

Texas Instruments Supplier Quality Expectation Document

Rev. 7.0

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1.0 PURPOSE AND SCOPE

This manual is intended to provide suppliers to Texas Instruments Incorporated with expectations for excellence. The ultimate goal is total customer satisfaction, beginning with conformance to this Texas Instruments Supplier Quality Expectation Document (TI SQED), and benefiting not only the supplier, but also, TI and its final customers.

TI SQED applies to all suppliers that supply products, equipment, materials, services, or software to TI. Compliance with all requirements called out in this document is mandatory, unless waived in writing, by authorized **TI Quality Manager**. TI retains the right at its option to determine the level of verification of compliance required for suppliers. The obligation and responsibility for compliance with the requirements called out in this document shall remain with the supplier.

TI SQED defines minimum expectations for excellence and encourages suppliers to achieve and maintain benchmark levels of performance. Should the supplier have questions, comments or concerns regarding the requirements set forth in this document, or suggested improvements, please contact your respective **TI personnel**.

2.0 DEFINITIONS AND ACRONYMS

- AIAG - Automotive Industrial Action Group
- CCB - Change Control Board
- CETRAQ - Scorecard for evaluating Supplier Performance in the categories of Cost, Environment, Technology, Responsiveness, Assurance of Supply & Quality.
- CoA - Certificate of Analysis
- CoC - Certificate of Compliance
- CPT - Category Procurement Team
- DPPM - Defect Parts Per Million
- **EDM** - **External Development and Manufacturing**
- FIFO - First-In-First-Out
- PCN - Process Change Notice
- PPAP - Production Part Approval Process
- SIMT - Supplier Information Management Team
- TI - Texas Instruments Incorporated
- TI SQED - TI Supplier Quality Expectation Document - The document that defines TI's minimum quality expectation for excellence and encourages suppliers to achieve and maintain benchmark performance.
- WPL - Worldwide Procurement and Logistics
- 8D - **8 discipline** corrective action document to describe the different phases of problem solving.

3.0 REFERENCE DOCUMENTS

- 3.1 [WPL External Website](#)
- 3.2 [Foundry/Subcon External Manufacturing Communicate Website](#)
- 3.3 [CETRAQ website](#)
- 3.4 [QSM 009 – Process/Product Change Control](#)
- 3.5 [AIAG - Automotive Industrial Action Group](#)

4.0 SUPPLIER QUALITY MANAGEMENT SYSTEM

4.1 Suppliers are expected to have an effective quality system that ensures conforming product is delivered to any TI facility. TI reserves the right to inspect records/evidence of quality management systems at the supplier's facility. This may be included in the scope of a process assessment or a site audit.

4.2 Quality Certifications:
ISO9001 (latest version) is the minimum expectation required through a verification of 3rd party registrar. Exceptions may be granted on a case-by-case basis.

Demonstration of conformance to ISO/TS16949 (latest version) may be required as defined by **the respective TI personnel**.

The Supplier Management Team may accept additional quality system certifications as evidence of an effective quality management system. This letter of **certification** may be provided to the **respective TI personnel** in softcopy.

ISO14001 (latest revision) provides guidelines on the elements of environmental management system and its implementation. Demonstration of conformance to this certification is not mandatory but encouraged by TI as indication of environmentally responsible supplier.

5.0 SUPPLIER APPROVAL PROCESS

Suppliers must have to complete the registration form. This form initiates the approval process within TI. **Detailed supplier registration process can be found in WPL external website.**

6.0 PART QUALIFICATION and CAPABILITY ASSESSMENT

6.1 Material Specification

6.1.1 Qualifications may be initiated for the following:

- a new supplier
- a proposed change in supplier manufacturing site or technology or part production process. **The definition of a major/minor change is documented in [QSM 009- Product/Process Change](#).**

6.1.2 The **category team** may request additional assessments and information prior to supplier qualification. The supplier must meet all technical requirements and specifications as communicated by **the respective TI personnel**.

