

# SILICONE RUBBER Specifications



## Silicone Rubber Keypad Data

The use of silicone keypads has revolutionized keyboard and switching design. Today's technology makes many exciting possibilities available to the designer.

No longer are you limited to a range of mechanical switches with expensive individual buttons. With silicone keypads the array of buttons, spacing and size is custom designed for the best possible functional use as well as increasing aesthetic appeal. The stroke force and feel of the buttons can be produced to exact requirements. If necessary the plastic push buttons can be dispensed with using the rubber key mat as an alternative. The button tops can be printed or coloured as required.

### Description

Membrane keypads are moulded in silicone rubber with raised dome protrusions, which give a controlled collapse when pressure is applied. Switching occurs when a conductive carbon loaded silicone disc moulded under the dome shorts the printed open circuit design on the printed circuit board underneath. The moulded domes can be made with various cross sections so that varying stroke length and tactile feel is obtained.

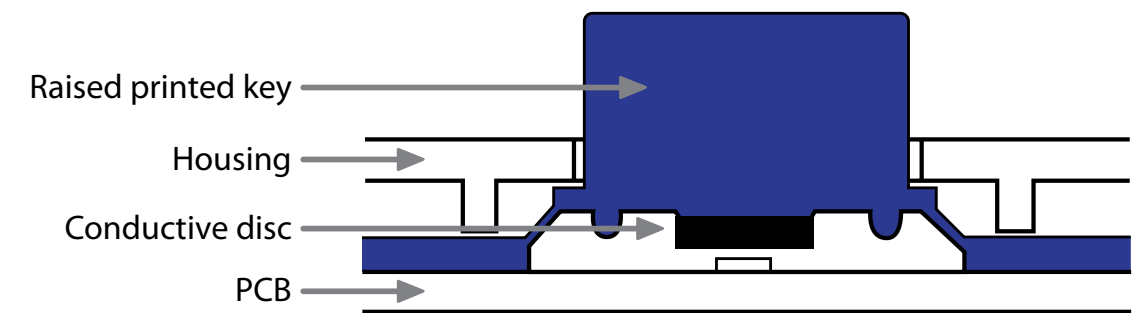
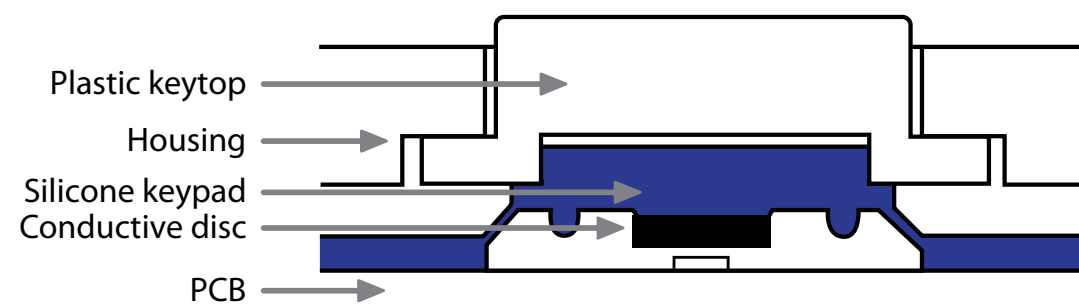
Switching can also be achieved by laying a similar rubber keypad over a plastic membrane touch switch. The rubber keypad in this instance need not have the conductive rubber disc.

Plastic key tops can actuate the raised domes of the keypad; alternatively domes may be extended in height to protrude through the fascia and act as a button. The raised protrusion of the dome may be printed with the figures or required design.

### Advantages

- Operating life up to 5 million cycles
- Keypad acts as gasket sealing the PCB
- Assembly simplified and cost reduced
- One piece construction
- Low chatter and bounce
- EUR certified production

### Typical Sections



### General Specifications

(dependent on test conditions and design)

Material	Silicone Rubber
Key Travel	0.2 to 5mm
Contact Rating	30 mA @ 12 VDC/.5 seconds
Contact Resistance	<100 ohm
Contact Bounce	<5 m sec
Operating Force	30 to 250gms
Dielectric Strength	>1 minute @ 500 VRMS
Life	>1,000,000 cycles
Temperature Operation	Between -40°C and +120°C
Insulation Resistance	>100 M ohms
Environmental Resistance	Resistant to corona, UV, Ozone, Aging
Compatibility	Does not corrode contacts due to absence of Sulphur and Halides
Colour	As required
Keytop Printing	As required in any colour
Durability of printing	No remarkable change after abrasion with a 10Ø x 5mm rubber eraser at speed of 10Hz and 200gms weight

