NEWS

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sti electronics inc

Leading the way in electronics





Merry Christmas
STI Electronics, Inc.

DAVE'S WORLD

By: Dave Raby

December 2014

As usual, it has been an interesting few months. We've had separate visits from Alabama Governor Robert Bentley, United States Representative Mo Brooks, and United States Representative Robert Aderholt to show off our growing small business and discuss various important issues.

We exhibited at the SMTAI Conference in Chicago which is one of my favorite weeks of the year. It is a great time to see old friends and meet new ones. Frank Honyotski was there to represent us in the High Temp Soldering area. STI does a tremendous amount of training as well as engineering and manufacturing for high temp applications. The show seemed better attended than in the past few years which is probably due to multiple factors but hopefully is a good sign for the industry overall. We also had Mel Parrish and Pat Scott there just to attend the IPC Committee meetings to provide input to the standards development meetings and the standards training meetings since we write multiple lesson plans for the industry.

I attended the IPC's EMS Management meeting in Raleigh at the end of October. I always learn something at those meetings and this one was no exception.

Mark McMeen, Vice President of Engineering/Manufacturing, was a keynote speaker at the SMTA/IPC High Performance Cleaning and Coating Conference in Chicago in November. Mark spoke of some of the research STI has been doing on cleanliness and some exciting things you can expect from us on this subject in the future.

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STI's employees continue to amaze me. They raised almost $2,000 for Parkinson's research and now are in the middle of our annual can-a-thon to help people in need in the Tennessee Valley. This year's can-a-thon was given an Iron Bowl theme (Auburn vs Alabama) to make it competitive and as a result the participation was bigger than ever. The employees of STI donated almost 1,000 non-perishable food items to benefit North Alabama and the surrounding area. Thankfully there was

DAVE'S WORLD cont.

no bloodshed during the competition, although we do have a blood drive coming up and Krispy Kreme Doughnuts are involved..... As you can see STI and its employees are very active in our community and plan to increase our impact in the coming year.

2014 has been quite a year for STI. We opened training centers in Houston, Texas and Odon, Indiana. We have instructors (full time STI employees) based in each of those. We are currently looking for full time instructors in Alabama, Texas and Mexico so if you know anyone who might be interested please have them contact Diana Bradford at dbradford@stielectronicsinc.com.

We sold our distribution business to HISCO this summer which has changed a lot of things within STI and I believe all of them are for the good.

Jim & Ellen retired this year and are enjoying doing whatever they want to do, whenever they want to do it. Jim & I went fishing recently and enjoyed our day together. Ellen has been hard at work decorating for Christmas and baking the cookies that made her famous.

We've worked hard this year on improving our processes in all areas. That will be an ongoing job but we are more efficient and producing better quality than we were this time last year. But as good as 2014 has been, it really has just been a platform from which to leap into 2015. I expect the new year to be our best yet as we launch exciting new products and technology enabling us to continue to improve in all facets of what we do. In addition to more classes at all of our locations, we'll be doing various online classes/seminars. I expect we'll have two new certifications to tell you about in the next newsletter.

Thank you for your support in making 2014 such a great year. I wish you a Happy Holiday season, a Merry Christmas and a Happy, Healthy, and Prosperous New Year. I look forward to serving you in 2015 and as always, if there is anything we can do to serve you better, please let us know. You can contact me or anyone else listed anywhere in this newsletter.

Please follow us on twitter (@daveraby) or facebook (STI Electronics) for more up to date STI information.

STI Social Media

STI's Newsletter will be released March, June, September and December. Follow us on Linked In, Facebook and Twitter for a chance to win an iPod Mini. Drawings will take place after the release of each newsletter from our list of Social Media followers.

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Find out what's new with STI
by visiting any one of these
Social Media Sites
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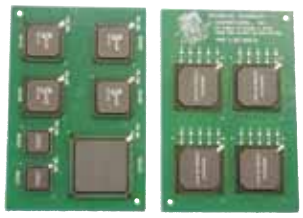
http://www.stielectronicsinc.com

STI's E-Stores

We always like choices in life and now you can purchase any of our training kits and components including IPC materials at either of our e-store locations.



amazon.com

To visit our new Amazon Store, go to http://sti-electronics-inc1.hostedbywebstore.com/

or go to http://estore.stielectronicsinc.com/.

