

Fit-Critical Assembly Part with CMM and PPAP-Ready Validation

Project Overview

Part: Automotive Interior Mounting Bracket

Industry: Automotive Interior Systems

Application: Precision mounting structure for interior assembly

Challenge: Dimensional stability, assembly fit, and production validation

Gege Mould developed an injection mold solution for a fit-critical automotive interior mounting bracket used to locate and secure interior components inside the vehicle cabin.

The bracket included multiple mounting points, locating features, and clip interfaces that required accurate positioning during assembly. Because the part connected with several mating components, dimensional control was essential to ensure proper fit, reduce assembly variation, and support a smooth production launch.

For automotive T1 suppliers, a successful mold project requires more than producing a first good sample. The mold must deliver stable dimensions across repeated cycles and provide reliable inspection data for validation and PPAP preparation.

Customer Challenge: Achieving Stable Fit Before PPAP Approval

During initial molding trials, the mounting bracket showed dimensional variation between shots.

The main issues included:

- Several critical features were outside tolerance.
- Clip locations did not consistently match mating components.
- Assembly force was higher than expected.
- Trial rejection rates increased due to dimensional instability.

The customer was concerned that continued variation could delay:

- Design validation.
- PPAP submission.
- Production approval.
- Vehicle launch timing.

The key question was:

Could the mold achieve repeatable dimensions and provide the validation confidence required for mass production?

Root Cause Analysis: Understanding the Dimensional Variation

Gege Mould performed a detailed review of the part design, mold structure, and molding process to identify the causes behind the fit issues.

The analysis identified several key factors:

1. Datum and Stack-Up Control

The original part design included multiple locating features that directly affected assembly alignment.

Small dimensional shifts across these features created larger variation when combined with mating components.

Gege Mould reviewed the datum strategy and focused improvement efforts on the dimensions that had the greatest impact on assembly fit.

2. Wall Thickness and Shrinkage Variation

Different wall thickness areas cooled at different speeds, causing uneven shrinkage.

This affected:

- Mounting hole positions.
- Clip locations.
- Flatness of assembly surfaces.

3. Cooling Balance

The initial cooling layout did not provide consistent temperature control across all critical areas.

Uneven cooling created part deformation and contributed to dimensional changes between molding cycles.

4. Gate and Runner Influence

The original filling balance affected packing pressure distribution.

This created variation in shrinkage behavior and increased the risk of out-of-tolerance dimensions.

Mold and Process Improvements

Gege Mould implemented several engineering improvements to stabilize the part dimensions.

Mold Design Optimization

The mold design was adjusted to improve dimensional control in critical areas.

Improvements included:

- Cooling channel optimization for better temperature balance.
- Gate and runner adjustment for more uniform filling.
- Support improvements around critical dimensional features.

Stack-Up and Feature Control Review

Critical datums and assembly-related dimensions were prioritized during mold optimization.

The focus was placed on:

- Mounting locations.
- Clip positions.
- Interface surfaces.
- Hole locations.

This ensured the mold was optimized based on actual assembly requirements rather than individual dimensions alone.

Process Window Optimization

Injection molding parameters were adjusted and validated, including:

- Injection speed.
- Holding pressure.
- Cooling time.
- Mold temperature.

The goal was to establish a stable process window that could maintain consistent dimensions during production.

Validation: CMM Inspection and PPAP-Style Checks

After mold improvements, Gege Mould completed detailed dimensional validation to confirm performance.

CMM Dimensional Inspection

Critical features were measured using CMM inspection to verify:

- Datum accuracy.
- Hole positions.
- Clip locations.
- Flatness requirements.
- Overall dimensional stability.

First Article Inspection (FAI)

Trial parts were checked against drawing requirements to confirm that all critical characteristics were within specification.

Dimensional Trend Monitoring

Multiple trial samples were inspected across molding cycles to evaluate consistency.

The analysis confirmed that:

- Dimensions remained stable between shots.
- Critical features stayed within tolerance.
- Process variation was reduced.

PPAP Readiness Support

The inspection data provided the customer with confidence for PPAP preparation and production approval activities.

Result: Stable Dimensions and Assembly-Ready Performance

After mold and process optimization, the mounting bracket achieved improved dimensional control.

Final results included:

- Critical assembly dimensions brought within specification.

- Improved clip and mating component fit.
- Reduced trial rejection caused by dimensional variation.
- More consistent CMM measurement results across production trials.
- Stable molding performance supporting PPAP preparation.

The customer was able to move forward with greater confidence toward production launch.

Buyer Value

For T1 automotive suppliers, dimensional stability is a critical requirement for successful launches.

A capable mold supplier must understand:

- How part design affects assembly performance.
- How mold cooling influences dimensions.
- How process settings affect repeatability.
- How to validate results with reliable measurement data.

This project demonstrates Gege Mould's ability to support fit-critical automotive components through:

- Engineering-based problem solving.
- Mold optimization.
- Dimensional validation.
- Production process stabilization.

By combining tooling experience with measurement-based verification, Gege Mould helps customers reduce launch risk and achieve reliable mass production.

Gege Mould Capability Highlight

Challenge: Fit-critical automotive assembly part with dimensional variation during trials.

Solution: Datum review, mold optimization, cooling balance improvement, process tuning, and CMM validation.

Result: Stable dimensions, improved assembly fit, and PPAP-ready production confidence.

Gege Mould provides automotive injection molding solutions for precision interior parts, mounting structures, housings, and other components requiring strict dimensional control and reliable production validation.