### Typical Tolerances

(recommendation of tolerance for dimension)

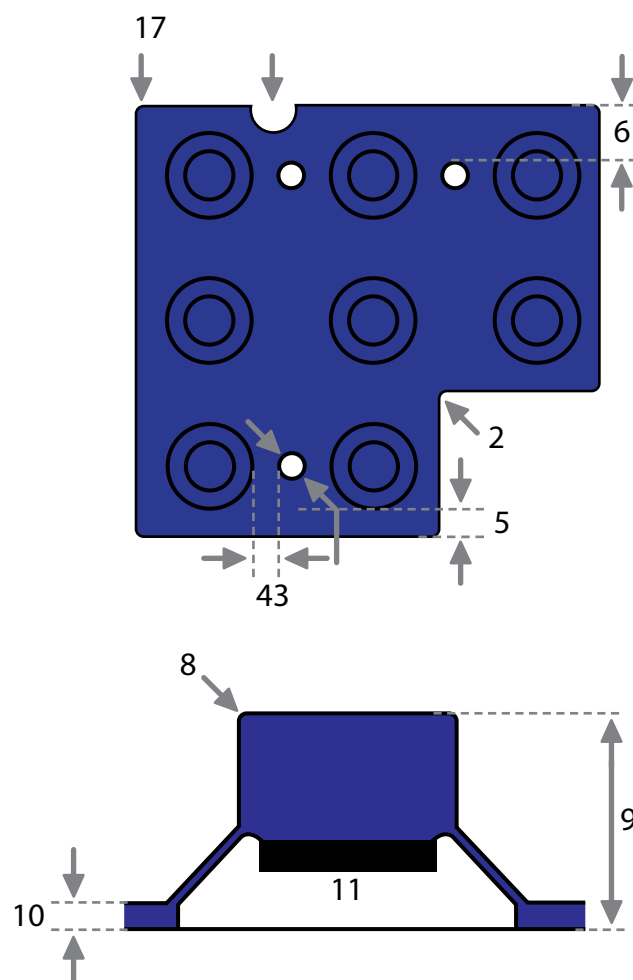
Dimension (mm)	Precision A+-	Std. B+-	Reg. C+-	Actuating Force (gms)	Precision A+-	Std. B+-	Reg. C+-
0.0 – 75.0mm	0.10	0.15	0.2	40 – 60	15	20	25
75.1 – 100.0mm	0.15	0.25	0.4	70 – 100	15	20	30
101.0 – 130.0mm	0.20	0.35	0.5	100 – 150	20	25	30
130.1 – 155.0mm	0.25	0.45	0.6	150 – 200	20	30	35
155.1 – 180.0mm	0.35	0.55	0.7	200 – 300	30	35	40
180.1mm and above	0.5 – 1.000	8 – 1.2	1.5 – 2.5	300 and above	40	50	60

## Applications and Typical Characteristics Required

	Stroke (mm)	Load (gms)	Operating Life
TV selection	0.1 – 1.5	60 – 150	300,000
VTR	1.0 – 1.5	100 – 200	500,000
Remote Control	0.3 – 1.0	90 – 150	300,000
Audio equipment	0.3 – 0.7	90 – 150	100,000
Car radio	0.3 – 0.8	150 – 250	300,000
Electronic calculator	0.3 – 0.6	60 – 100	500,000
Computer	2.5 – 3.5	50 – 90	1 – 10 million
Typewriter	3.0 – 4.0	60 – 90	5 million
Telephone	2.0 – 4.0	150 – 250	1 million
Electronic toy	0.3 – 0.6	50 – 90	30,000
Oven controller	0.0 – 0.3	80 – 100	100,000