- 6.1.3 The supplier shall be able to provide a process qualification package that includes **the following as defined by the respective TI personnel:**
 - 6.1.3.1 Production part approval process (PPAP) as necessary
 - 6.1.3.2 Specifications used
 - 6.1.3.3 All test or inspection plans
 - 6.1.3.4 Reliability plans (if applicable), analysis, audit plans, etc
 - 6.1.3.5 Data that substantiates the decision to release the process from product development into manufacturing.
- 6.2 Change Control Management
 - 6.2.1 All approved suppliers shall be made aware by **the respective TI personnel** of TI's requirement for supplier's change control and TI notification procedure.
 - 6.2.2 In the event that a supplier needs to implement a change to the product/equipment/ material delivered to TI, approval or permission has to be granted from the respective **TI Quality Assurance Manager.**
 - 6.2.3 Suppliers shall make use of the TI-provided Risk Assessment form to review all changes in their product/process. (Refer to Attachment 1 and 2 for AT and FAB changes respectively.)
 - 6.2.4 All High Risk Minor Supplier Change must be submitted to the affected TI facility's CCB for review.
 - 6.2.5 TI's CCB will review and decide if a supplier change should be classified as a Major or Minor Change.
 - 6.2.6 For Supplier Changes that will be classified as Major Change, **or High Risk Minor Change**, TI will provide a qualification plan that needs to be completed before the change can be implemented.
 - 6.2.7 All Low risk Minor Supplier Change does not need TI notification / approval. Execution of the change may take effect immediately once the supplier's change control board approves the supplier change. **Exceptions will be communicated to the supplier/s by the respective TI personnel.**
 - 6.2.8 Supplier High Risk Changes **that include the following as minimum:**
 - 6.2.8.1 Change Location
 - 6.2.8.2 Change in Supplier's Supplier/Second Sourcing
 - 6.2.8.3 Change in Supplier's Bill of Materials
 - 6.2.8.4 Change in Supplier's Process Flow
 - 6.2.8.5 Change in Supplier Process Method
 - 6.2.8.6 Change in Supplier's Tool/Equipment
 - 6.2.8.7 Changes that could affect supplier Lead Time/Delivery Time
 - 6.2.8.8 Changes in Supplier's Packing Materials/Process/Labels
 - 6.2.8.9 Change in supplier process parameter that affects final material behavior such as moduli, interfacial adhesion, etc.

6.2.8.10 Change in design which has a visible impact on cross section.

6.2.8.11 Change in fiducial design and location.

6.3 Approval Process

6.3.1 For those changes which have been identified by TI requiring notification, the Supplier will provide notification to the respective TI personnel in a timely manner.

6.3.2 A TI sponsor will be identified by WPL or EDM. This TI sponsor will be responsible to submit and present the change in the CCB review and own the monitoring of the completion of the CCB requirements until Approval/Disapproval.

6.3.3 TI's CCB will define the minimum qualification requirements for the change being requested by the supplier.

6.3.4 Execution of the change at supplier (if approved) will take effect only after TI CCB provides a written approval in the form of a Release Memo and after the maturity of the proposed date of Implementation to be identified in the PCN form or waived by the respective Quality Manager.

6.3.5 During implementation, the supplier is required to provide monthly monitoring data that represents the change material.

6.3.6 TI reserves the right to recall an approval given to a change request or require 8D reports if the supplier fails to meet the target improvement defined in the Supplier CRF.

6.4 TI PCN Requirements:

6.4.1 Once a supplier change is accepted by the CCB, the supplier is required to submit a Supplier PCN Letter (refer to Appendix 1 Assembly Process Risk Assessment Form)

6.4.2 The Supplier PCN Letter shall contain the following as a minimum:

6.4.2.1 Details of the Change

6.4.2.2 Affected Part Numbers

6.4.2.3 Supplier Qualification Requirements with Results

6.4.2.4 Proposed Implementation date.

Note: Proposed Implementation date should not be any earlier than 30 days of the CCB Approval date unless with a written consent from the CCB to implement on an earlier date.

6.4.2.5 Signature of Supplier's Quality Manager

6.4.3 Suppliers will be held accountable for corrective action when changes to product specifications without prior notification to TI result in non-conformity to TI's product or processes.

6.5 Production Part Approval Process Overview (PPAP)

- 6.5.1 TI supplies products to automotive customers and one of the requirements is PPAP submission. The purpose of PPAP is to determine if all customer engineering design record and specification requirements are properly understood by the supplier, and that the manufacturing process has the capability to produce product that consistently meets these requirements during an actual production run.
- 6.5.2 PPAP is a requirement for certain material suppliers. Suppliers will be notified if they are required to provide PPAP.
- 6.5.3 Contact the CPT if you have questions. PPAP manual is published by the Automotive Industrial Action Group (AIAG).

