



PRODUCT ARCHITECTURE

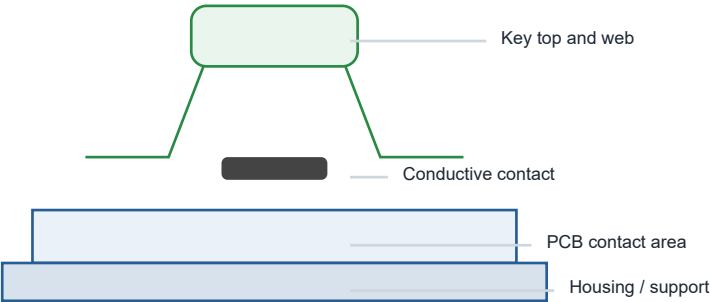
Silicone Rubber Keypad Design Guide

Design inputs and integration guidance for molded silicone keypads, conductive contacts, legends and backlighting.

Design note. Key geometry, material, force and contact performance are interdependent. Final values require tooling and assembly DFM.

Architecture Molded keymat, key web, contact, PCB, housing and optional light path	User response Actuation force, tactile drop, travel, return and key stability
Appearance Color, legends, coating, texture, light leakage and cosmetic zones	Release gate Tooling DFM, force-curve approval and assembly validation

Typical silicone keypad assembly



1. Required Design Inputs

Input group	Information to provide
Application	User, environment, expected operation, cleaning and abuse conditions
Key layout	Centers, key sizes, functions, grouping and simultaneous operation
Tactile target	Force, response shape, travel, return and acoustic expectations
Electrical contact	Contact type, PCB pattern, load, resistance target and life plan
Appearance	Colors, legends, finish, backlighting and visible cosmetic zones
Integration	Housing, PCB, supports, fastening, sealing and assembly sequence

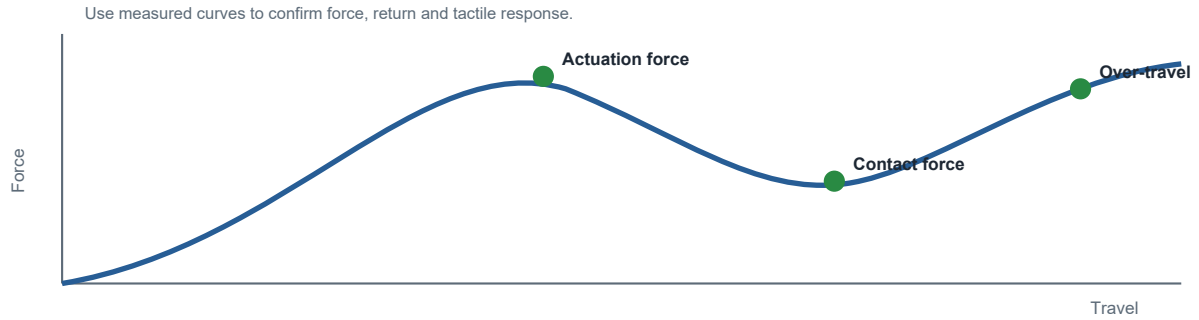


TACTILE RESPONSE AND FORCE CURVES

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Tactile force curve terminology



Term	Definition for project review
Actuation force	Peak force required to move through the tactile event.
Contact force	Force present when the conductive contact closes on the PCB.
Tactile drop	Difference between peak and post-snap force, reported with the full curve.
Travel	Displacement to contact and any controlled over-travel after contact.
Return force	Available force to reopen the contact and restore the key.
Consistency	Allowed variation by key family, location, temperature and life condition.

2. How to Specify the Feel

- Approve a complete force-displacement curve, not a peak-force value alone.
- Group keys by size and function, then identify any keys needing a distinct response.
- Measure with a defined probe, speed, support condition and press location.
- Evaluate initial, environmental and life-conditioned samples using the same method.