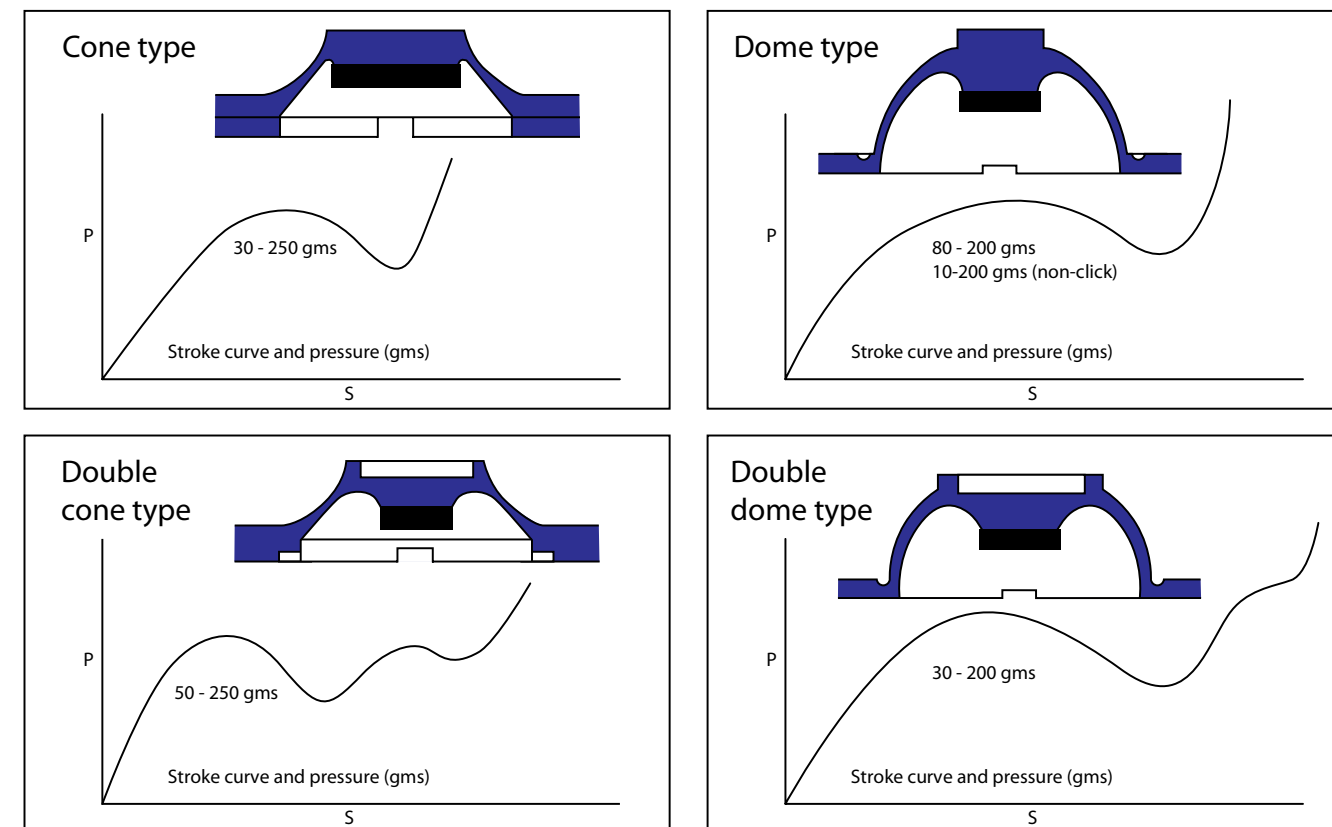
## Dimensional guide

1. Minimum 0.5mm radius.
2. Minimum 0.75mm radius.
3. Minimum 2.0mm in diameter.
4. 3.0mm or more.
5. 3.0mm or more.
6. 3.0mm or more.
7. Minimum 1.0mm radius.
8. Minimum 0.75mm radius generally 0.3mm minimum by electrospark machining.
9. Over 7.0mm and the volume should not exceed 140 cu. mm. Otherwise, the cost of the metallic mould will increase.
10. Thickness of the product should be 1.0mm for the total within 100mm. For total length exceeding 120mm thickness should be 1.2-1.5mm.
11. Size of conductive rubber pellet.



**Diameter (mm)** 2.0 2.5 3.0 3.5 4.0 5.0  
**Thickness (mm)** Generally 0.5/0.7mm

## Typical sectional shapes and characteristics



The life for Cone type is shorter than Dome type. This is because the spring component in the Cone type has a more severe bending movement.

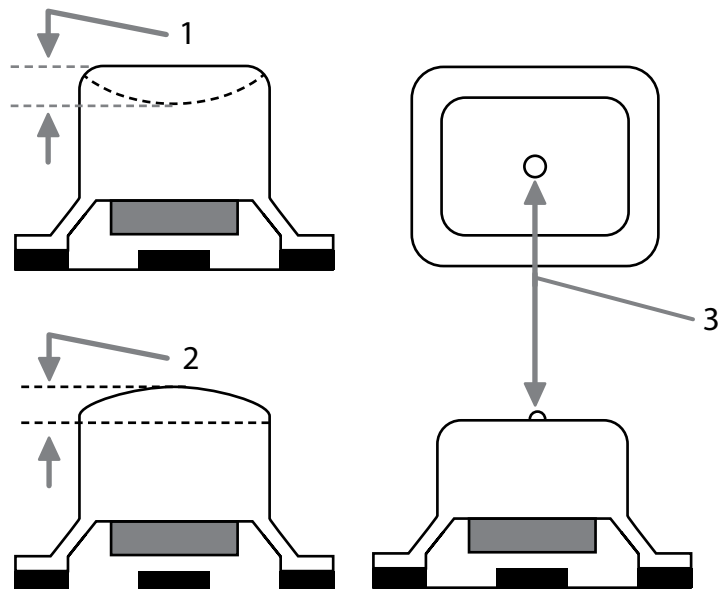
**Typical life cycle for cone: 0.5-3 million**  
**Typical life cycle for dome: 5-10 million**