6 MATERIAL/PART DOCUMENTATION REQUIREMENTS

This section applies to suppliers who deliver or store the following: finished goods, parts that become a component of TI's end product or raw materials used in manufacturing. Otherwise, skip this section and move on to controlled substances.

7.1 Product Identification and Traceability

The Supplier shall maintain documented procedures for identification of product from receipt and during processes of production and delivery. When traceability is a specified requirement, the Supplier shall establish and maintain a documented procedure for unique identification of individual product or batches. This identification shall be recorded and document/s retained by Supplier **as required in TI's specification**.

7.2 Inspection and Test

- 7.2.1 The supplier shall provide and maintain suitable gauges, measuring instruments and test equipment to measure/test all material for conformance to Buyer's requirements.
- 7.2.2 Copy of quality conformance inspection data pertinent to material inspection **will** be supplied by supplier **as** required.

7.3 Shelf Life - Date of Manufacture

- 7.3.1 The supplier should maintain a First-In-First-Out (FIFO) procedure. If the items supplied are subject to age and/or temperature control, the supplier must maintain FIFO procedure. Materials with specific shelf life requirement will be communicated **by the respective TI quality personnel**.

7.4 Barcode/Label requirements

- 7.4.1 All intermediate containers must be labeled to identify the parts inside. The labels should either be scanned, readable by human eye, and visible at all times. Do not cover the label with other forwarder label or manufacturing label.
- 7.4.2 Any discrepancy of label information versus actual shipment will warrant a discrepancy report to be filed against the supplier. The supplier has to respond with a proper 8D report in a timely manner.

- 7.4.2.1 Each inner pack must be labeled to include this minimum information:
- material name or product name
 - quantity
 - batch number
 - date code
- 7.4.2.2 If shipment comes on a pallet, labels **may** be placed on any of the four sides of the pallet load. These labels are used to identify and summarize the total contents of a pallet load.
- 7.4.2.3 If mixed loads are delivered, a mixed load label **may** be affixed on any of the four sides of the pallet load.
- 7.4.2.4 Certificate of Analysis (CoA)/Certificate of Conformance (CoC)
For products supplied to TI that require a 'Certificate of Analysis' (CoA) or Certificate of Conformance (CoC), this document must be together with the parts/materials or transmitted to TI via electronic data interchange or other means of transmitting data. Supplier should ensure that CoA/CoC data are within TI's specified spec limits.

8.0 SUPPLIER DEVELOPMENT PROCESS

8.1 Supplier Performance Assessment

CETRAQ is a tool used to assess **key** supplier performance. It is part of the process for managing and developing suppliers, awarding business and creating procurement strategies.

8.1.1 CETRAQ

TI will select and retain suppliers based on their ability to provide TI with a sustainable competitive advantage in CETRAQ. These are the areas of Cost, Environmental Responsibility, Technology, Responsiveness, Assurance of Supply and Quality.

For new suppliers, CETRAQ **and other related TI documents** clearly states TI's performance expectations. For existing critical suppliers, CETRAQ metrics show their ranking with respect to other existing suppliers, and identifies areas of improvement.

- 8.1.2 For direct material critical supplier, the 'Q' portion of CETRAQ will be defined by the Category Procurement Team with consideration for continually meeting or exceeding Texas Instruments quality expectation. This will apply during the CETRAQ cycle (e.g., quarterly, bi-annually). Criteria to be considered may include the following:

Key Performance Indices	Example
Customer Disruption	0
# Supplier Issue/Incidents	= <3 quality issues
Supplier Issue 8D closure cycle time	<10 days
Quality Indices	As applicable

8.1.3 Supplier Site audit. TI will perform a site audit as necessary.

- Discrepancies resulting from the site audit are to be addressed by the supplier.
- Failure to implement any required corrective actions may negatively impact the supplier’s qualification status.

