

► DESIGN RECOMMENDATIONS

Display/ LED Lightpipe/ Window Opening:

1. Maximum depth of undercut for feature window opening is 0.250”.
2. Underside lip for window opening is the depth of undercut (#14) x 0.660”.
3. Minimum size for molded in silicone window/lightpipe is 0.060”.
4. Minimum thickness for molded in silicone window is 0.030”.
5. Minimum height for molded in silicone lightpipe is 0.030”.
6. Minimum distance from window/lightpipe to and edge is 0.030”.
7. Min / Max wrap around underside is 0.060” to 0.500”. Deeper wraps may be considered depending on design.
8. Sealing rib diameter is 0.030”.

Keypad Wrap - Around Design:

The wrap-around design offers unique capabilities in silicone rubber. Using liquid injection process, one can create hand held units similar to complete plastic cases. With the wrap-around feature, an appealing product can be designed with all the protection requirements for harsh environments.

► TYPICAL PART TOLERANCES

- | | |
|-----------------|---------|
| • < 0.400 | • 0.004 |
| • 0.401 - 0.800 | • 0.006 |
| • 0.801 - 1.200 | • 0.008 |
| • 1.201 - 1.600 | • 0.010 |
| • 1.601 - 2.000 | • 0.012 |
| • > 2.001 | • 0.6% |



► RECOMMENDED GRAPHIC PARAMETERS

Graphic Design:

1. Solid colors can be screened up to the edge of flat keytop.
2. On curved keytops, solid colors can be screened up to 0.015” to the tangent point of the outer radius.
3. Distance from edge of the keypad to legend is 0.015”.
4. Distance of matte legends to key is dependent on key height.
5. Minimum line weight for legends is 0.007”.
6. Minimum text height is 0.050”.
7. Color consistency is within 1 Delta for production run. Typical screening tolerances are 0.015”.







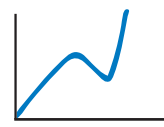
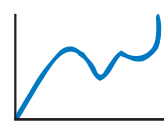
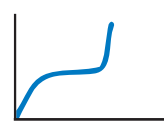
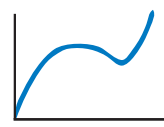
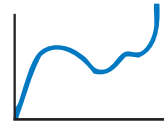
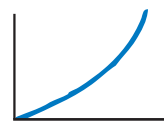
Keypads Considerations for Graphic Screening:

1. Minimum radius allowable for printing over the edge is 0.375”.
2. On legend overrun onto matte surface, a minimum transition radius of 0.010” is required.
3. Maximum curvature depth for concave keytops with a minimum radius of 0.375” is 0.060”.
4. Maximum curvature height for convex keytops with a minimum radius of 0.375” is 0.060”.

► TYPICAL DRAWING INFORMATION

- | | |
|---|--|
| • Overall Keypad Size | • Key Spacing |
| • Keypad Mat Thickness | • Actuation Force (grams) |
| • Keypad Dimensions | • Material Specifications (durometer) |
| • Mounting Hole Details | • Legends & Color(s) (PMS numbers, etc.) |
| • Mounting Boss Details | • Keypad Color |
| • Radii Dimensions (keypad and buttons) | |

▶ ACTUATION FORCES OF CERTAIN KEY SHAPES & STYLES

Name Of Shape	Cone	Double Cone	Bell/Cone	Cone	Double Cone	Flat
Profile Of Shape						
Force Vs. Travel						
Typical Actuation Force	20-250 Grams	20-250 Grams	20-200 Grams	20-150 Grams	20-150 Grams	20-100 Grams

Rubber keypads can be designed so that they achieve a positive tactile response when the operator depresses the keypad. To achieve good tactile feel that is inherent in the rubber keypad the keypad should have at least .060" of travel and should have an actuation force of between 50 and 170 grams.

As an alternative, a tactile layer can be incorporated in between the rubber keypad and the circuitry layer, which will enable a good tactile feel even with small keys and minimal travel distances. This option, which utilizes either stainless steel domes or formed polydomes, does add cost to the project.