TRAINING SERVICES

Many of you have received emails regarding IPC's Certification Quality Initiative (CQI) and the new online portal that allows for online reporting and online testing.

Here are some important dates you should keep in mind:

- October 1, 2014 CIS and CIT Programs available for online reporting and exams.
- January 1, 2015 All reporting will be online only –
- IPC will no longer accept "word document" reporting
- IPC will no longer sell paper certificates
- April 1, 2015 IPC will no longer support paper certificates
- All certificates will be issued through CQI and will be tracked through unique serial numbers
- Training Centers and CITs must use online exams/online certificate printing

Change is always challenging but in order to embrace change you need to understand the process. When it comes to understanding CQI the best place to get information from is the IPC Website at www.ipc.org. The knowledge tab will direct you to the Certification Quality Initiative (CQI) information. Here you will find the following: CQI Overview, Certification Portal, User Guide, etc. If you go to the IPC Certification Portal you will find a help tab that has the User Guide, Frequently Asked Questions (FAQ), and How to Videos. After reviewing this information if you have questions you can contact IPC directly. Remember we're also here to help so if you have any questions please let us know.

Currently STI has transitioned to online reporting for all courses and will be providing online testing the first quarter of 2015.

Contact Information:
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With the release of the J-STD-001F and IPC-A-610F standards comes the development of the training curriculum. The J-STD-001F Certified IPC Trainer (CIT) Certification Beta Course is schedule December 8-12, 2014. The IPC-A-610F CIT Certification Beta Course is scheduled February 2-5, 2015. Both these courses will be conducted at STI using on-line testing.

Please check out our 2015 course schedules for our Madison, AL and Houston, TX facilities. Remember we also conduct all training on-site.

STI's Training Services

2015 Schedule

J-STD-001 "Requirements for Soldered Electrical and Electronic Assemblies"

J-STD-001 Certified IPC Trainer (CIT) Certification Course - Madison, AL

February 9-13
April 6-10
June 1-5
August 3-7
September 28-October 2
December 7-11

J-STD-001 Certified IPC Trainer (CIT) Recertification Course - Madison, AL

January 7-8
March 18-19
May 20-21
July 29-30
September 23-24
November 18-19

February 11-12
April 22-23
June 24-25
September 2-3
October 21-22
December 16-17

J-STD-001 Certified IPC Trainer (CIT) Space Addendum Course - Madison, AL

January 9
March 20
May 22
July 31
September 25
November 20

February 13
April 24
June 26
September 4
October 23
December 18

J-STD-001 Certified IPC Application Specialist (CIS) Certification Course (Modules 1-6) - Madison, AL

January 26-30

April 27-May 1

J-STD-001 Certified IPC Application Specialist (CIS) Recertification Course (Modules 1-6) - Madison, AL

September 9-11

IPC-A-610E "Acceptability of Electronic Assemblies"

IPC-A-610 Certified IPC Trainer (CIT) Certification Course - Madison, AL

March 23-26
June 1-4
October 5-8

April 27-30
July 13-16
December 14-17

IPC-A-610 Certified IPC Trainer (CIT) Recertification Course - Madison, AL

January 5-6
March 16-17
May 18-19
July 27-28
September 21-22
November 16-17

February 9-10
April 20-21
June 22-23
August 31-Sept 1
October 19-20
December 14-15

IPC-A-610 Certified IPC Application Specialist (CIS) Certification/Recertification Course - Madison, AL

January 12-14

July 7-9

MSFC/NASA-STD-8739.4 Cable Harness Certification Operator/Inspector

March 23-27

September 14-18

MSFC/NASA-STD-8739.1 Staking and Conformal Coating Operator/Inspector

August 31-September 3

Basic Soldering - Madison, AL

June 29-July 2

Training Services • Curriculum Development • Highly Skilled Staff

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www.stielectronicsinc.com

2015 Schedule

IPC/WHMA-A-620 "Requirements and Acceptance for Cable and Wire Harness Assemblies"

IPC/WHMA-A-620 Training Center

IPC/WHMA-A-620 Certified IPC Trainer (CIT) Certification Course - Madison, AL

February 23-26
August 17-20
May 11-14
December 1-4

IPC/WHMA-A-620 Certified IPC Trainer (CIT) Recertification Course - Madison, AL

January 20-21
April 2-3
June 10-11
October 26-27
February 19-20
May 28-29
September 10-11

IPC/WHMA-A-620B Certified IPC Trainer (CIT) Space Addendum Course - Madison, AL
Prerequisite: IPC/WHMA-A-620B CIT Certification or Recertification Course.

