



Texas Instruments General Quality Guidelines

Texas Instruments (TI) is dedicated to designing, manufacturing and marketing integrated circuits, systems, and supplying high quality products that serve our customers' needs. Each TI business segment has customer Quality Representatives that work closely with our customers to understand their particular quality requirements and establish appropriate processes that support our customers' quality needs. In addition, our customer Quality Representatives facilitate communications in order to quickly resolve quality related issues by coordinating efforts and communicating with TI sales and manufacturing teams. These communications include such topics as, new product qualification, Process Change Notices (PCN's), the timely resolution of customer issues and complaints, routine customer quality data requirements, product containment and corrective action, and quality improvement programs.

TI's commitment to customer satisfaction is communicated through the TI Quality Policy: We will achieve business excellence by:

- Encouraging and expecting the creative involvement of every TI'er.
- Listening to our customers and meeting their needs.
- Continuously improving our processes, products and services.

Texas Instruments sites first achieved the International Organization for Standardization's (ISO) Quality Management System (ISO 9001) and Environmental Management System (ISO 14001) Certifications in 1996 and have maintained compliance with the ISO requirements since that time. Texas Instruments is also certified to the following standards:

- TS 16949 certified in 2004 (Global automotive industry).
- OHSAS 18001 certification in 2007 (Occupational health and safety).
- Sony Green Partner certified in 2002.

A handwritten signature in black ink, appearing to read "Robert Furtaw", written over a horizontal line.

Robert Furtaw
Vice President of Worldwide SC Quality

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1 SCOPE

The General Quality Guidelines (GQG) apply to the provision of quality assurance with respect to materials, products, services, manufacturing processes, tests, controls, handling, storage and transport measures as well as the management processes used and/or applied by TI in order to ensure compliance of TI components with the published and/or specifically agreed specifications.

TI shall endeavor to comply fully with these guidelines; however, nothing in this document shall be construed to create, expand or in any way alter remedies, if any, as defined in TI's standard [terms and conditions](#) of sale.

TI works hard to follow these quality practices and seeks to provide customers with the most accurate and up to date information available about its general quality practices. Although the information provided herein is true and accurate at the time of this writing, TI may occasionally make changes or updates.

2 QUALITY MANAGEMENT SYSTEM

TI's Quality Policy Manual has been written to meet the requirements of our customers as well as applicable International and National Standards such as International Standardization Organization (ISO) 9001 and ISO/TS16949. It is supported by documented procedures, work instructions, and process flows that define specific activities needed to implement the quality management system and the quality policy. This documentation describes the interaction between the processes of TI's quality management system.

3 MANAGEMENT RESPONSIBILITY

Top management is committed to the implementation and continual improvement of TI quality systems as a critical method for product realization and customer support. Top management and other management as appropriate regularly review the effectiveness and efficiency of the quality system, and make the necessary adjustments to meet planned objectives and customer requirements.

4 AUDITS

Periodic internal audits are performed to ensure compliance to stated requirements, the effective implementation and operation of the quality management system, and the identification of opportunities for continual improvement. Audits are scheduled according to system performance and the criticality of the processes and are performed by qualified personnel independent of the area being assessed. A process is in place to ensure qualified internal assessors are used. Results of audits are documented; corrective actions are executed and evaluated for effectiveness. Review of audit results are part of the management review process.

TI's supplier quality system assessment is addressed in the Purchasing and Supplier Management section. Occasionally, customers may ask to verify product at one of TI's supplier sites. TI manages these requests on a case-by-case basis and coordinates with the supplier, as appropriate.

Customer audits will be conducted during regular business hours and any requests for audits should be received at least thirty days prior with agendas provided at least two weeks prior to the audit. Customer audits are restricted to TI's Quality Management System and any mutually agreed upon customer specific requirements. Any additional audit topics should be agreed upon in advance as part of the audit planning process.