## Keypad Graphics

Most keypad graphics, positive or negative images are surfaced printed using silicone ink that is bonded to the keypad. Graphics are applied to the tops of the rubber switches by curing the keypads in a high temperature oven after printing. Printing can be difficult if the key tops are of concave or convex design. Each colour to be printed requires its own screen. The colours used can be matched to pantone reference numbers or to colour chips if provided.

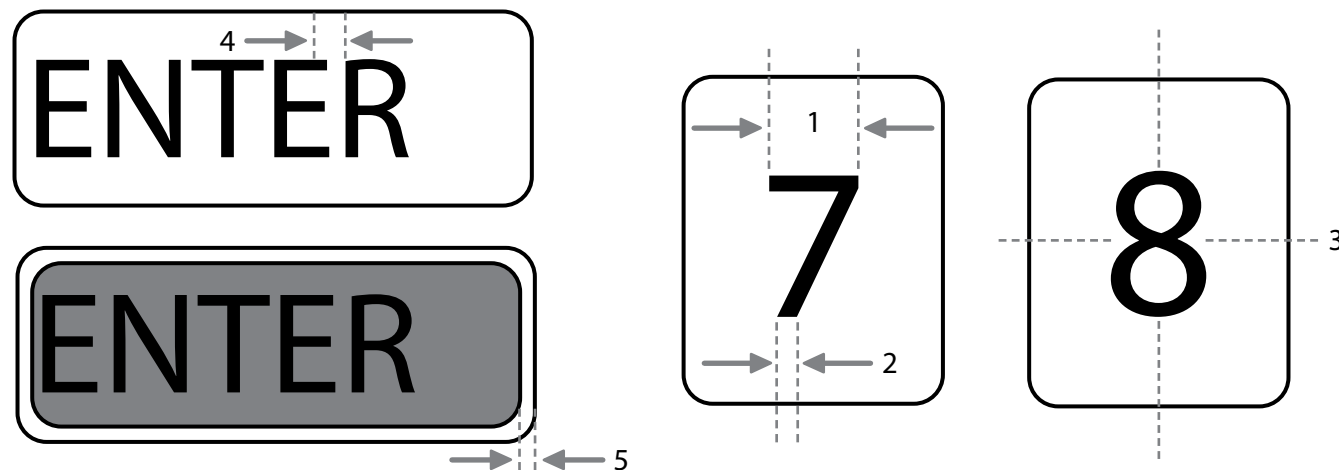
## Screen Printing Limitations

1. Maximum curvature for concave key tops is 0.5mm
2. Maximum curvature for convex key tops is 0.5mm
3. Locating dimple can be any size. Negative image prints cannot be printed on a key surface with a dimple; only positive image prints can be used.



## Legend and Registration Limitations

1. Minimum legend size is 1mm sq with 0.2mm line widths.
2. Minimum line width is 0.2mm
3. Registration tolerance is +/- 0.4mm
4. Minimum line spacing between legends is 0.2mm
5. Minimum spacing required is the radius +0.3mm



## Pad Printing

Pad printing offers an alternative to screen-printing. With pad printing you have the ability to print curves, textures and recess areas.

## Spray Coat Finishes

There are various types of finishes that can be applied to a keypad.

**Laser etched finishing.** Allows backlighting to only penetrate printed graphics. Key tops are first sprayed with the required graphic colour on the translucent silicone base material. The key top surface is then over sprayed usually black and the required graphics are then etched using laser technology. A matt or hard coat spray finish is then applied.

**Epoxy Resin.** Key tops greatly improve the cosmetic appearance of any keypad while prolonging its graphic life. Graphics are printed on the silicone rubber key top surface prior to installing the epoxy resin key top.

