ENGINEERING PRACTICES STUDY

TITLE: Destructive Physical Analysis for Diodes and Transistors Under the MIL-PRF-19500 Program

October 25, 2004

STUDY PROJECT 5961-D198

FINAL REPORT

Study Conducted by Alan Barone

Prepared by

Alan Barone

I. OBJECTIVE: The objective of this study was for the device manufactures, OEMs and the services to come to a consensus on the appropriate use of DPA testing on MIL-PRF-19500 semiconductor product.

II. BACKGROUND: See preliminary engineering practices study dated 11 August, 2004 (See attachment 1).

III. RESULTS: A meeting was held at the September 2004 JEDEC meeting in Columbus Ohio to discuss DPA and the preliminary EP Study dated 11 August, 2004. (See attendee's list attachment 2). NASA representative (Benny Damron) and the Army representative (Jeff Jarvis) were concerned over not being able to get baseline information on MIL-PRF-19500 products. The manufacturers and DSCC indicated that all the information that a separate DPA test would generate is already available upon request on the 36D and the qualification data as provided by DSCC. This discussion led to the service representatives agreeing to allow DSCC to rescind the DPA testing requirements from individual slash sheets. (See attachment 3).

IV. CONCLUSION: DPA test methods are available in MIL-STD-750 and in MIL-STD-1580 as needed. DSCC will retain the reference in Appendix E of MIL-PRF-19500 for use in contractor prepared documents. OEMs and the services may invoke these methods in purchase orders or contract on an as needed based. Baseline criteria is available from device manufacturers (36D) and data from the DSCC qualifications report that can satisfy agency needs for DPA reports.

DSCC will rescind DPA on all dated MIL-PRF-19500 specifications sheets. DPA will no longer be imposed on all specifications sheets.

V. RECOMMENDATIONS: This final study report will be disseminated to all interested parties both in military and industry to document these technical deliberations and conclusions.

Attachment 1

ENGINEERING PRACTICES STUDY

TITLE: Destructive Physical Analysis for Diodes and Transistors Under the MIL-PRF-19500 Program

11 Aug 2004

STUDY PROJECT

DRAFT

Study Conducted by Alan Barone, Robert Petty

Project Number: 5961-D198

DPA Engineering Practices
Study

I. OBJECTIVE: The objective of this Engineering Practices (EP) study is to identify issues that have arisen regarding the recent introduction at the individual specification sheet level of mandatory DPA requirements for all quality levels under the MIL-PRF-19500 program (i.e., JAN, JANTX, JANTXV, JANS). This study will investigate current industry concerns, current enforcement of the DPA requirements, as well as address issues that the Space Community has also raised. This study will be coordinated with the interested industry organizations and military departments including NASA.

This initial study report focuses on identifying the issues for all concerned parties to allow further discussion regarding the various pros and cons of the DPA testing. Based on the comments received on this initial study assessment and follow on discussions on these issues, DSCC would issue a final study report that would give a roadmap for consistence DPA testing for the MIL-PRF-19500 Program for the various levels of product covered (i.e., JAN, JANTX, JANTXV, and JANS).

II. BACKGROUND:

Until early 2003, DPA testing was only required under the MIL-PRF-19500 program for QPL products for glass diodes to address metallurgical bond issues. This requirement was based on invoking method 2101 of MIL-STD-750. The method itself simply required a “cross section” and a “scribe break to act as a check of the design and construction of the glass diode. The DPA test was verified as part of Group E in the MIL-PRF-19500 for affected glass diode specification sheets. There was support throughout the industry and military for this level of testing. A more general requirement for DPA testing did exist in Appendix E of MIL-PRF-19500, Group E, but only on an “as specified’ basis. For other than the glass diodes, there was no DPA for other standard MIL-PRF-19500 QPL products.

DSCC was aware that the Space Community (primarily NASA and the Air Force Space and Missiles Center) had been for many years requiring the aforementioned MIL-PRF-19500 “as specified DPA” in SCDs or in purchase orders on a variety of semiconductor products. In short, when standard MIL-PRF-19500 QPL parts were bought, space contractors would, after the fact, arrange for DPA testing (sometimes method 2101 or 2102 of MIL-STD-750 or alternatively, MIL-STD-1580 testing) through 3rd party laboratories for evaluation purposes. However, such DPA testing was not part of the actual QPL program in that it was not part of the qualification or conformance testing requirements for those standard parts. This approach was and is still being followed in a number of other types of specification programs (e.g., standard QPL/QML microcircuits, passive devices, etc) in that DPA was invoked usually in a purchase order. Except for a few Class S level type specifications, DPA testing was not required on general-purpose type standard military QPL products.

