

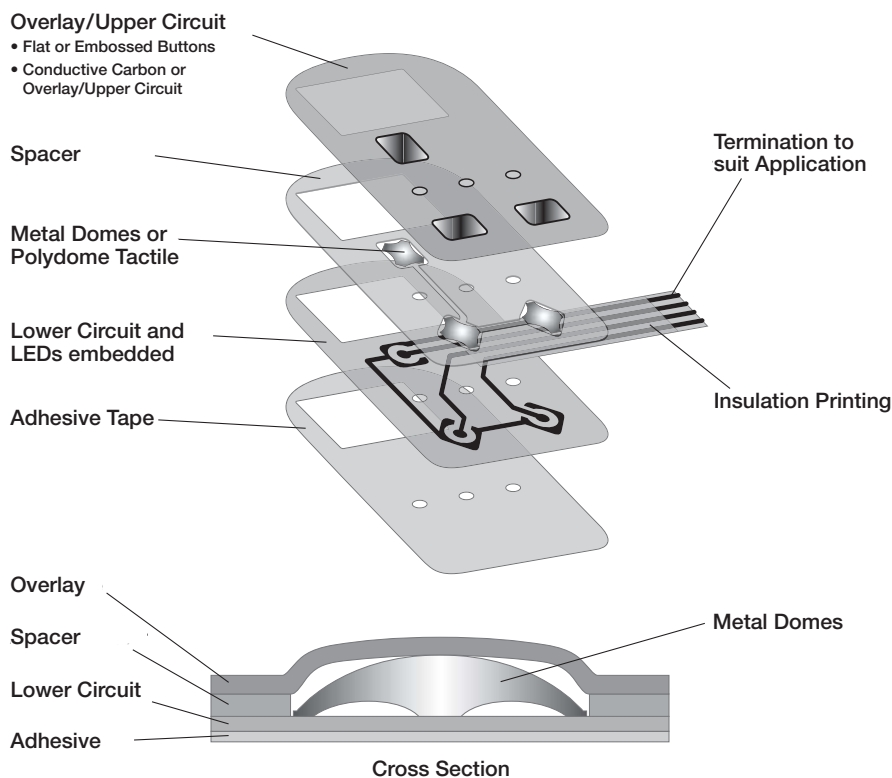
# Membrane Keypad Structure

## Reference Materials:

Overlay	Polycarbonate Film (PC) – Matt or Glossy surface Thickness (mm): 0.075, 0.125, 0.175, 0.250, 0.375, 0.500 Polyester Film (PET) with UV-cured texture coating – Matt or Glossy surface Thickness (mm): 0.15, 0.20, 0.25
Circuit Layer:	Polyester Film (PET) – Thickness (mm): 0.075, 0.100, 0.125
Conductive:	Carbon Ink, Conductive Silver Paste or Metal Domes
Spacer:	Polyester Film (PET)
Adhesive:	Adhesive Double Tape

## Standard Specification for Membrane Keypads:

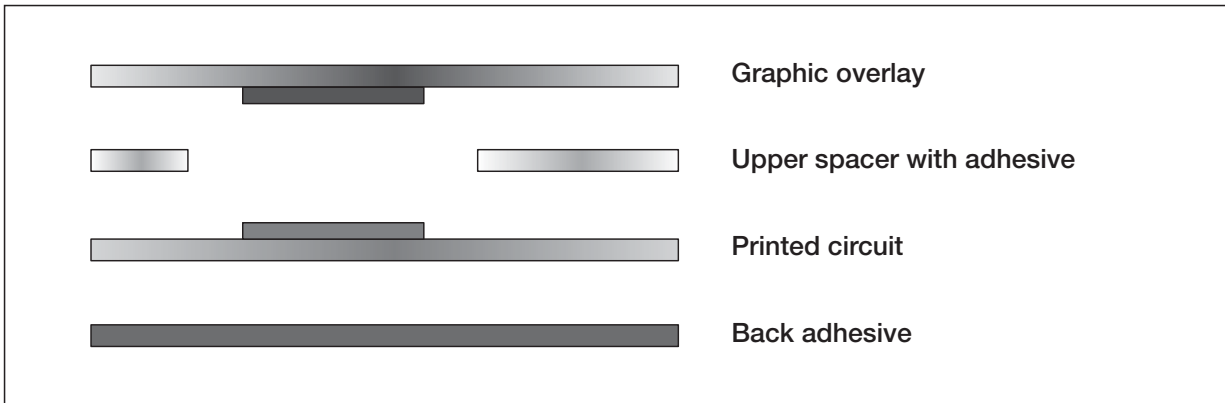
Contact Resistance:	10 to 500 $\Omega$
Operation Voltage:	< 35 V DC
Operation Current:	< 100 mA
Open Circuit Resistance:	> 10 M $\Omega$
Operation Force:	30 g to 500 g
Operation Temperature:	-20°C to +70°C
Storage Temperature:	-20°C to +70°C
Life Expectancy:	5 x 10 <sup>5</sup> to 10 x 10 <sup>5</sup> cycles
Switch Stroke (travel):	0.1mm to 0.6mm
Contact Bounce:	5 to 30 mSec