March 2-6
June 22-26
April 6-10
August 24-28

IPC/WHMA-A-620 Certified IPC Application Specialist (CIS) Certification/Recertification Course - Madison, AL

May 27-29
October 28-30

IPC-7711/7721 Rework, "Modification and Repair of Electronic Assemblies"

IPC-7711/7721 Training Center

IPC-7711/7721 "7721B Rework, "Modification and Repair of Electronic Assemblies"

IPC-7711/7721 Certified IPC Trainer (CIT) Certification Course - Madison, AL

March 23-27
November 2-6
July 20-24

IPC-7711/7721 Certified IPC Trainer (CIT) Recertification Course - Madison, AL

January 22-23
September 10-11
June 8-9
October 28-29

IPC-7711/7721 Certified IPC Application Specialist (CIS) Certification Course - Madison, AL

July 6-14
November 9-17

IPC-7711/7721 Certified IPC Application Specialist (CIS) Recertification Course - Madison, AL

November 2-3

IPC-A-600E "Acceptability of Printed Boards

IPC-A-600 Training Center

IPC-A-600 Certified IPC Trainer (CIT) Certification/ Recertification Course - Madison, AL

March 30-April 1
June 29-July 1

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www.stielectronicsinc.com

TRAINING MATERIALS

Contact Information:
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New Lead Free Mixed Technology Training Kit

The Mixed Technology Training Kit is one of our best sellers and a favorite of our customers and our own Training Services Department. The layout uses a mixture of through hole and surface mount devices and more than adequately simulates actual production assemblies for our industry. Many of our customers prefer to use this kit for their internal training and certification programs. Previously we offered two types of board finishes for this kit: Tin Lead and Lead Free/Immersion Silver (ImAg). We created the Immersion Silver version by request for a custom kit but as Immersion Silver has fallen off in popularity and is a bit of a challenge to work with, we are now offering a new Lead Free version that uses HASL LF.

Also, as a result of the IPC J-STD-001 Training Committee, we are in the process of redesigning the Training and Certification Kit which should be available 1/2015. The J-STD-001 training subcommittee decided to replace the single QFP-100 that had 25 mil spacing with two QFP100 at 20 mil spacing similar to the IPC-7711 Certification Kit. Additionally, 0402 chips and bottom termination DPAKs will be added to the board. This component selection should prove to be a significant increase in skill development required for the practical workmanship portion of certification training.

Our feature kit this month will be the new Lead Free Mixed Kit with HASL LF finish.

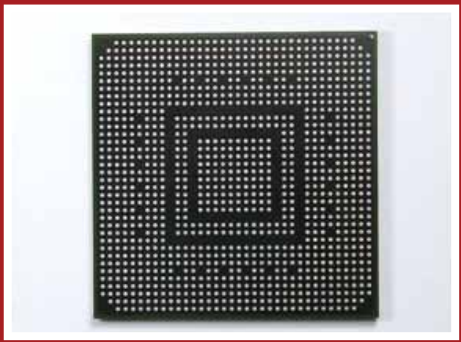

Figure 1: Underside of BGA Component

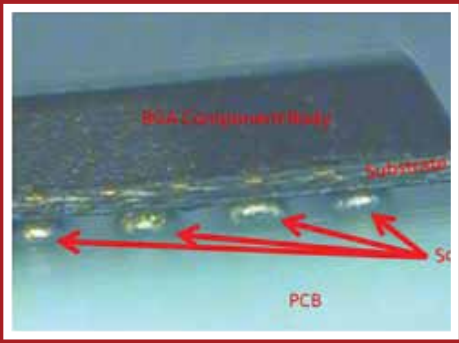

Figure 2: BGA Attached to PCB

Vibration Testing:

Why Is It Important? (Part 1 of 2)

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With increasing reliance on "smart" technologies, the need for robust electronics becomes a necessity. Ball Grid Arrays (BGA), in particular, are heavily relied upon for performance in demanding environments. Integrated Circuits (IC) are commonly integrated into BGA packages, and are used for critical data processing and decision making in embedded systems. BGA's, as the name would suggest, utilize a grid of tiny solder balls to connect to the Printed Circuit Board (PBC) (See Figure 1). These solder balls serve as the sole electro-mechanical link between the BGA and the rest of the system (see Figure 2). Any damage to solder connections can negatively impact performance. An unreliable solder joint on a BGA has the potential to render the entire system unreliable. In a children's toy, this may not be a major issue, but in a weapons system on the wing of an aircraft for example, the penalty for unreliability increases exponentially.