In late 2002, DSCC began receiving “essential comments” from NASA to add DPA requirements to military specification sheets under MIL-PRF-19500 for quality levels JAN, JANTX, and JANTXV. For the first time DPA testing would become mandatory for the standard type QPL products. Specifically, DSCC was asked to add DPA testing to Group E, Subgroup 3 of MIL-PRF-19500 so that it became part of the qualification process. Despite strong reservations from many in industry, DSCC did approve this addition as requested. As of the date of this study, this requirement has been added to over 50 MIL-PRF-19500 specification sheets.

However, the imposition of the DPA requirement onto the JAN, JANTX, and JANTXV parts continues to raise issues and concerns with the industry (e.g., individual device manufacturers, JC 13.1 and G-12 task group) and also NASA on the details of implementation and whether or not a review of the need and extent of the requirement should be revisited.

DPA Engineering Practices Study

DISCUSSION: We have attempted to capture a wide range of inputs and issues from various sources in industry and the Space Community related to this matter. As of the date of the study, we have tried to distill these into a manageable set of issues to frame the discussion. These issues are itemized below and then discussed further in detail:

(1) Is requiring DPA testing as part of the QPL program for the high volume standard JAN, JANTX, and JANTXV a cost effective approach for all the various military users?

(2) Why should the approach for DPA be different for the MIL-PRF-19500 program versus other high reliability programs (e.g., ER passives) in that only the Class S level type products require DPA testing on standard QPL/QML product? In fact the MIL-PRF-38535 program has no DPA requirements for any level of microcircuits.

(3) The current requirement that was included into the MIL-PRF-19500 spec sheets was for a Group E type qualification test as part of an effort to establish a technical benchmark or "gold standard for DPA modeling". There is no specification requirement for conformance testing to minimize risk at the lot level.

(4) The extent of DPA testing being currently enforced is another matter of some ambiguity from simple "decap" to full DPA as required in methods 2101 and 2102.

(5) Should DPA testing for the Space Community be based on methods 2101 and 2102 of MIL-STD-750 or on the methods established in MIL-STD-1580?

First, JAN, JANTX and JANTXV QPL products are used in extremely high volume in hundreds of existing military systems. This usage covers not only spare parts maintenance by DSCC but also high volume procurements by equipment contractors for major system builds and major modifications of existing systems. These MIL-PRF-19500 product levels have always been intended for general type military system applications (e.g., Air Force and Naval aerospace applications, tanks, land vehicles, missiles, and maritime applications). The JANS level was established to address the critical space level type applications and the procurement costs associated with this level are much high as a result. A fundamental question arises on whether it might be most cost effective to apply DPA on standard JAN, JANTX, and JANTXV as was done previously on a purchase order basis for the limited quantities that need this requirement versus introducing the requirement broadly for all affected users with associated costs. It might be necessary to establish the market for these "add on" DPA and compare it to the general standard product market as part of the deliberation process.

Second and somewhat related to the first point, is a consistent approach to addressing DPA requirements across all of the major specification programs on electronic components. Except for this recent introduction of the DPA for JAN, JANTX, and JANTXV in MIL-PRF-19500, the other high reliability electronic components specifications do not require DPA testing for the general purpose military standard parts (e.g., ER parts in the passive specs and Class Q for microcircuits). Today the Space Community has MIL-STD-1580, which establishes DPA requirements across a broad category of electronic components. Typically, the space contractor invokes DPA on a contract, has the actual DPA performed by a separate 3rd party lab and evaluates the results and makes a decision on whether to use the product or not. This raises a fundamental question for DSCC: Shouldn't the approach for DPA be consistent for the various programs?

Third, the current requirement for the DPA that was added to MIL-PRF-19500 for JAN, JANTX, and JANTXV is a Group E type qualification type test. In discussing this requirement with the Space Community, we understand that this requirement is part of their desire to establish a technical benchmark or "gold standard" for creating a DPA model for JAN, JANTX and JANTXV parts. Also, the current MIL-PRF-19500 DPA testing requirements are predicated on a Go/No Go type requirement verses modeling. Today the current DPA requirements are not adequate for this modeling approach. The intent still seems to be to require another contractual DPA after the fact on these standard QPL parts with a third party lab and compare the results with the original "gold standard". It assumed that the space contractor would still make a determination on whether or not to use the parts after this evaluation. Since DPA is not part of the normal conformance testing of MIL-PRF-19500, rejection of the lot could be problematic. At least one device manufacturer has proposed to do DPA on each lot for (JANS devices only) to avoid the necessity of 3rd party after the fact processing.