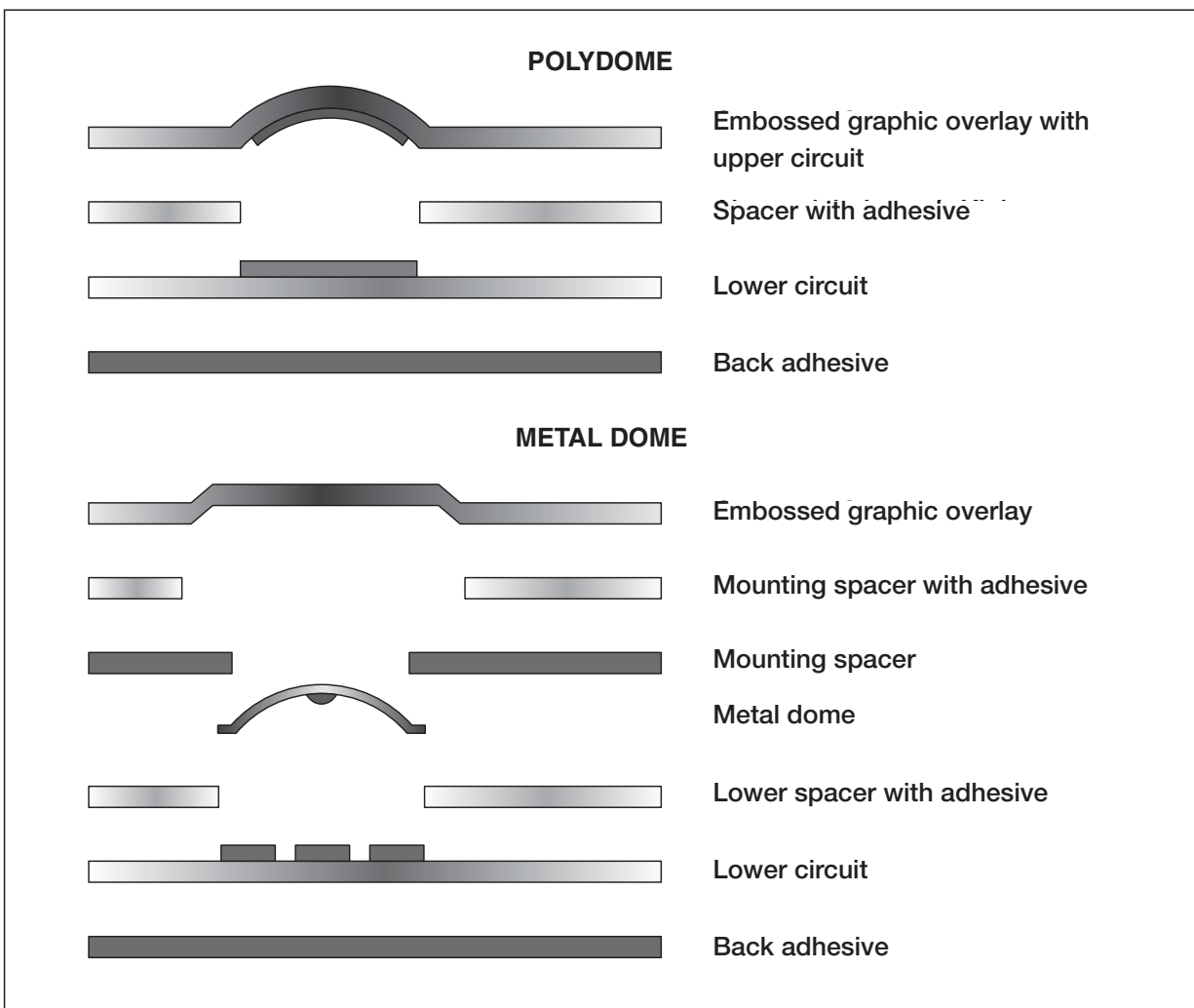


# Membrane Switch Structure

## Flat Type (Non-Tactile)



## Tactile Type



# Rubber Keypad Design

## Tolerance Requirement of Silicone Rubber Key:

### Dimensions:

0 – 9 mm	± 0.10 mm
10 – 19 mm	± 0.15 mm
20 – 29 mm	± 0.20 mm
30 – 39 mm	± 0.25 mm
40 – 49 mm	± 0.30 mm
50 – 59 mm	± 0.35 mm
60 and above	± 0.6 %