There is, therefore, a need to qualify design, manufacturing, and deployment activities for hardware being used in harsh environments. Consider an electronic sensor on a forward-deployed all-terrain military vehicle. Such a system could experience a wide range of environmental conditions, from paved to dirt roads to debris-strewn corridors – and any variety of speed, shock, and vibration level. Yet, the system must remain as reliable in the field as on a workbench in a lab. This is the first installment of a two-part series on vibration testing in electronics. Here, we will explore the theory and importance of vibration testing. By establishing a foundational understanding of the topic in part one, the subsequent publication will focus on application and empirical results. Ultimately, the reader will be more capable of making informed decisions when encountering vibration-related issues. Most vehicles exhibit known and quantifiable shock and vibration environments, known as profiles. These profiles describe the conservative amount of vibrational energy directed at all objects attached to the vehicle. The energy is described in terms of energy and frequency. Depending on the characteristics of the vehicle, some frequencies will

have more energy available than others. For example, a four cylinder engine turning at 2250 rpm has 9000 combustion events per minute, or 150 per second. These predictable combustion events could conceivably introduce more available oscillation energy at 150 Hz. For equipment within the vehicle that has normal modes near this frequency can be easily excited by this vibration profile, causing exaggerated stress levels for this hardware. The same principles apply to other vehicles and other hardware, including electronics.

Normal modes of an oscillating system are the patterns of motion in which all parts of the system move sinusoidally with the same frequency and with a fixed phase relation. The first mode is characterized by the lowest frequency at which the system oscillates and typically presents the largest deflections from neutral. For a simply-supported board similar to that of the sample CCA, the center of the board would exhibit the largest movement, while the short ends of the board remain at a neutral position. See Figure 3. The second mode is typically a multiple (or octave) of the first mode, but has a different shape. For the sample CCA, the center and short edges of the board would be stagnant, while the two sections on either side of the center move out of phase with one another. The amplitude of the second mode is considerably less than the first. The third mode takes yet another shape, with a corresponding reduction in amplitude.

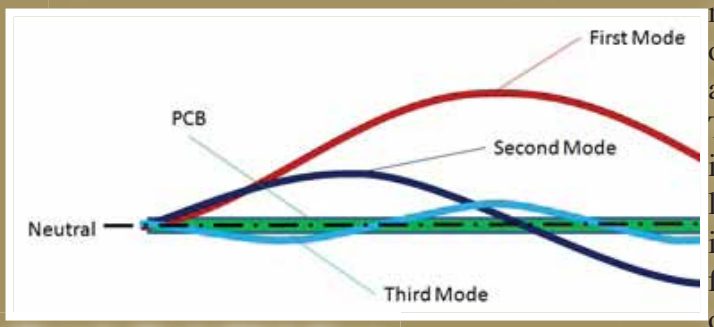

Figure 3: Classical Mode Shapes

The amplitude of each mode represents the system's propensity to amplify driving motion at that particular frequency. The reduction in amplitude can be associated with the duration of the force being applied in a particular direction. For an oscillating force at 500Hz, the direction of the force reverses every millisecond. At 1000 Hz, the force reverses direction every 0.5 millisecond. Classical dynamics suggests that the energy of an object in simple harmonic motion is proportional to the square of the amplitude of the wave and inversely proportional to its frequency ($E_{Total} = A^2 \frac{m}{2f^2}$). Doubling the frequency (cutting the acceleration time in half), while maintaining the same energy level, has the effect of quartering the amplitude (displacement). Higher frequency forces exhibit significantly lower amplitudes. Figure 3 shows a simple, one-dimensional representation of a three-dimensional phenomenon. There are modes that produce shapes that vary normal to the page. For example, a "potato chip" mode is common on PCB's as low as the third mode. This mode shape is characterized by large displacements in each of the four quadrants of the board, but two diagonal quadrants are out of phase with the other two. Any amplification effect tends to locally increase stresses in the board and solder connections. The larger the amplification, the higher the risk of damaging hardware. The last factor that is often overlooked in determining a parts risk of damage is its size. Consider a small row boat on choppy seas. Though the row boat is tossed around violently, it is in constant contact with the water. The water is fully supporting the length of the boat. Now consider a long ship. Though the ride is much smoother than that of the small row boat, there are segments of the ship that are not in contact with the water. The lack of contact requires for the surrounding ship structure to carry the increased load. See Figure 4. This produces stresses in the hull.

