Guidelines for Returns
(SPRAC01A – SEPTEMBER 2017)

Introduction
Texas Instruments (TI) strives to provide quality products and is continuously improving products, processes and services.

To enable an efficient and effective quality review process, and to avoid unnecessary false failures, it is critical that TI understand the customer’s alleged issue with a suspect TI part, separate from the any application issue that the customer may be experiencing. It is equally crucial that the suspect TI part not incur damage during removal, handling, or shipping.

In this document, TI has combined established guidelines and best practices describing verification and handling processes targeted to achieve this objective.

Nothing in these guidelines gives rise to any obligation on the part of TI to conduct verification or analysis. See TI’s Terms of Sale.

Handling Overview
These following guidelines must be followed when suspect parts are being returned to TI:

- Verify and confirm the issue
- Carefully de-solder the part from the PCB/board
- Return parts free of mechanical damage and in a testable condition
- Ensure that there is no obvious electrical overstress (EOS) damage
- Affix and return the part in a proper container
- Pack the part in a shielding (S) bag or container for return shipment
- Include a detailed description of the alleged issue with the TI part

Failure to observe these guidelines may cause technical issues and and/or render a proper quality review impossible. TI reserves the right to reject requests for review, verification, or analysis if a customer is unable to demonstrate compliance with these guidelines.
Handling Process Requirements

- **Verify and confirm the issue**

  Only return suspect TI parts that have been tested through by A-B-A swap cross check to confirm the observed issue is not system related.

**A-B-A Swap Method:**

To perform the A-B-A swap:

(A) Remove the suspect TI part (A) from the original failing board.
(B) Replace the suspect TI part (A) with a known good TI part (B) and check if the original failing board is now working correctly.
(A) Mount the suspect TI part (A) to a known good board and see if the observed issue continues to occur.

The last step is critical to exclude the possibility that the issue is caused by an interaction with another part on the board.

- **Carefully de-solder the part from the PCB/board**

All suspect TI parts returned for TI verification and analysis must be carefully removed from the customer printed circuit board (PCB) prior to shipping.
TI will advise customers *in advance* in rare cases were a complete PCB with the TI part(s) mounted is required!

**De-Soldering:**
The plastic mold compound of the part package is soaking humidity to some extent. Therefore, all TI parts, including MSL1 classified TI parts, must be dry-baked according to IPC/JEDEC J-STD-033 before de-soldering.

Manual de-soldering of any electronic part is not recommended. Instead, use a rework station allowing control of the soldering temperature according to the JEDEC soldering profile. Uncontrolled de-soldering may damage the part and induce, *e.g.*, plastic package delamination and popcorning effect.
Do not cut off the pins / leads from the TI part, as that will prevent any further electrical testing.

Fresh / Virgin Parts:
Do not return fresh/virgin TI parts unless explicitly requested to do so by TI. There might be special cases where TI would like to get back fresh/virgin TI parts, such as:

- solderability issues
- generic tape & reel, tray or tube related issues
- reel cover tape issues

Return parts free of mechanical damage and in a testable condition

Suspect parts must be carefully removed and appropriately handled to allow for a proper root cause analysis.

Unacceptable / untestable conditions such as:
- mechanical damages to the part package,
- remainder of coating material,
- cut-off / broken or bent leads / pins, or
- excessive solder residues in-between the leads / pins

are in most cases a result of inappropriate part handling. TI may reject the analysis of such parts and label them as "NAC - non-actionable cases."

Below are examples of customer returns that were received in an unacceptable condition. TI does not to accept such parts for verification / analysis because the original issue may be masked.
To improve the effective quality analysis, TI focuses on verification / analysis of returns that can give value to our customers and TI as part of TI’s Lean Six Sigma methodology.

1) Heavily bent leads/pins
2) Covered with lacquer, silicone or coating @ package and/or pins
3) Missing leads/pins
4) Excessive solder residues resulting in bridging neighboring pins / leads
5) Severe package defects & cut-off pins / leads
6) Unfortunately just ultrasonic cleaning using acetone in most cases cannot remove the coating. It’s up on the customer to deliver the unit in testable condition, since TI will not be in the position to clean the parts.
7) Mechanical damage will disqualify the parts from further TI verification & analysis. (e.g. performing a re-test using automated test equipment (ATE)).

**Note:** BGA TI parts must be re-balled adequately. This is needed for the customer A-B-A swap exercise.

- **Ensure that there is no obvious electrical overstress (EOS) damage**

In cases where the issue seems to be induced by electrical overstress (EOS) with visible signs of damages, a TI failure analysis will have a limited chance to find the true root cause.

An analysis of such parts (examples shown next page) will only be able to illustrate eventually melted metallization lines inside the Die, fused open bond wires or combinations of it.

Heavy EOS damage masks the issue. TI is not in a position to know the customer’s operating, environmental and temperature conditions at the time of the issue to determine what may have caused the EOS damage. There is no useful action TI can take in such cases.
Burnt package

Carbonized mold compound

**Affix and return the part in a proper container**

When returning a suspect TI part for analysis, always:

- Select a suitable shielding (S) shipping container, and
- Fix parts properly to prevent them from moving around or touching one another.