5 PURCHASING AND SUPPLIER MANAGEMENT

The quality of TI products is dependent on the quality of purchased materials and services. The purchase process is documented and structured to meet the following requirements:

- Ensure that purchasing documents clearly describe the product and services ordered
- Ensure that purchased products and services conform to purchase requirements
- Communicate to suppliers the appropriate product, quality, and delivery requirements
- Ensure that purchased materials and services meet government, safety, and environmental regulations
- Ensure that finished product, direct materials, and packing materials meet the provisions of regulatory and customer requirements

All TI groups/organizations utilizing purchased materials and services shall work with the established supplier management organizations, as applicable; to ensure that the supplier management process in place is structured to cover the following:

- Identify and select suppliers with the capability to meet TI needs
- Establish criteria for selection, evaluation, qualification, and certification of suppliers
- Perform supplier quality management system development
- Ensure continuity of supply
- Ensure that critical materials and services are purchased only from approved sources
- Monitor and provide feedback on supplier performance
- Monitor product quality and delivery performance (including use of premium freight, as applicable)

TI shall conduct a quality system assessment of direct material suppliers or, in lieu of an assessment, may accept third party registration to ISO 9001. For TS16949 certified organizations, critical, direct material suppliers are required as a minimum to be certified to ISO 9001 Quality Standard. TI verifies the quality of some materials and services by inspection of incoming material, review of supplier provided data, verification at the supplier's premises, or receipt of successful 3rd party assessment. The level of control applied is dependent on the criticality of the purchased material to the product realization process and the historical performance of the supplier. When suppliers have demonstrated their ability to provide the level of quality required by TI, inspection and/or data review may be reduced or eliminated. Records are maintained of the evaluation and qualification of suppliers.

6 EXTERNAL CALIBRATION LABORATORIES

The External Calibration Laboratories that Texas Instruments chooses to use must be approved based on their accreditation or their status as an Original Equipment Manufacturer. When supporting TS 16949 certified sites external calibration labs will be certified to ISO 17025 or national equivalent.

7 PRODUCT DEVELOPMENT

All new product development at TI follows a structured new product development process such as Product Quality Planning, Advanced Product Quality Planning (APQP), and/or Product Realization as applicable. A phase review system for each group is defined in controlled documented procedures. A formal project review and approval, by responsible management, is completed and documented at critical points in the development process. The process is designed to manage organizational interfaces, project risks, schedule (including sample delivery, qualification, and PPAP documentation) and communication between groups involved in the development process.

8 RISK MANAGEMENT

TI uses risk management as part of new product development and manufacturing. For ISO/TS 16949 requirements TI uses FMEA as the risk management methodology. Other risk management considerations including but not limited to functional safety and safety critical application may be utilized and will depend upon the specific TI component requirements. Applicable manufacturing risk management summaries are available for review at TI facilities.

9 QUALIFICATION / RELIABILITY

TI qualification testing is a risk mitigation process that is engineered to assure device longevity in customer applications.

Wafer fabrication processes and package level reliability are evaluated in a variety of ways that may include accelerated environmental test conditions with subsequent derating to actual use conditions. Manufacturability of the device is evaluated to verify a robust assembly flow and assure continuity of supply to customers.

Non-Automotive devices are qualified with industry standard test methodologies performed to the intent of Joint Electron Devices Engineering Council (JEDEC) standards and procedures. Enhanced reliability testing may be performed to meet the intent of Automotive Electronics Council (AEC)-Q100 or military standards that would be specific to the intended environmental conditions that are anticipated for field application of the device.

When qualification testing is complete, test results are made available to customers upon request in the form of a reliability report that documents the pass/fail status of the device.

10 PROCESS MONITORING

TI uses process measurement and monitoring for manufacturing process control and to minimize process and product variation with a goal to achieve zero defects. Important characteristics are identified, data is analyzed, and statistical process control (SPC) is used in all phases of manufacturing with an emphasis on defect prevention versus detection.

Automated systems are applied for device statistical yield outlier (SYL) and standard statistical bin outlier (SBL) with quarterly limit recalculation, where applicable. Additional statistical based controls may be available for specific design and process technology that is based on business product engineering.

TI manufacturing uses process capability measurements as a key component of process monitoring and control with a goal to achieve values of $C_p > 2.00$ and $C_{pk} > 1.67$. For critical charts on automotive products, characteristics with C_{pk} between 1.67 and 1.33, continuous improvement activities will be documented to ensure process improvement and C_{pk} values remain above 1.33. For automotive products any characteristics with a $C_{pk} < 1.33$ will have an identified action plan to improve the process capability and an identified containment plan to screen out product not meeting specifications. Measurement systems used for process monitoring are controlled by using established qualification, verification and calibration procedures. TI manufacturing operators and specialists are trained to use and employ statistical control processes and procedures as an additional component of process monitor and control.

A test of outgoing components is included as part of process and product monitoring. This monitoring may include inline parametric, functional, visual verification utilizing statistical and product outlier control methods. Samples (such as "golden" samples) may also be used as references for the manufacturing process and final product.