8.2 Supplier Corrective Action/Preventive Action

Suppliers must embrace continuous improvement as a business and quality systems methodology. This methodology includes the following as a minimum:

- 8.2.1 Programs to correct and eliminate manufacturing/design/material defects.
- 8.2.2 Use of structured problem resolution and corrective action methods such as 8D reports, or 8-Discipline problem solution, or 3 x 5 why root cause and corrective actions. The 8D process is defined in Attachment 3.
- 8.2.3 Sample of blank 8D report is in Attachment 4.
- 8.2.4 Root Cause Analysis
 - The root cause analysis method must be defined in the 8D document by the supplier.
 - The analysis method may consist of any industry defined processes such as 3 x 5Why, Fishbone or Ishikawa, Cause and Effect, etc. An example of 3 X 5 Why analysis format is on Attachment 5.
 - A copy of the root cause analysis may be requested by the CPT at any time during the corrective action process.
 - The supplier shall have adequate procedures in place to effectively handle quality and reliability non-compliance issues including field alerts and product recalls. TI must be quickly notified of such events.

8.3 Continual Improvement Process

- The supplier is expected to have documented plans to baseline, and improve, process capabilities for critical processes or parameters.
- Continual quality improvement process must be demonstrated.
- On time delivery, and other criteria defined in the supplier performance measurement process, or scorecard, will be monitored by the CPT. Information will be furnished to the supplier for action as necessary to improve.
- Satisfactory performance is necessary to maintain qualification.

8.4 Supplier Disqualification

8.4.1 TI may remove a supplier from the qualified supplier status when sufficient justification exists. Justification includes but is not limited to:

- Quality, delivery, or service problems
- Failure to achieve or maintain acceptable CETRAQ ratings
- Continue to supply inaccurate date
- Failure to implement effective corrective actions to correct findings from an assessment
- Failure to notify TI of process or product changes as required
- Failure to implement process or product capability improvements if deemed as necessary by WPL

8.4.2 The **respective category team** will document in writing the reasons for the disqualification.

8.4.3 The **respective category team** will notify the supplier and request corrective action to bring the supplier back to a conditionally qualified status.

8.5 Supplier re-qualification

To obtain re-qualification, the supplier must present acceptable corrective action on the root cause of the reason for disqualification and demonstrate sustainable quality performance.

9 CONTROLLED SUBSTANCES

9.1 As a supplier to TI, you and your products and services are integral to our success. TI depends on suppliers in the creation of products and services that enhance the quality of life for customers and employees and progressively reduce the potential ecological impact of its activities by focusing on productivity and eco-efficient processes.

9.2 Because of stringent regulatory requirements, customers of TI are requiring that the products they buy from TI do not contain certain substances above specified concentrations. To meet customers and regulatory requirements, TI has created a Specification, TI 6453792, "Controlled Chemicals & Materials Specification", identifying these substances and has updated the Terms & Conditions of Purchase. The document can be accessed online at [WPL external website](#). Click on "Controlled Chemicals."

- 9.3 The Specification is required of all TI suppliers who supply a chemical or material, which will become part of TI's final product or packing materials used to ship TI products. **The respective category team** will facilitate this topic with supplier, as needed, to ensure compliance to this specification.
- 9.4 The Specification requires these suppliers to report annually to TI a web form "Compliance & Analysis Certificate". The Supplier Specification, Certificate, and Terms and Conditions of Purchase can be accessed at the same web site. **First click 'Controlled Chemicals' then click 'Compliance & Analysis Certificate'.**

Attachment 1 (Appendix B of QSS 009-005 Rev E)

Assembly Process Risk Assessment Form

RISK ASSESSMENT FORM

1. DESCRIPTION OF CHANGE

Change Title: _____ Date: _____

Engineer: _____

Description of proposed change:

From: _____

To: _____

2. MAJOR CHANGE DETERMINATION

Check one: Major _____ or Minor _____

3. CLASSIFICATION OF CHANGE

(Answer yes or no for each question.)

A process change is considered to be high risk until rationalized to be low risk.

Where appropriate, include justification or explanation for the answer to each question.

PROCESS INTEGRATION/DEVICE AND RELIABILITY RISK FACTORS:

___ a. Could the change result in a physical change in any measurable package dimension?

___ b. Could the change impact baseline targets, controls or process margin of any prior or subsequent process/operation? If yes, propose plan to characterize impact.