### Actuation Force:

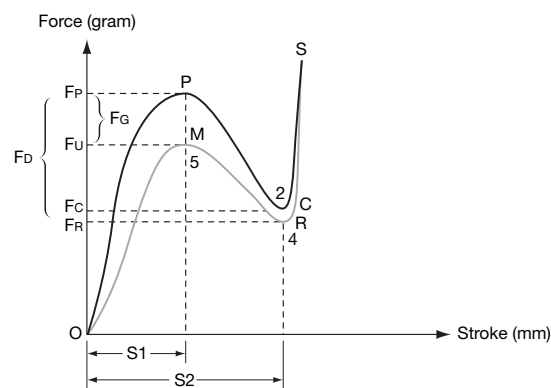
50 – 60 grams	± 15 grams
61 – 80 grams	± 20 grams
81 – 100 grams	± 25 grams
101 – 120 grams	± 30 grams
121 – 150 grams	± 35 grams
151 – 200 grams	± 40 grams
201 and above	± 25 %

## Mechanical and Electrical Properties of Silicone Rubber:

	Non-Conductive Silicone
Temperature for use:	-55°C to +250°C
Specific Gravity:	1.15
Tensile Strength:	90 Kg/cm <sup>2</sup>
Tear Strength:	13 Kgf/cm
Compression Set:	10% (180°C x 22 hrs.)
Elongation at Break:	350%
Volume Resistivity:	8 x 10 <sup>14</sup> Ω cm
Insulation Breakdown:	24 Kv/mm
Colour:	Colouring possible
Dielectric Constant:	4.2 (50 Hz)
Dielectric Tangent:	13% (50 Hz)

Depending on the size of contacts and keyboard layout.

## Force-Stroke Curve of Rubber Keypad



Force	
Fp	Peak Force (Fmax)
Fu	Max. Return Force
Fc	Contact Force
Fr	Min. Return Force (Fmin)
Fm	Max. Return Force
Fd	Drop Force (Fd = Fp - Fc)
Fg	Gap Force (Fg = Fp - Fm)

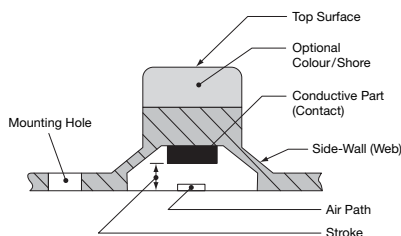
Stroke	
S1	Peak Stroke
S2	Contact Stroke

Location:	
O	Original Point
P	Peak Point
C	Contact Point
R	Return Point
M	Max. Return Point

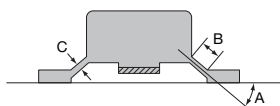
Travel	
O-P	Peak Force (FMAX)
P-C	Contact Force
C-S	Min. Return Force (FMIN)
S-R-M-O	Gap Force (FG = FP - FM)

## Basic Construction

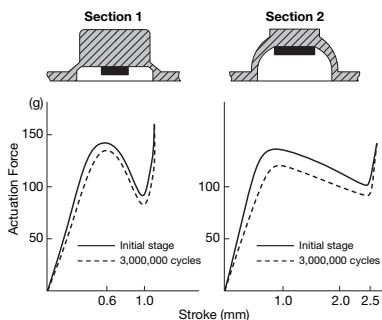
### Illustration:



## Life Test:



- Operating life depends on:**
- **Soft Material** ... 50 Shore is preferred.
  - **Low Stroke** ... less than 1 mm
  - **Angle** (as part A illustrated above) ... 40-degree is recommended.
  - **Length of side-wall** ... (as part B illustrated above)
  - **Thickness of side-wall** ... (as part C illustrated above) ... determined by key structure. The thicker the web, the higher the operating force.

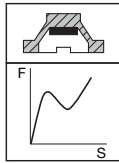




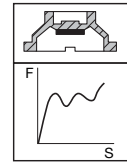
# Rubber Keypad Design

## Typical Key Sections and Characteristics:

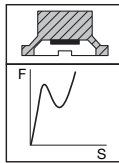
Force Range: 30 ~ 350 grams  
 Stroke Range: 0.5 ~ 3.0 mm  
 Cycle Life (x10<sup>3</sup>): 500 ~ 2000  
 Typical uses: Telephone, Remote Control, Automotive, Radio, Toys, Calculator, etc.