11 MEASUREMENT SYSTEM ANALYSIS (MSA)

Accurate and precise measurement systems are used to ensure that products are compliant to specification and customer requirements. Measurement system gage repeatability and reproducibility (GRR) verification is performed to ensure measurement system performance meets expectations. All manufacturing sites certified in ISO/TS 16949 have implemented a more comprehensive approach for measurement system analysis that includes bias, linearity, stability and %GRR measurements.

12 PRODUCTION PART APPROVAL PROCESS (PPAP)

TI supplies PPAP documents compliant with the Automotive Industry Action Group (AIAG) manual for devices qualified and released for automotive. Proprietary information may not be included in the PPAP but should be available for review at the applicable TI sites.

13 ELECTROSTATIC DISCHARGE (ESD)

All TI operations worldwide that handle, test, or ship ESD sensitive devices or assemblies containing such devices shall implement electrostatic discharge prevention methods or procedures. TI adheres to an industry standard ESD control program, JEDEC JESD625.

14 SOFTWARE QUALITY ASSURANCE

All TI operations responsible for the development of software products or related services will document their activity requirements which include: the integrity of the development process, continuous compliance to customer requirements, base-lining software products and maintaining their revision status, and quality control activities.

15 CONTINUAL IMPROVEMENT

TI conducts periodic reviews of the effectiveness of the entire quality management system and changes that could affect the quality management system. These reviews include monitoring trends in operational, business, customer feedback and quality performance of the product realization processes and the associated support processes.

Metrics are defined for key performance areas and are used to monitor ongoing progress to quality objectives, to identify critical issues, to track improvement activities, to identify and prioritize opportunities for quality and productivity improvements and to measure cost of poor quality, as applicable. Organizational resources are analyzed against quality objectives for suitability. Data and information from all sources of product and process issues, including analysis of field failures and other customer feedback as applicable, are also reviewed to identify areas where action may need to be taken to reduce or eliminate nonconforming product and to prevent potential issues from occurring.

TI's continuous improvement processes includes:

- 5S Activities
- Defect Reduction
- Automotive flow

- Additional testing and inspection
- Problem solving programs
- Lessons learned and fan out

16 NONCONFORMING PRODUCTS

In the event that TI discovers that nonconforming goods were delivered to a customer, TI shall inform the customer in a reasonable time of this regard in writing and shall take reasonable measures in order to avoid and/or minimize damages.

If it becomes necessary to deliver products to a customer and the products do not comply with TI's datasheet or mutually agreed customer device specifications, TI will provide in advance, a waiver which documents this event and requires customer approval. This can be done in system-generated form without a signature.

17 CORRECTIVE AND PREVENTIVE ACTION

When nonconformities occur in the process, product, quality management system, or when customer complaints or returns are received, personnel take immediate and appropriate correction and corrective action according to their documented procedures. Managers with responsibility and authority for corrective action shall be promptly informed when products or processes become noncompliant with specified requirements. The documented corrective action shall include:

- Reviewing and documenting the problem
- Where product is involved, preventing any additional defective product from being produced, and preventing any defective product from being shipped to a customer
- Prompt customer notification when nonconforming product has been shipped
- Investigating the root cause of the problem and recording the results of the investigation
- Utilizing problem solving and error proofing methods, as applicable, to determine appropriate corrective actions based on the root cause analysis
- Documenting and implementing the appropriate corrective actions
- Verifying that the corrective action is effective in eliminating the problem and preventing its recurrence
- Applying the corrective action to similar processes and products as appropriate

Additionally, data and information from quality management sources including product and process problems are periodically analyzed to identify areas where action may be needed to prevent potential problems from occurring. According to documented procedures, appropriate actions are taken to initiate preventive actions and to ensure they are effective.

The documented preventive action shall include:

- Determining potential nonconformities and their causes
- Evaluating if action is required to prevent the occurrence of potential nonconformities
- Documenting and implementing the appropriate preventive actions
- Documenting the results of the preventive action, and
- Reviewing the effectiveness of the preventive action

18 CUSTOMER RETURNS

In the event that a customer experiences issues or failures with a TI product, actions will be taken to ensure a thorough and timely analysis of the reported problem. Execution of appropriate corrective action including appropriate communication with customers during the analysis process will occur. TI has an established method for initiating and processing returns via TI's customer Return Material process. For information on how to process returns, please contact your sales representative, TI authorized distributor or TI's Sales Support Line.