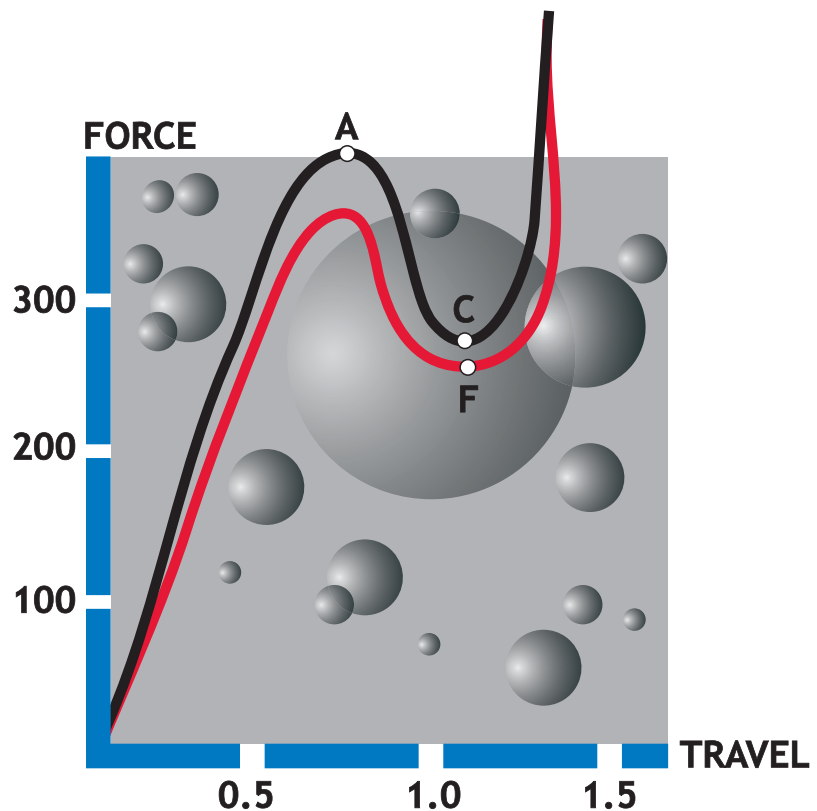
Rubber keypads should be designed with a minimum return force of 30 grams in order to eliminate the potential of sticking keys.



▶ TACTILE RESPONSE

- F = Return Force
- A = Actuation force
- C = Contact force

- Snap Ratio = $(A-C)/A$
- A = 350 grams
- C = 230 grams
- $(350-230)/350=0.343$



▶ TERMINOLOGY

Actuation Force: The force required to collapse the web of a rubber keypad in conjunction with polydome, metal dome, mechanical switch or rubber only.

Air Channel: Air path(s) on the bottom of rubber keypads that allows for air passage when rubber is depressed.

Alignment Hole: Through hole in rubber keypad that is used to position keypad in enclosure.

Base Matte: Silicone sheet material that joins all keys on a rubber keypad. Also known as mat.

Bezel: The faceplate or cover, typically plastic or metal, used to secure a keypad to a printed circuit board or switch.

Bosses: Small posts used for positive alignment of rubber keypad in bezels or assemblies.

Compression Set: The measurement of a material's ability to recover its original size and shape after compression under prescribed conditions.

Conductive Rubber: Silicone keypad impregnated/coated with conductive material.

Color Matching: The visual and electronic analysis of a mixed silicone rubber material compared to a supplied color sample.

Diaphragm / Web: The thin hinged area that permits a rubber key to flex.

Durometer: A measurement range of hardness for silicone rubber.

Key Height: The measured distance from the bottom of a keypad (base matte) to the top surface of a key.

Legend: Printed graphic (symbol, letter or number) on the top of the rubber surface.

Life: The number of actuations realized before the rubber diaphragm/web ruptures.

Reversed-Out Graphics: Graphics that allow rubber color or masking color to be seen through top surface printing on keypad.

Positive-image Graphics: Single or multi-color printing on top of key surface.

Stroke / Travel: Distance from the contact surface of a rubber part to a surface.

Swell: The increase in volume of rubber when in contact with petrochemicals for a determined period.

Tactile Feel: The response of rubber while depressing. For tactile rubber keypads, it is a critical function of the diaphragm web geometry.

Tear Strength: The tear strength is a measure of the resistance of rubber to tear forces. The tear strength is calculated by dividing the maximum force load by the thickness of the rubber.

Wear or Abrasion Resistance: The resistance of a particular ink or coating to manual wearing. The testing process is usually a Norman tester with the number of cycles legends can perform before wear is noticeable.

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