**Dipped process.** Is the most recognized method and generally has a convex "lens" effect. Standard thickness for dipped epoxy key tops is 0.5mm ± 0.25mm. Hard and soft surfaces as well as clear and matt finishes are available

We also offer standard **matt** or **gloss** finishes, these spray finishes increase the life of the print on the keypad and also give the keypad a higher quality look and feel. Key tops can also be sprayed using a **metallic finish**, **hard coat finish** or a **chemical resistant finish** that is similar to Paraleyne coating.

## Materials

### General silicone rubber for molding

This product has good physical and mechanical properties, and is suitable for making common keypads, silicone rubber products and accessories, especially for colored rubber products and molding process.

Item	Type	NE-5130	NE-5140	NE-5150	NE-5160	NE-5170	NE-5180
Appearance		milky-white, light-yellow, light-gray					
Density	(g/cm <sup>3</sup> )	1.09 ± 0.05	1.13 ± 0.05	1.15 ± 0.05	1.18 ± 0.05	1.21 ± 0.05	1.25 ± 0.05
Hardness	(Shore A Points)	30 ± 3	40 ± 3	50 ± 3	60 ± 3	70 ± 3	80 ± 3
Tensile strength	(MPa ≥)	5.0	6.0	7.0	7.0	6.5	6.0
Elongation at breakage	(% ≥)	440	380	320	280	200	150
Tension set	(% ≥)	8	9	10	10	9	8
Tear strength	(kN/m ≥)	15	16	18	18	16	15

First vulcanization condition for test piece: 175 °C x 5 min.  
Vulcanization: 80% DMBH, quantity added 0.65%

**General purpose fire resistant silicone rubber**

This product has excellent physical, mechanical and electrical properties, as well as fire resistant and retardant properties. The fire resistance reaches the stipulation of Grade FV-0 of China Standard GB/T13488-92. It is suitable for making various kinds of electrical and electronic fabrications with fire retardant and insulation properties. Eg. Anode cap and kinescope for TV set.

Item \ Type	NE-Z140	NE-Z150	NE-Z160	NE-Z170	NE-Z250	NE-Z260	NE-Z270
Appearance	gray or white color, no obvious extraneous matter						
Density (g/cm <sup>3</sup> )	1.42 ±0.03	1.47 ±0.03	1.52 ±0.03	1.56 ±0.03	1.47 ±0.03	1.52 ±0.03	1.56 ±0.03
Hardness (Shore A Points)	40±3	50±3	60±3	70±3	50±3	60±3	70±3
Tensile strength (MPa ≥)	4.5	5.0	5.5	5.0	5.0	5.5	5.0
Elongation at breakage (% ≥)	440	350	300	220	350	300	220
Tension set (% ≥)	8	7	7	6	10	12	10
Tear strength (kN/m ≥)	13	15	15	15	15	15	15
Volume resistivity (Ω.cm)	5.0 x 10 <sup>14</sup>						
Dielectric strength (kv/mm ≥)	20						
Fire resistance (class)	FV-0						

Physical and Mechanical properties are based on first vulcanization data, Electrical properties are drawn from second vulcanization data.

First vulcanization condition for test piece: 175 °C x 5 min.  
Second vulcanization condition for test piece: 200 °C x 2 h.  
Vulcanization: 80% DMBH, quantity added 1.0%

**NE-91 Series**

This product has excellent physical properties, anti-yellowing performance and good processability. Is suitable for molding application with higher transparency requirements. Eg. Keypad, sanitation commodity for living, O-ring, seal ring (parts for industrial use).

Item \ Type	NE-9130	NE-9140	NE-9150	NE-9160	NE-9170
Appearance	translucent, no obvious extraneous matter				
Density (g/cm <sup>3</sup> )	1.07 ±0.04	1.13 ±0.04	1.15 ±0.04	1.18 ±0.04	1.22 ±0.04
Hardness (Shore A Points)	30±2	40±2	50±2	60±2	70±2
Tensile strength (MPa ≥)	8.0	8.0	8.5	8.5	8.0
Elongation at breakage (% ≥)	700	600	500	400	300
Tension set (% ≥)	8	8	8	8	8
Tear strength (kN/m ≥)	15	20	25	25	25
Volume resistivity (Ω.cm)	1.0 x 10 <sup>16</sup>				
Dielectric strength (kv/mm ≥)	22				
Linear shrinkage rate after the first vulcanization (class)	FV-0				

Physical and Mechanical properties are based on first vulcanization data, Electrical properties are drawn from second vulcanization data.

First vulcanization condition for test piece: 175 °C x 5 min.  
Second vulcanization condition for test piece: 200 °C x 2 h.  
Vulcanization: Liquid DMBH, quantity added 0.65%

## SILICONE RUBBER SPECIFICATIONS

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