19 CHANGE MANAGEMENT

After formal product/process release, continual improvement strategies are emphasized, and as a result, there may be a need to modify, update, or discontinue the product/process. When this occurs, the change management system is used to plan, qualify, and implement the change. Where practical, analysis is performed on potential impact to the systems in which the product/process is used and the effect of changes on product already delivered.

A formal documented change process is used to ensure that the appropriate validations are completed and modifications

documented prior to implementing the change. When a product/process change requires customer notification, a formal product change notification process is used. Records are kept indicating the initiation of any change to production processes and to demonstrate conformance to these requirements.

TI complies with the requirement in JESD46, latest issue for notification of product changes. Consistent with this industry standard, customers will be notified of major changes which affect the form, fit, function, or adversely affect quality or reliability of the product. For custom devices, Texas Instruments will not implement a change until customer approval is received.

20 PRODUCT WITHDRAWAL/DISCONTINUANCE

TI's Product withdrawal/discontinuance process complies with JESD48, latest issue. TI makes an effort to not obsolete products out of convenience. Convenience means: low running device, poor yields, limited customer adoption or similar items. TI's obsolescence withdrawal schedule provides a longer lead time than the industry standard. TI allows 12 months for the last order and an additional 6 months to take final delivery of obsolete items. In rare circumstances, an accelerated withdrawal schedule may be necessary. In such cases, TI will communicate the last buy and final delivery dates in the EOL notice, along with an explanation of the circumstances necessitating the early withdrawal.

21 BUSINESS CONTINUITY PROGRAM

TI has a Business Continuity Program that covers contingency planning, incident management, crisis communications, customer response, crisis management, external agency coordination and program maintenance. The TI Business Continuity policy aims to protect corporate interests by doing the following:

- Minimize the impact and potential disruption to customers and stakeholders
- Support a timely and effective response, recovery and contingency for interrupted business operations, such as shipping, supply chain, planning, sales and design
- Minimize financial and operational impacts that could seriously jeopardize the corporation and brand
- Satisfy TI's business obligations throughout the crisis event
- Communicate effectively in order to provide accurate and consistent information to internal and external stakeholders
- Address employee, humanitarian and community concerns where TI operates
- Ensure leadership support and expectations for program elements

22 IDENTIFICATION AND TRACEABILITY

Product is identified from raw materials through all stages of production and shipment to the customer. The tracking procedure includes:

- Assignment of a unique identifier to each lot or batch of material
- Recording the completion of each process step and the inspection and test status recording of pass/fail quantities
- Identification of key process information as defined in work instructions
- Recording of key process parametric data as defined in work instructions
- Traceability to key raw materials and the production process as needed
- Assignment of a unique tracking STC (Ship Track Code) for every intermediate container (bag, box, reel) is located in TI's standard 2D label.
- Custom marking for products will need to mutually agreed between the customer and TI

23 PACKING

The packing design for components shipped to customers will be TI's responsibility and conforms to JEDEC-STD-033 for moisture sensitive devices. The packing material has been designed to guard against damage during shipping, stacking and handling. If there are major changes in the packing design TI will communicate appropriately to the customer or distributor through the previously mentioned change management process.

24 SHELF LIFE

TI's standard shelf life for packaged products is two years from the time it was manufactured. There are devices which are

specifically packed for extended storage up to five years. TI product shipment is based on Moisture Sensitivity Levels (MSL) and complies with JEDEC-STD-020. Product warranty is measured from the actual shipment date, not the date of manufacture.

Customers can check product Extended Shelf Life (ESL) capability thru TI's Extended Shelf Life: [Part Search tool](#):

25 LOT COMBINATION:

Assembly date codes shall not be combined prior to final pack. For catalog products four (4) date codes maximum, not more than 52 weeks apart may be combined into one intermediate manufacturing pack (bag/box/reel). 52 weeks must be calculated from Max Age LTC minus Min Age LTC.

26 CUSTOMER LABELING:

Consistent with industry standards TI provides a human readable and 2D data label pasted to every intermediate manufacturing container (bag, box and/or reel) used in the product identification/tracking and receiving process. Each label will include, as applicable, the Pb free symbol, RoHS logo, lot traceability information and MSL level.

27 ARCHIVING PERIOD:

TI has a comprehensive record retention strategy which must account for more than fifty different categories of record types, with retention periods matrixed against market segments

Storage locations and archival processes also vary by record type and are managed as part of this comprehensive strategy which is in-line with industry standards. All TI record retention periods are subject to change without notification.