___ c. Could the change impact any electrical parameters, device performance, yield?

___ d. Could the change impact device reliability such as wire bond integrity, package integrity, die crack susceptibility, solderability and lead integrity.

MANUFACTURABILITY/CUSTOMER DISRUPTION RISK FACTORS:

___ e. Does the change involve a single machine operation or put more than 20% of the work-in-progress (WIP) at an operation at risk?

___ f. Does the change have an impact that is only detectable at electrical test or later? If yes, propose plan to characterize at each process point.

___ g. Does the change have a cumulative impact that would be difficult to characterize until a large volume of material has been processed?

___ h. If the change affects inline measured parameters, will the measurement tool be less accurate or will the GR and R be unacceptable at the new target?

EQUIPMENT/SAFETY

___ i. Does the change introduce unqualified tooling or material in the equipment?

___ j. Could the change affect the original safety features of the equipment?

___ k. Does the change require retraining of the operator on equipment operation?

CYCLE TIME

___ l. Could the change increase the processing time at the process step and at subsequent steps?

___ m. Could the change increase the set-up time and modify the material handling sequence?

4. SUMMARY OF RISK

If the answer is NO to all of the above questions, the proposed process change is considered a "low risk" change. If the answer to any of the questions is YES, the proposed process change is considered "high risk" unless downgrade is approved by the change review board.

5. DOWNGRADE JUSTIFICATION

If downgrade is recommended, provide supporting data.

Attachment 2. (Appendix B of QSS 009-025, Rev. C)

WAFER FAB Risk Assessment Form

1. CLASSIFICATION OF CHANGE

A process change is considered to be high risk until rationalized to be low risk. Where appropriate, include justification or explanation for the answer to each question.

PROCESS INTEGRATION/DEVICE AND RELIABILITY RISK FACTORS:

- a. *Could/Does* the change result in a physical change in any measurable wafer structural dimension outside of the currently defined control limits? (i.e., etched feature profile, remaining film thickness, doping profile, wafer topography. *Note:* Some devices may not operate within the entire PCD/PARMS spec range and, therefore, could be negatively impacted by the change.) If yes, describe the structural change.
- b. *Could/Does* the change impact baseline targets, controls, or process margin of any prior or subsequent process/operation? If yes, propose plan to characterize impact.
- c. *Could/Does* the change increase surface contaminants such as particles, mobile ions, or other metallic contamination? If yes, propose plan to characterize impact.
- d. *Could/Does* the change negatively impact any electrical scrap parameters, speed performance, or device yield?
- e. *Could/Does* the change negatively impact device reliability? (i.e., Increase in outliers, shorter lifetimes)
- f. *Could/Does* the change have a cumulative impact that would be difficult to characterize until a large volume of material has been processed? (i.e., metal target age impact, chamber build-up issues, etc.)

MANUFACTURABILITY/CUSTOMER DISRUPTION RISK FACTORS:

- g. *Does* the change involve a one-of-a-kind machine operation or put > 25% of the fab work-in-progress (WIP) at risk?
- h. *Could/Does* the change have an impact that is only detectable at parametric test or later? (i.e., increase in photo resist thickness that causes shadowing of angled implants)
- i. If the change affects inline measured parameters, will the measurement tool be less accurate or will the GR&R be unacceptable at the new target?
- j. *Could/Will* this change be impacted by another change that is in the process of being evaluated or implemented?
- k. *Could/Does* this change have a product dependent response? (i.e., will a limited release be required evaluate the change over multiple products?)

2. SUMMARY OF RISK

If the answer is NO to all of the above questions, the proposed process change is considered a "low risk" change. If the answer to *any* of the questions is YES, the proposed process change is considered "high risk" unless downgrade is approved per paragraph 6.3. If downgrade is recommended, provide supporting justification. To release a minor change that a risk analysis indicates could lead to decreased yield or increased parametric scrap, a 20 lot release strategy must be employed on each technology affected unless it is not feasible to use 20 lots in which case fewer lots may be used with the approval of the fab quality manager.

3. MAJOR CHANGE DETERMINATION

If the proposed change is deemed a Major change per QSS 009-001, the change is automatically classified as high risk. Proceed with step 7 of the flow diagram and notify your Quality Manager of this major change.