The following methods should not be used to ship or fix the TI parts:

- *Blue tape* end plug @ tubes
- Parts in tray not fixed
- Sticky polymer film tape (e.g. std. 3M, Scotch or TESA tape) used to fix parts
- Part wrapped in paper or into a styrofoam /foam
- Multiple unit loose in bag
The TI Freising Device Analysis Lab (FDAO) checked the charging of submitted parts after pulling a TI part from a polymer film tape with an electro-field meter and measured a voltage >1kV. Thus the origin electrical issue can be masked by damages due to improper ESD protection.

![Part fixed with polymer film tape inside a conductive box](image)

**Pack the part in a shielding (S) bag or container for return shipment**

Electronic parts must be handled, packed and shipped appropriately. Shipments might go through rough uncontrolled areas and might be exposed to high electrical fields, for example, when a shipment is inspected by customs or when the shipment is exposed to high electrical fields from conveyor belt motor drives in logistic centers.

Consequently, electronic parts that are not packed in shielding (S) bags / containers can be easily damaged directly (direct discharge) or indirectly (electromagnetic pulse) by external electro static discharge (ESD) during shipment.

The following specific ESD standards for the packing of semiconductors must be applied:

- **Inside ESD Protected Area (EPA*)**:  
  Packing used within an EPA shall consist of dissipative (“pink poly” bags) or conductive (“black” bags or boxes) material for intimate contact to the electronic part.
  - dissipative (D) “pink poly” bags (10^5 <= Rs <= 10^11) or conductive (C) “black” bags or boxes (10^2 <= Rs <= 10^6) material for intimate contact

- **Outside ESD Protected Area (EPA*)**:  
  Thus packing used outside an EPA shall require packing that provides both:
  - dissipative (D) “pink poly” bags (10^5 <= Rs <= 10^11) or conductive (C) “black” bags or boxes (10^2 <= Rs <= 10^6) material for intimate contact
  - electrostatic discharge shielding (S) (E < 50nJ)

*EPA = ESD Protected Area
**ESD-safe Packaging for Shipments:**
Always use packing material that provides shielding (S) protection as illustrated below.

![Various examples of shielding bags and boxes](image)

Although dissipative (D) “pink / green / blue” or conductive (C) “black” bags or containers provide protection against tribocharging, they do not protect against electric fields. These bags (examples illustrated above) can only be used within an ESD protected area (EPA*)!

Do not use standard plastic (PE-LD) bags or containers for shipments as these bags may charge up the parts inside.

**Improper Packaging for Shipments:**

![Plastic (PE-LD) bag](image) ![Dissipative (D) “pink / green / blue” or conductive (C) “black” bags](image)

If these types of packaging are used, the original issue may be masked by external ESD damage. Failure analysis of such a part might therefore give misleading results.

In summary, it is crucial to protect against external ESD during shipment. TI will only accept returned parts that are packed such that later damage can be ruled out. The interior of shielded bags / containers may be regarded as a “mobile EPA*”.
The TI Freising Device Analysis Lab (FDAO) checked the charging of submitted parts within a plastic PE-LD bag with an electro-field meter and measured a voltage of >1kV. Thus the origin electrical issue can be masked by damages due to improper ESD protection.

4) The TI Freising Device Analysis Lab (FDAO) checked the charging of submitted parts within a plastic PE-LD bag with an electro-field meter and measured a voltage of >1kV. Thus the origin electrical issue can be masked by damages due to improper ESD protection.

- Include a detailed description of the alleged issue with the TI part

To streamline analysis, TI requests that the following information be provided with any returns:

- Full orderable TI part number (TI P/N) and customer part number (CP/N);
- Customer reference number;
- A clear and detailed description of the alleged issue at the TI part level including, set-up and use conditions for stimulation of the alleged issue as well as software sequence, as appropriate;
- Quantity, frequency and clustering, related volumes and observed potential failure rate of suspect TI parts;
- Photos of the suspect TI parts’ top and bottom marking;
- Photos of the TI labels attached to the original shipping carton/boxes/bags or reels; and
- Schematic drawing of the application circuitry including set-up, voltage and current conditions of the suspect TI part in the customer application.

Failure to include the required information could jeopardize an efficient and successful analysis.

Summary

These guidelines are meant to enable an efficient and effective issue-solving process. Thank you for your careful attention to, and compliance with, these guidelines.
### References

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JEDEC JESD625</td>
<td>Requirements for Handling Electrostatic-Discharge (ESD) Sensitive Devices</td>
</tr>
<tr>
<td>IEC/EN 61340-5-3</td>
<td>Electrostatics – Part 5-3: Protection of electronic devices from electrostatic phenomena – Properties and requirements classification for packaging intended for electrostatic discharge sensitive devices</td>
</tr>
<tr>
<td>ANSI/ESD S541</td>
<td>Packaging Materials for ESD Sensitive Items</td>
</tr>
<tr>
<td>ANSI/ESD S8.1</td>
<td>Symbols ESD Awareness</td>
</tr>
<tr>
<td>IPC/JEDEC J-STD-033</td>
<td>Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices</td>
</tr>
<tr>
<td>IPC-7711</td>
<td>Rework of Electronic Assemblies</td>
</tr>
</tbody>
</table>
IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated (‘TI”) technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, “TI Resources”) are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI’s provision of TI Resources does not expand or otherwise alter TI’s applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED “AS IS” AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include, without limitation, TI’s standard terms for semiconductor products (http://www.ti.com/sc/docs/stdterms.htm), evaluation modules, and samples (http://www.ti.com/sc/docs/sampterms.htm).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2017, Texas Instruments Incorporated