A similar situation occurs with components on a board. Unlike a boat on choppy seas, however, the solder between the part and board terminations seeks to maintain contact between the component and board. Figure 5 depicts this scenario.

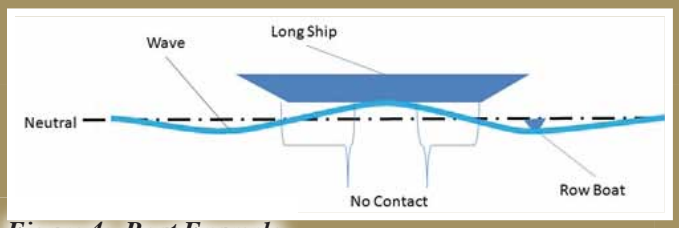

Figure 4: Boat Example

Maintaining connection during vibration can increase the stress when the board deflects. Because larger parts span a larger area, there is an increased probability of those parts residing on maxima (peak or trough) and reversals. Solder has both strength and fatigue limits that can be exceeded, resulting in local or cross-sectional failure. Stress in a CCA is not uniform throughout the board, but depends, rather, on the frequency, amplification, mode shape, and part size, among other design characteristics. For sensitive components, as in real estate, location matters.

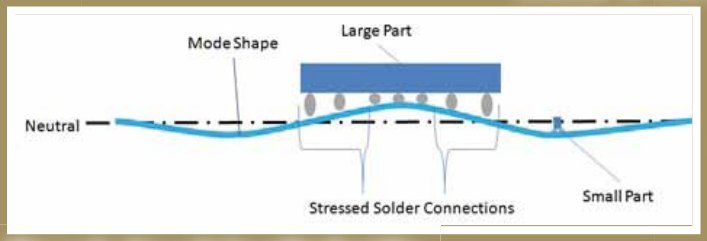

Figure 5: Stress Induced by Part Size

Stress in a CCA is also dependant on environmental conditions. A board with a first mode at 500Hz, as opposed to 800Hz, is not necessarily undesirable. In an environment with a significant amount of vibrational energy at 800Hz would likely cause more damage to the 800Hz board than the 500Hz board (provided there are no secondary or tertiary modes at or near 800Hz!). Hardware should be designed for the environment in which it is expected to be subjected to. With such a wide range of variables contributing to damage and/or subsequent failure, it should also be tested in a representative, yet conservative, environment to demonstrate its capability of surviving such an environment.

Most damage due to vibration in electronics occurs from the impact of the first and second modes. Identifying their frequencies and shapes becomes a necessary exercise when establishing a CCA attachment scheme as well as critical component placement in harsh environments. A common way of establishing these system properties is to affix a representative PCB to a single axis shaker table, and impose a uniform random vibration profile between 100 and 2000Hz. Outfitting the unit under test with an array of accelerometers, the intent is to identify frequencies and mode shapes specific to the design. Comparison of natural frequencies to environmental specifications allows for the intelligent placement of sensitive and/or large components. During such testing, it is important to be cognizant of the fact that all components add weight to the PCB, which reduces the frequency (and subsequently increases the amplitude) of each mode. A bare board first mode of 500Hz, for example, usually drops once populated with components.

The increased susceptibility to damage, coupled with the criticality of BGA components underscores the need for shock and vibration testing. This testing imposes conservative loads on the electronics, uncovering issues with board support schemes and/or manufacturing workmanship. The next part of this series will provide empirical results from sample circuit cards. It will explore frequency response spectrums, amplification and attenuation, and product life expectancy. By applying representative vibration profiles to sample hardware in order to produce real response data, the reader will be able to better understand their own vibration results.

Look for Part 2 of Jason's article in the March issue of STI's Newsletter.


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wishes You and Your Family
a Merry Christmas
and a Happy New Year