publicly Traded
- 175 Privately Held

RP / Q7

185 respondents

Source: U.S. Department of Commerce, Bureau of Industry and Security
U.S. Bare Printed Circuit Board Industry Assessment – 2017 - Unclassified

The USA Does Not Produce IC Substrate "Boards"

Estimates of 2016 PCB Production in the World's Major PCB-Producing Areas

In millions of U.S. dollars

Country or Region Where PCBs Were Produced	Rigid 1-2 Sided	Standard Multilayer	HDI/ Microvia/ Build-Up	IC Substrate	Flexible Circuits	Rigid Flex	Others	Total Aggregate Data in US$
China	2,091	12,548	5,950	774	6,340	325	0	28,028
Hong Kong	1	41	15	75	0	0	2	134
India	228	110	2	0	2	2	19	362
Japan	849	1,269	417	1,918	734	85	307	5,579
South Korea	577	1,903	1,197	2,049	1,055	311	0	7,093
Taiwan	597	1,639	1,299	1,972	1,577	164	0	7,248
Other Asia	482	814	358	546	2,462	34	21	4,716
Western Europe	478	815	224	0	204	149	0	1,870
Eastern Europe	57	33	0	[illegible]	0	0	0	90
North America	355	1,571	200	3	45	52	335	2,561
Central & South America	11	6	0	[illegible]	0.3	0	0	17
Middle East & Africa	2	23	10	0	2	31	0	67
Global Total	5,727	20,771	9,673	7,337	12,421	1,153	684	57,765

Source – World Electronics Circuits Council 2016 Report (from circuit associations around the world, including IPC).

OSATs - Not a Small Business and Not in the USA

Table: Projected Top 10 OSAT Providers by Revenue for 2017 **(Revenue in US$ Million)**

Ranking	Company	2017 Revenue (E)	2016 Revenue	YoY	2017 OSAT Market Share (E)
1	ASE Group	5,207	4,896	6.4%	19.2%
2	Amkor	4,063	3,894	4.3%	15.0%
3	JCET	3,233	2,874	12.5%	11.9%
4	SPIL	2,684	2,626	2.2%	9.9%
5	PTI	1,893	1,499	26.3%	7.0%
6	TSHT	1,056	823	28.3%	3.9%
7	TFME	910	689	32.0%	3.3%
8	KYEC	675	623	8.3%	2.5%
9	UTAC Group	674	689	-2.2%	2.5%
10	ChipMOS	596	568	4.9%	2.2%

Source: TrendForce, Oct., 2017

Note: The full names of companies listed in the table are as follows -- ASE Group (Advanced Semiconductor Engineering, Inc.), Amkor (Amkor Technology, Inc.), JCET (Jiangsu Changjiang Electronics Technology Co., Ltd.), SPIL (Siliconware Precision Industries Co., Ltd.), PTI (Powertech Technology Inc.), TSHT (Tianshui Huatian Technology Co.,Ltd.), TFME (Tongfu Microelectronics Co., Ltd.), KYEC (King Yuan Electronics Co., Ltd.), UTAC Group (United Test and Assembly Center Ltd.), ChipMOS (ChipMOS Technologies Inc.).

Solution? – Previously Proposed NNMI Language

An Electronics Packaging and Reliability Institute would scale up manufacturing processes currently proven in labs or prototype facilities and intended for consumer electronics while ensuring that reliability was increased for use in the safety-critical sectors of aerospace, defense and transportation. The scope would include verifiable closed-loop design and development processes that have the capabilities necessary to provide a positive means of control of the key/critical parameters. The institute focus would include Integrated Circuit Packaging, manufacturing processes for reliable first level (die to package external connections) interconnects and circuit assembly, failure models for first and second level interconnects addressing Defense environmental and operational stresses, low temperature bonding with adhesives, thin film coatings, and of course system level co-design tools to transition leading practices upstream.

IPC Support for Defense and Small Business/Board Fabricators

July 26, 2018 – IPC – Association Connecting Electronics Industries® is applauding leaders in the U.S. House and Senate for finalizing the FY2019 National Defense Authorization Act (NDAA) and including a provision on military electronics backed by IPC.

Section 845 of the bill calls on the Secretary of Defense, in consultation with the Executive Agent for Printed Circuit Board and Interconnect Technology (based at the Naval Surface Warfare Center in Crane, Indiana) and the Director of the Office of Management and Budget (OMB), to prepare a report to Congress by January 2019 on the health of the U.S. defense electronics industrial base. The report will include an examination of the Department's partnerships with industry and a plan to formalize the long-term resourcing of the Executive Agent.

1. Conclusions

- The current structure of the US Printed Circuit Board (PCB) industrial base will not allow the investment necessary to integrate forward into Chip Packaging.
- We need financial and technical help on materials, equipment, and processes to establish a "packaging foundry" for a secure supply chain for Defense electronics

Back-up Slides

Solution? – Previously Proposed NNMI Language

Concurrently, the industry is pursuing dramatic reductions in size, weight and power (SWaP) which can be gained through advanced packaging architectures such as System-in-Package, Wafer Level Packaging, Chip Stack MCM, or Through Silicon Vias (TSV). Further integration at the chip and die level is crucial to continue the progression of Moore's Law, which is simply based upon the size and number of transistors on a chip. This new trend, known as "More than Moore", will ultimately lead to high-density, multifunctional electronics.

Specific IPC Pb-free Electronics Risk Management Program for Pb-free Research

Purpose: IPC would like to end the reliance of the high reliability electronics industry on SnPb-based technology, which was abandoned by the commercial electronics industry 15 years ago, by filling the remaining knowledge gaps through R&D.
The Right Timing and Atmosphere: The federal government (Bureau of Industry and Security) recently completed an assessment of the PCB industry. Findings show the U.S. domestic industry's continued decline. The government-sponsored assessment calls for increased federal investment for R&D spending in critical areas to PCB Industry/Electronics Supply Chains. We will have an interested audience for the proposal.