Date: December 1, 2000

To: All Agilent customers using SOT-323 (SC70 3-Lead) Diodes

From: Boon-Teong CHAN, QA/CS Manager

Subject: Recall Notification for SOT-323 (SC-70 3-Lead) Surface Mount Diode Unused Inventory-Potential Vf Instability

Background

Analysis of a customer return in November has identified a potential Vf instability for subject diodes manufactured in Agilent’s factory in Penang during workweeks 31-39 (August and September 2000). The marking datecodes are “Y” and “Z”. Reported component failure rate in the range of 2-5% in the affected lots. The failing devices exhibited high and/or unstable Vf when tested after PCB solder assembly. The diode exhibited intermittent Vf when slight pressure was applied to the package body.

Failure analysis was performed on failing devices and Scanning Electron Microscope (SEM) inspection on cross-sectioned defective units showed delamination between the leadframe and the silicon diode chip through the conductive epoxy adhesive. The package leads appeared to be over-formed on most of the units.

Root Cause

Investigation of the assembly process revealed the cause to be the trim/form/singulate (TFS) machine. Maintenance logs for the TFS equipment showed an abnormal frequency of downtime during the period when lots with rejects were manufactured. Experimental data showed that the delamination was a result of the pulling force on the leads caused by an excessively worn anvil which forms the leads.

Corrective Actions

Appropriate anvil preventative maintenance corrective actions have been taken to eliminate the root cause and prevent future recurrence. Please refer to Appendix for details.

Products Affected

Two manufacturing facilities in Malaysia produce subject parts. Only products manufactured in Penang with marking date code “Y” and “Z” are potentially affected. Products from the Ipoh facility are not affected. Customers are advised to return all unused Penang manufactured parts within above datecodes to Agilent Technologies Malaysia for replacement. The table below details how to distinguish affected parts.

<table>
<thead>
<tr>
<th>Penang manufactured parts for Recall</th>
<th>Parts manufactured in Ipoh NOT AFFECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Product marking date code:</td>
<td>“Y”, “Z”. All OK</td>
</tr>
<tr>
<td>3. Reels package color:</td>
<td>White reels Blue reels</td>
</tr>
<tr>
<td>4. Lot ID:</td>
<td>Starts with “B031xxxxx” to “B039xxxxx”. Starts with “U-xxxxx”. (NOT affected)</td>
</tr>
</tbody>
</table>
\textit{Replacement Product Availability:}
All replacement parts will be expedited. It is expected that that most customers’ immediate replacement needs would be available three to five weeks after return of recalled parts. Please contact your local Agilent representative for further details.

\textit{Risk Assessment}
All defective parts to date have been detected at the customer’s test process after PCB assembly. No returned parts to date have been from field failures.

Due to unavailability of adequate sample quantities, only limited reliability assessment data has been performed. With the return of product within the affected datecodes, additional reliability assessments will be performed.

We apologize for any inconvenience caused to your operation and would appreciate the purging of the “Y” and “Z” unused parts built in Agilent Penang factory to be done as soon as possible.

Thank you.
APPENDIX

Corrective Actions

After analysis of the defective customer returns in early November, the manufacturing process review identified the worn TFS anvil as the probable cause. Maintenance logs identified that in addition to the abnormally high down during August and September, the die punch (includes anvil) was replaced on September 22. Experiments were performed in November which verified the worn anvil to be the root cause. Reliability evaluation was performed on samples of parts produced after replacement of the punch (see Assessment below) and verified the parts to be good.

The following preventative maintenance corrective actions have been put in place to prevent future recurrence of the worn TFS anvil which caused the delamination defects:

1. Revise the TFS production maintenance procedure to include the following:
   a). Increase die-set check and service frequency from weekly basis to every 200k strokes, with software control. This ensures early detection of wear. The weekly frequency was inadequate during high production periods.
   b). Real time visual inspection check on 20 units/lot under 200X high magnification after TFS, in addition to the existing 200 units/lot under low power scope for over-forming and package delamination.
   c). Use mirror to check for stuck units/mold debris into inaccessible parts each time operator perform die-set cleaning on shift basis.
   d). Revise TFS machine downtime record and engineering disposition flow for lots being triggered.

2. Add monthly monitoring check using unit cross-section and SEM inspection.

3. Weekly monitoring tests implemented to detect defectives with the same failure mechanism:
   85°C/85%RH for 4 hrs -> 3xIR -> 5xTMCL -> E-Test (with press on units).

Assessment on newer date codes “delta” and “=”:
Existing FGI inventories with marking date code Oct (“delta”), Nov (“=”)) were sampled and stressed with the following flow: 4hrs UBPP -> 3xIR -> extended Temp Cyc (10,20,50,200,500x) -> E-Test. Following results showed that materials from Oct and Nov were not affected by this problem:

<table>
<thead>
<tr>
<th>Cell #</th>
<th>Device</th>
<th>Wafer Lot #</th>
<th>s/s</th>
<th>D/C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>QSMS-295C</td>
<td>2568.24</td>
<td>600</td>
<td>Oct</td>
</tr>
<tr>
<td>2</td>
<td>HSMS-282C*</td>
<td>2720.13</td>
<td>600</td>
<td>Nov</td>
</tr>
<tr>
<td>3</td>
<td>HSMS-282C</td>
<td>2721.13</td>
<td>600</td>
<td>Nov</td>
</tr>
<tr>
<td>4</td>
<td>HSMS-282C</td>
<td>2318.08</td>
<td>600</td>
<td>Nov</td>
</tr>
</tbody>
</table>

(* This device was chosen as it represent the major runner of SC70 3-LD devices.)