EQUIPMENT/SAFETY

___i. Does the change introduce unqualified tooling or material in the equipment?

___j. Could the change affect the original safety features of the equipment?

___k. Does the change require retraining of the operator on equipment operation?

CYCLE TIME

___l. Could the change increase the processing time at the process step and at subsequent steps?

___m. Could the change increase the set-up time and modify the material handling sequence?

4. SUMMARY OF RISK

If the answer is NO to all of the above questions, the proposed process change is considered a "low risk" change. If the answer to any of the questions is YES, the proposed process change is considered "high risk" unless downgrade is approved by the change review board.

5. DOWNGRADE JUSTIFICATION

If downgrade is recommended, provide supporting data.

Attachment 3. (The 8D process)

When it is determined that the discrepancy is the responsibility of the supplier, the supplier shall provide an 8D document which addresses the root cause and implements corrective actions to resolve the root cause. The following are defined elements of the 8D:

- D1) Definition of the team: Establish a Champion, Select Team leader/members. Check for cross-functional team representation & expertise.
- D2) Analysis of the problem: To solve a problem, it must be Precisely Defined. Construct basic information using the following:
 - What: The object or Part Concern (Defect)
 - Where: Seen on the Object. The location of the problem (In-house or physical)
 - When: Date when first Discovered Problem. When previously encountered, or when seen in Process Cycle.
 - How Big: How big is problem? (Pareto Chart) How many products have the defect (Quantify)
 - Once Problem is identified, continue to ASK WHY until you reach a level that can be acted upon. Develop Paynter Chart.
 - Start Chronological Action Plan.
- D3) Definition of containment actions: If a potential product defect, yield, capacity, or other problem/situation could negatively impact commitments to TI. The supplier must take immediate containment and corrective actions, then notify TI. Complete information concerning the effect on processes, part numbers, TI sites or customers, schedules and cost must be rapidly determined and communicated. Implementation of containment actions:
- D4) Determination of the root cause(s): Define Difference/Gap in the process. What changes happened that result to the problem. Re-evaluate Problem Description.
- D5) Definition of corrective actions: Continue with Info Database, Analyze best corrective action, Focus on Impact & Risk.
- D6) Verification of effectiveness of corrective action(s): Verify that Corrective Action Eliminates Root Cause by duplicating failure and it does not create another type of defect.
- D7) Definition of actions to prevent recurrence of the same or similar problem
- D8) Congratulation of the team: Determine appropriate recognition. Determine need to continue problem resolution.

Attachment 4. (Blank 8D Form)

PART DESCRIPTION:

Supplier Name	:	Package Type	:
TI Reference No	:	Site	:
Affected Product	:	Qty Returned	:
Material Name	:	Date Received	:

D1) TEAM MEMBERS:

Process Role	Name	E-mail
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D2) PROBLEM DESCRIPTION:

D3) IMPLEMENT AND VERIFY CONTAINMENT ACTIONS:

Action	Owner(s)	Due Date(s)
---------------	-----------------	--------------------

D4) DEFINE AND VERIFY ROOT CAUSE:

D5) DEFINE AND VERIFY CORRECTIVE ACTION:

Action	Owner(s)	Due Date(s)
---------------	-----------------	--------------------

D6) IMPLEMENT AND VALIDATE CORRECTIVE ACTION:

Action	Owner(s)	Due Date(s)
---------------	-----------------	--------------------

D7) ACTION TAKEN TO PREVENT RECURRENCE:

Action	Owner(s)	Due Date(s)
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D8) CONGRATULATE THE TEAM:

Attachment 5. (Sample of 3 x 5 Why Format)

Problem Solving Summary Form 5-Why Analysis

Define Problem

Input the problem here.

Use this path to investigate why the problem exist?

I. WHY DID WE HAVE THIS PROBLEM??

Root Causes

Use this path to investigate why current system/process did not detect it?

Use this path to investigate why issue reach internal partners?

Corrective Action with Responsibility	Date
A	
1a.	
1b.	
1c.	
1d.	
B	
2a.	
2b.	
2c.	
2B.	
C	
1a.	
1b.	
1c.	
2.	
3.	

Ref. No. (Spill, PR/R...)		
Reference Document		
Date of Spill		
Product / Process	TI Location	Content Latest Rev Date

=====End of File=====