28 RESTRICTED CHEMICALS AND MATERIALS (RCM)

TI manages product compliance status through its RCM management program. Materials used in TI finished IC products must go through an approval process that includes: complete substance declarations, supplier compliance statements and applicable 3rd party test reports. Material reporting is through the <http://www.ti.com/productcontent> database for finished IC products. If any RCMs are identified in a material shipped to customers, they are managed through the RCM process.

TI requires its suppliers to comply with TI's "[Customer Material Specification](#) (Controlled Chemicals and Materials)," which incorporates TI's "[Restricted Chemicals and Materials List](#)." In addition, TI's internal chemical and material specifications guide TI manufacturing processes and products toward compliance with applicable local laws and regulations where TI products are manufactured and sold. Suppliers must provide updates to their certificates of compliance to the latest TI RCM list, including yearly 3rd party test reports for the RoHS 6 substances of Pb, Hg, Cd, Cr6+, PBB and PBDE. TI also requires testing for Cl and Br for non-metal material sets to check for content of any BFR, CFRs or PVCs. All other restricted chemicals are verified through material declarations and/or compliance statements from these suppliers.

TI's RCM documentation and data for customer's compliance obligations with respect to their products is located at the www.ti.com/ecoinfo site where the latest documents such as TI's "Material Declaration Certificate for Semiconductor Products" and "Statement on REACH Provisions from Texas Instruments, Integrated Circuit Products" are located. When working with customer substance lists, TI will provide appropriate information through its [Product Content](#) database on what substances are contained in the product for due diligence purposes. If reported values exceed customer stated thresholds but remain below regulatory requirements, no corrective actions will take place. Reporting thresholds for RoHS 6 substances of Pb, Hg, Cr6+, Cd, PBB and PBDE are at the homogeneous level. For the brominated and chlorinated substances, the thresholds are as defined by the JP 709 Low Halogen Guideline. All other substance thresholds are at the component / Article 33 level or as required by legislation.

TI bases its material content knowledge on information provided by third parties and has taken and continues to take reasonable steps to provide representative and accurate information, however, TI may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI periodically updates such information as new requirements are identified, in order to support its customers ongoing information needs. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

TI provides no representations, warranties or guarantees, express or implied, related to the content of TI's products

except as otherwise provided in documents referenced herein, which are provided "as is." Further, TI provides no representation, warranty or guaranty, express or implied that its customers' products will comply with any applicable laws and regulations as and where such customer products are manufactured or sold.

29 CONFLICT MINERALS

TI uses tungsten, tantalum, tin, and gold in most of its semiconductor devices. Such minerals have been identified as "conflict minerals" in Section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act. TI does not purchase these metals directly from smelters or mines and TI is working with our direct suppliers of these metals to understand their supply chain and determine the origin of these metals. In the absence of federal regulations, TI, as a member of EICC, has been working with the EICC/GeSI Extractives Working Group to create industry consensus on due diligence methods to use with our suppliers to ensure proper control of the sources of these metals. Please see TI's statement on [conflict minerals](#).

30 ENVIRONMENTAL SAFETY AND HEALTH

TI's approach to environmental stewardship is interdisciplinary and comprehensive. TI's goal is "zero wasted resources" and this drive for efficiency helps reduce greenhouse gases and other air emissions as well as energy consumption, water use and waste, while increasing resource conservation and efficiency in all aspects of TI's operations. TI's [citizenship principles](#) guides our efforts to operate sustainably, from manufacturing conscientiously designed products to efficient product distribution, and from responsibly sourcing materials to maintaining compliance with environmental regulatory requirements. It is the responsibility of every TI employee to understand and support TI's ESH policy and principles. All TI employees globally receive ESH training on TI's programs to ensure their safety and health and contribution to environmental stewardship. TI's occupational health and safety management system helps us reduce or eliminate risk that could result in personal injury or illness. TI employees receive additional relevant training and communications based on their role and working environment. Contractors must also comply with TI's ESH standards.

The majority of TI manufacturing sites worldwide have obtained Occupational Health and Safety Assessment Series (OHSAS) 18001 and International Standardization Organization (ISO) 14001 external certifications. All TI sites are certified or working toward OHSAS 18001 and ISO 14001 external certifications.

31 ELECTRONIC INDUSTRY CITIZENSHIP COALITION

TI is a member of the Electronic Industry Citizenship Coalition (EICC) and has declared its support for the EICC Code of Conduct (Code) www.eicc.info. The Code establishes standards to ensure that working conditions in the electronics industry supply chain are safe, that workers are treated with respect and dignity, and that business operations are environmentally responsible and conducted ethically. TI is actively working to implement the code to its supply chain.