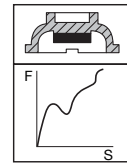
Force Range: 30 ~ 80 grams  
 Stroke Range: 2.0 ~ 4.0 mm  
 Cycle Life (x10<sup>3</sup>): 5000 ~ 20000  
 Typical uses: Computer, Typewriter etc.



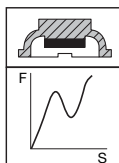
Force Range: 30 ~ 250 grams  
 Stroke Range: 0.7 ~ 2.5 mm  
 Cycle Life (x10<sup>3</sup>): 1000 ~ 3000  
 Typical uses: Telephone, Remote Control, Toys, Games, Calculator, etc.



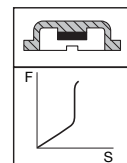
Force Range: 30 ~ 200 grams  
 Stroke Range: 1.0 ~ 2.5 mm  
 Cycle Life (x10<sup>3</sup>): 500 ~ 3000  
 Typical uses: Telephone, Typewriter, Test Instruments, etc.



Force Range: 30 ~ 150 grams  
 Stroke Range: 0.5 ~ 3.0 mm  
 Cycle Life (x10<sup>3</sup>): 1000 ~ 3000  
 Typical uses: Telephone, Remote Control, Toys, Measuring Instruments, Office Machine

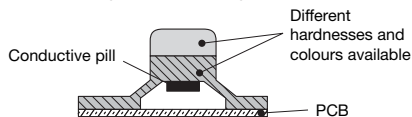


Force Range: 20 ~ 80 grams  
 Stroke Range: 0.2 ~ 1.0 mm  
 Cycle Life (x10<sup>3</sup>): 500 ~ 10000  
 Typical uses: Typewriter, Household Appliances, Computer, etc.

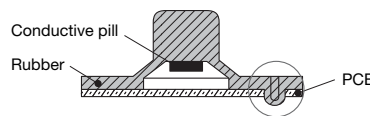


## Some Special Design Illustrations:

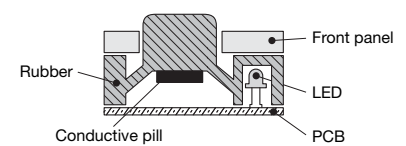
1. Different shorehardnesses in the basic keypad and key



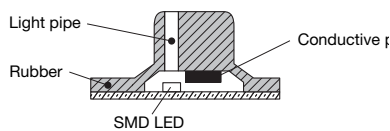
2. Push or pull thru to anchor keypad to PCB



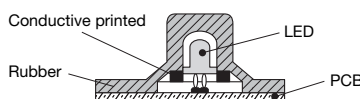
3. Back lighting – option 1



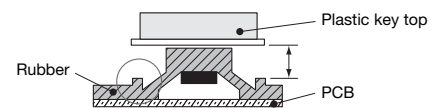
4. Squared key top design with LED light pipe



5. Back lighting – option 2

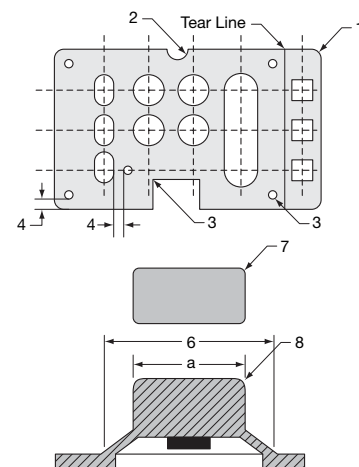


6. Control of travel distance



## Special Design for Construction Ideas:

1. Typical outside radius is 1.0 to 1.5 mm.
2. Minimum radius is 0.3 mm.
3. Minimum inside radius is 0.2 mm.
4. Spacing between the edges of a rubber dome and a guide hole is 1.0 mm or more.
5. Guide holes are min. 1.0 mm in diameter.
6. The width of a rubber dome base is typically 2.0 mm more than a.
7. The minimum radius for the side edges of key top is 0.25 mm.
8. The minimum radius for the top edges of key top is 0.2 mm.