Fourth, based on the current language in MIL-PRF-19500 and MIL-STD-750 there is some ambiguity on the full extent of DPA testing now being required. NASA has raised issues on whether or not the full DPA testing required in methods 2101 and 2102 is being invoked (e.g., RGA, PIND, XRAY…). Based on current language in the specification and the standard, what is currently being enforced today is a Decap analysis. NASA has verbally asked to revisit this issue and may want to reference MIL-STD-1580 for a "full" DPA. This raises additional issues related to the first two topics.

Fifth, and related to the fourth issue is whether the DPA requirements needed by the Space Community should be those covered in MIL-STD-1580 or in methods 2101 and 2102 of MIL-STD-19500? This will require benchmarking the two test methods.

As we go through the deliberation process more issues will probably arise and there may be a further restatement of the issues listed above.

CONCLUSIONS: DSCC has concluded that a more detailed discussion of the aforementioned issues and probably others as the discussion unfolds, is required with industry, the military departments, and the Space Community before a comprehensive approach for DPA in MIL-PRF-19500 can be established. Including the requirement into individual specification sheets in MIL-PRF-19500 in a piecemeal fashion has, in retrospect, has not been a satisfactory methodology.

RECOMMENDATIONS: To arrive at a technical consensus among the various parties involved, DSCC makes the following recommendations:

(1) Circulate this initial study effort to all interested parties in the military and industry and gather feedback and comments.
(2) Deliberate these issues and others that might arise in military/industry working groups meetings and/or JEDEC/G-12 meetings and task groups.
(3) Prepare a roadmap on how best to resolve the issues and move forward.
(4) Document this technical process and conclusions in final EP study report.
(5) Due to all of the aforementioned issues and problems DSCC recommends, at this time, to suspend any more efforts to include DPA requirements into additional specification sheets under MIL-PRF-19500 until there is a consensus on the best approach.

ATTENDANCE ROSTER

DPA

Attachment 2

COMMITTEE NUMBER	COMMITTEE / SUBCOMMITTEE	DATE(S)	NAME OF MEETING SITE	LOCATION
	G-12	9/21/04	Columbus, OH	

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This PART I includes general guides applicable to all Electronic Industries Association activities. They are

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NAME (PLEASE PRINT LEGIBILY)	STATUS: MEMBER (M) ALTER (A) GUEST (G)	COMPANY & ADDRESS	TELEPHONE	FAX	E-MAIL ADDRESS
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DEFENSE SUPPLY CENTER, COLUMBUS
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COLUMBUS, OH 43218-3990

IN REPLY REFER TO DSCC-VAC

September 30, 2004

MEMORANDUM FOR MILITARY/INDUSTRY DISTRIBUTION

SUBJECT: Removal of Destructive Physical Analysis (DPA) Testing in MIL-PRF-19500 Slash Sheets.

DSCC has been working an ongoing DPA issue with the Device Manufacturers, Original Equipment Manufacturers (OEMs) and the Military Services. In order to resolve a recent influx of essential comments from the military services on DPA, an Engineering Practices Study (5961-D198) was initiated by DSCC and distributed for review on 11 August 2004.

During the September JEDEC meeting in Columbus, Ohio a task group, consisting of the device manufacturers, OEMs and the military custodians, met to discuss the issue of DPA. All parties agreed to remove DPA testing from all slash sheets immediately. The DPA information that the military services were interested in receiving is available on the device manufacturers 36D. Manufacturers indicated they would supply the 36D and supporting information upon request to their customers.

Therefore, DSCC is rescinding the DPA requirement from all slash sheets. As these slash sheets are revised the requirement will be removed. OEMs that may require DPA testing for specific applications should include this as part of their purchase order or contract.

If there are any questions, please contact Alan Barone by the preferred method of email at alan.barone@dla.mil; by telephone at commercial 614-692-0510, DSN 850-0510; or by facsimile at 614-692-6939.

/Signed/
Thomas M. Hess
Chief
Active Devices Team

Federal Recycling Program Printed on Recycled Paper

Attachment 3