32 ABBREVIATIONS

| | |
|--------|--|
| AEC: | Automotive Electronics Council |
| AIAG: | Automotive International Action Group |
| APQP: | Advanced Product Quality Planning |
| CODE: | EICC Code of Conduct |
| ECHA: | European Chemicals Agency |
| EICC: | Electronic Industry Citizenship Coalition |
| EU: | European Union |
| FMEA: | Failure Mode and Effect Analysis |
| GQG: | General Quality Guidelines |
| GRR: | Gage Repeatability and Reproducibility |
| ISO: | International Standardization Organization |
| JEDEC: | Joint Electron Devices Engineering Council |
| NDA: | Non-disclosure agreement |
| MSA: | Measurement System Analysis |
| OHSAS: | Occupational Health and Safety Assessment Series |
| PCN: | Product Change Notification |
| PPAP: | Production Part Approval Process |

SBL: Standard Statistical Bin Outlier
 SPC: Statistical Process Control
 SVHC: Substances of Very High Concern
 SYL: Statistical Yield Outlier
 REACH: Registration, Evaluation, Authorization and Restriction of Chemicals
 WW: World Wide

33 RECORD OF CHANGES

| Revision | Reason for Change | Paragraphs Modified | Date |
|----------|--|--|------------|
| 0 | Initial Release | Initial Release | 09/04/2012 |
| 1 | Important Notice was missing in PDF | Page 12/13 added | 11/05/2012 |
| 2 | <ul style="list-style-type: none"> - Remove reference to MPA - Corrected "External Laboratories" to "External Calibration Laboratories" - To show TI's Product Discontinuance Policy - To make reference to TI/eco info and Product content at ti.com for access to RCM documentation - To remove the reference of ISO14001 certification by 2012 | Paragraph 1 Paragraph 6 Paragraph 20 Paragraph 26 Paragraph 28 | 01/27/2014 |
| 3 | <ul style="list-style-type: none"> - Removed Chapters from the document - removed capitalization of "customer" - Removed reference to contacting quality or sales rep and link to quality documents - Added language around the scope of customer audits - Added schedule with examples - Replaced commercial grade with non-automotive, removed the reference to tailored enhanced reliability testing - Reworded for clarity - Added examples of TI's continuous improvement processes - Changed the word "defective" to "nonconforming" - Changed the word "problems" to "issues", Changed Product Information center to TI's Sales Support Line - Included how JESD46 defines a major change - Added 2 bullets regarding ship tracking code and customer markings - Added a method for customers to verify ESL parts - Added lot combination paragraph - Added customer labeling paragraph - Added sentence stating retention periods are subject to change without verification | Throughout document Throughout document Paragraph 1 Paragraph 4 Paragraph 7 Paragraph 9 Paragraph 12 Paragraph 15 Paragraph 16 Paragraph 18 Paragraph 19 Paragraph 22 Paragraph 24 Paragraph 25 Paragraph 26 Paragraph 27 | 07/16/2014 |
| 4 | - Revised to change Vice President's signature | Page 1 | 12/03/2014 |

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information 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.

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Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

| | |
|------------------------------|--|
| Audio | www.ti.com/audio |
| Amplifiers | amplifier.ti.com |
| Data Converters | dataconverter.ti.com |
| DLP® Products | www.dlp.com |
| DSP | dsp.ti.com |
| Clocks and Timers | www.ti.com/clocks |
| Interface | interface.ti.com |
| Logic | logic.ti.com |
| Power Mgmt | power.ti.com |
| Microcontrollers | microcontroller.ti.com |
| RFID | www.ti-rfid.com |
| OMAP Applications Processors | www.ti.com/omap |
| Wireless Connectivity | www.ti.com/wirelessconnectivity |

Applications

| | |
|-------------------------------|--|
| Automotive and Transportation | www.ti.com/automotive |
| Communications and Telecom | www.ti.com/communications |
| Computers and Peripherals | www.ti.com/computers |
| Consumer Electronics | www.ti.com/consumer-apps |
| Energy and Lighting | www.ti.com/energy |
| Industrial | www.ti.com/industrial |
| Medical | www.ti.com/medical |
| Security | www.ti.com/security |
| Space, Avionics and Defense | www.ti.com/space-avionics-defense |
| Video and Imaging | www.ti.com/video |

TI E2E Community

e2e.ti.com