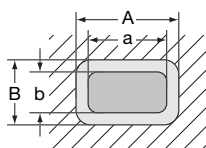


# Rubber Keypad Design

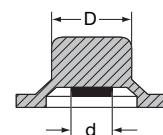
## Guideline for Assembly Design:

A & B: dimensions of plastic  
a & b: dimensions rubber

$A-a \geq 0.5 \text{ mm}$ ,  $B-b > 0.5 \text{ mm}$

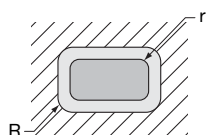


$D-d = 1.5 \text{ to } 2.0 \text{ mm}$



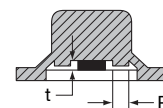
R: the corner radius of plastic  
r: the corner radius of rubber

$1 \text{ mm} \leq R \leq 1.25 \text{ mm}$ ,  $0.75 \text{ mm} \leq r \leq 1 \text{ mm}$  is better



P: diameter of post  
t: the gap between post & conductive pill

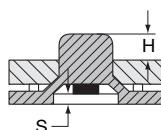
$P = 1.0 \text{ mm}$  is better  
 $t = 0.1 \sim 0.15 \text{ mm}$  is better



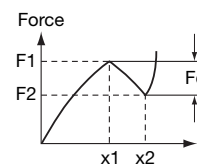
H: the dimension of key tops & plastic

S: the stroke of key pad

$H-S \leq 1.5 \text{ mm}$

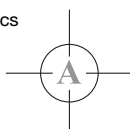


$F_c$ : click force  
 $F_1 - F_2 > 25 \text{ g}$  is better



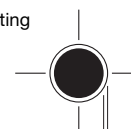
## Guideline for Printing Artwork Design:

Button Graphics



Graphics Off Centre  $\pm 0.3 \text{ mm}$

Full Surface Printing



$\pm 0.5 \text{ mm}$   
 $0.5 \text{ mm}$

## Patterns of Conductive Designs:

### Items:

Circle:

Square/Ellipse:

Conductive Pill Resistance:

Mechanical Life:

Print type Resistance:

Mechanical Life:

Standard Sizes of Conductive Pill

1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, 9, 10

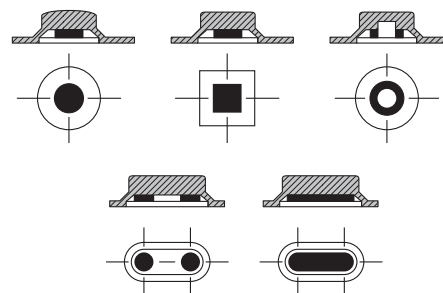
Recommended size of conductive ink printing contact is flexible.

Less than 150 ohms, with 125 grams loading

minimum 10 million operations

Less than 500 ohms, with 125 grams loading

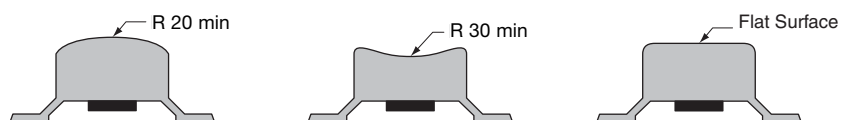
$1 \times 10^6$  max. operations



## Colour/Printing:

### Suitable Key Surface for Legend Printing:

The commonly used colour for the underlay is medium-grey. Customers should provide us with the Pantone code or a colour specimen for both the key button and the legend.



# Keypads Inquiry Form

Company \_\_\_\_\_

Department \_\_\_\_\_

Attention \_\_\_\_\_

Address \_\_\_\_\_

Postcode \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

Email \_\_\_\_\_ Web \_\_\_\_\_

## Membrane Requirements

### Graphic Layer

Overall size \_\_\_\_\_

What finish is required (matt, gloss or selective texture) \_\_\_\_\_

Are windows required \_\_\_\_\_

Size \_\_\_\_\_

Position \_\_\_\_\_

Do they need to be tinted \_\_\_\_\_

Is embossing required \_\_\_\_\_

Pillow or rim \_\_\_\_\_

Number of colours \_\_\_\_\_

### Switches

Number \_\_\_\_\_

Tactile or non-tactile \_\_\_\_\_

If tactile: polydome or metal dome \_\_\_\_\_

*Metal means higher unit cost, lower tool cost.  
Polydome means lower unit cost, higher tool cost.*

Detail of switch matrix \_\_\_\_\_

### LEDs

Are embedded LEDs required \_\_\_\_\_

Number and colour \_\_\_\_\_

Will a separate tail be required \_\_\_\_\_

### Tail position and length

Position of tail – exit from side and rear \_\_\_\_\_

Type of connector (if required) \_\_\_\_\_

If ZIF connector being used, get type for ref. \_\_\_\_\_

### Any special features required

Insert legends \_\_\_\_\_

Luminescent inks \_\_\_\_\_

Other \_\_\_\_\_

### Estimated project volume

\_\_\_\_\_

Please complete this questionnaire and return to us with your sketch overleaf  
(See back page for address details)