Return margin is a system property. Friction, housing preload, venting and off-axis operation can prevent a good molded key from returning correctly.



GEOMETRY AND HOUSING
INTEGRATION

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Geometry topic	Design instruction
Key top	Define shape, size, tilt, legend area and any hard-cap or insert interface.
Web	Use a smooth, balanced geometry and avoid abrupt sections that concentrate strain.
Key spacing	Provide clearance for motion, molding variation and housing alignment.
Travel stop	Define whether the key, housing or PCB support controls over-travel.
Support	Place PCB or housing support so pressing force does not bow the contact plane.
Locators	Use pins, holes or perimeter features to control assembly without stretching the keymat.

3. Housing and Sealing

Integration topic	Review requirement
Opening	Allow full key motion without edge rubbing throughout tolerance.
Guidance	Use housing guidance only where needed and avoid binding from off-axis press.
Preload	The bezel or cover must not hold the key partially actuated.
Sealing	Define the compression surface, load path, venting and allowable leakage path.
Fastening	Distribute clamp load and prevent local distortion around keys or contacts.

4. Contact System

Contact topic	Required definition
Conductive contact	Define material system, geometry, location and resistance acceptance method.
PCB pattern	Provide contact geometry, finish, flatness and contamination controls.
Alignment	Dimension contact-to-key and contact-to-PCB location from functional datums.
Electrical test	Specify circuit, applied load, threshold and conditioning before measurement.
Life test	Define force, rate, environment, cycle profile and failure criteria.



**GRAPHICS, COLOR AND
BACKLIGHTING**

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Graphic topic	Design instruction
Printed legends	Supply vector artwork, color references, location and approved print side.
Protective coating	Define the wear zone, gloss, texture, chemical exposure and appearance target.
Laser legends	Define illuminated and non-illuminated appearance, color stack and edge quality.
Hard caps	Show retention, orientation, gap, height and material interface.
Color	Approve molded and printed color on production-intent material and texture.

5. Backlighting Definition

Lighting topic	Required input
Light source	Provide LED location, color, drive condition and available optical height.
Light path	Define transmissive material, mask layers, internal geometry and reflective surfaces.
Leakage	Identify acceptable light only at intended legends and indicators.
Uniformity	Define viewed area, operating condition and acceptance comparison method.
Off-state	Confirm legend visibility, dead-front intent and color appearance without illumination.

6. Appearance Approval

Approve color, texture, gloss, legend edge quality and illumination on production-intent material. Use defined lighting, viewing distance, angle and powered state for cosmetic decisions.

Artwork files must identify printable legends, laser-removal areas, opaque masks and illuminated windows as separate controlled layers.



TOOLING, VALIDATION AND
RELEASE

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Release input	Minimum content
3D model	Finished part geometry, draft intent, parting strategy and critical surfaces
2D drawing	Datums, critical dimensions, materials, colors, contacts and inspection notes
Assembly data	PCB, housing, caps, light sources, fasteners and assembly sequence
Approval targets	Force curves, appearance standards, dimensional report and functional tests
Change control	Tool, material, color, coating and process changes subject to approval

7. Validation Checklist

- Every key clears the housing and returns under worst-case tolerance.
- Force curves are approved for representative key families and locations.
- Contacts align to the PCB and meet the defined electrical test.
- The assembly controls PCB support, keymat location and compression.
- Legends and lighting meet both on-state and off-state appearance criteria.
- Environmental and life tests use production-intent parts and mating hardware.

8. Approval Evidence

Evidence	Record
Dimensional	First-article report tied to the approved drawing revision
Tactile	Force-displacement data and approved comparison samples
Electrical	Contact resistance, insulation and functional test results
Appearance	Color and cosmetic approval with controlled viewing conditions
Reliability	Environmental and life reports using production-intent assemblies

Release gate: Approve the complete keypad, PCB and housing assembly. A keypad cannot be released from isolated part measurements alone.