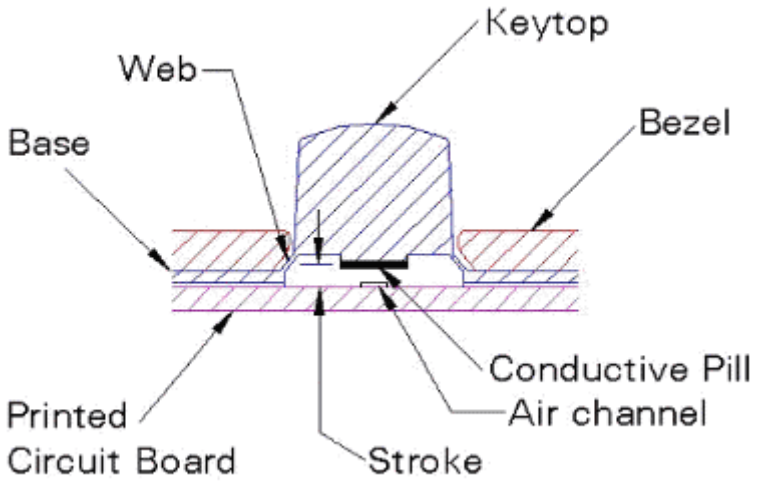
Silicone rubber keypad by JOESMEN

Terminology (1)



Actuation Force
The minimum force required to compress the membrane of the switch (F^1) so contact is made with the printed circuit board.

Air Channel
Air path from switch to switch so keytops can return to normal position after actuation. Switches are normally vented on at least two sides by air channels.

Base
The sheet material forming the"apron" for all switches on the keypad. The base ties or connects all switches on the keypad.

Bezel
The faceplate(usually plastic or metal) that "egg crates" all rubber keypad switches and typically covers the base material of the keypad so it cannot be touched by human hands.

Click Ratio
The difference between the actuation force(F^1)and the contact force(F^2)of a switch divided by the actuation force: $(F^1-F^2)\div F^1\times 100\%$
This "ratio" is extremely important when life is calculated and positive tactile feel is required in a keypad.

Conductive Pill
Current-carrying contact(silicone rubber impregnated with amorphous carbon)under each keytop completing electrical connection with the printed circuit board when the keytop (switch)is actuated.

Terminology (2)

Contact Force
The force a switch typically realizes (F^2) when contact is made with the printed circuit board.

Durometer:
The hardness of all keytops (switches) on the keypad and the hardness of the base material as well (unless the keypad is a dual durometer keypad).The higher the durometer of the keytop or base material ,the harder the material.

Keytop
A non-conductive,silicone-rubber, direct-contact switch(pushbutton). If the keypad is designed to have direct-contact switches,these switches will be silicone rubber,but if the keypad is designed to have indirect-contact switches,the silicone rubber dome will usually be covered with plastic keycaps.

Membrane
The non-conductive"hinge,""cushion"or"web" that creates tactile feel and stroke possible for each switch on the keypad.

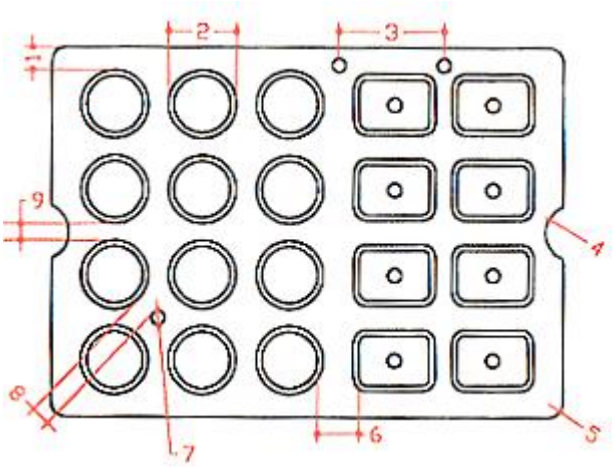
Printed Circuit Board
An electrical circuit formed by applying conductive material(gold,nickel,tin lead or carbon) to fine lines or orther shapes to an insulating sheet.

Stroke
Distance from bottom of conductive pill (contact) to top surface of printed circuit board.

Volume Resistivity
Electrical resistance within one (1) cm cube of conductive material.Volume resistivity is normally expressed as ohm-centimeters.

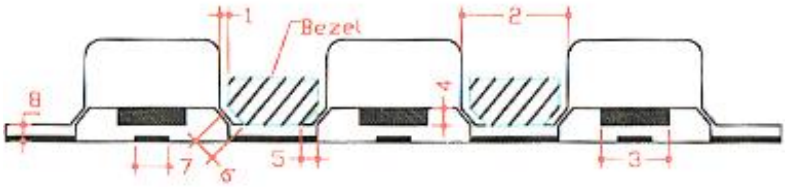
Design Recommendations

Figure 1



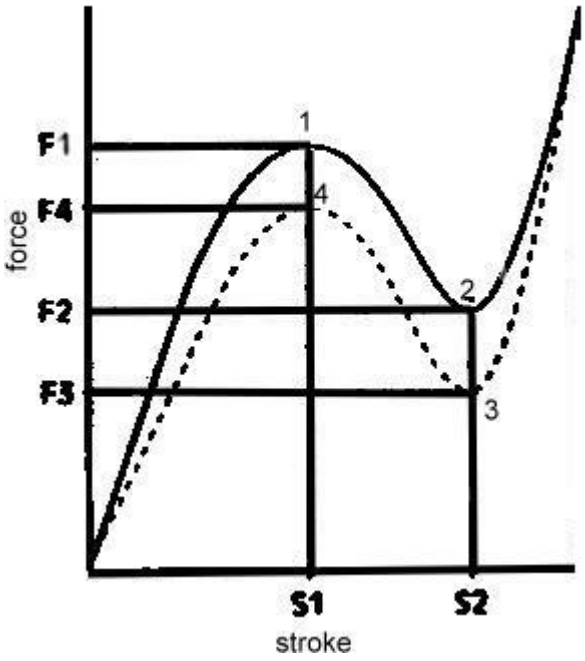
1. Minimum distance from edge of keypad : 1.0mm.
2. typical membrane dimension : key size+2.5mm.
3. typical guide hold spacing : 30-50 mm.
4. Minimum radius dimension : 2.0 mm.
5. typical corner radius dimension : => 1.0 mm.
6. Minimum key pitch dimension : =>4.0 mm.
7. Minimnm guide hole dimension : =>1.5 mm.
8. Minimum distance from hole to membrane of switch : 1.0 mm.
9. Minimum membrane spacing dimension : 1.0 mm.

Figure 2



1. Minimum clearance between bezel and keys : 0.3mm.
2. Minimum key pitch dimension : 4.0mm.
3. Typical pill size dimension(circular pills) : 2.0-8.0mm.
4. Typical pill thickness dimension : 0.4-0.5mm.
5. Typical chamfer dimension : 0.5mm.
6. Typical chamfer angle dimension : 45°.
7. Typical air channel dimension : 1.5~2.0mm.
8. Typical base thickness dimension : 1.0mm.

Force-stroke curve of rubber keypad



1. Peak point
2. Contact point
3. Return point
4. Return-peak point

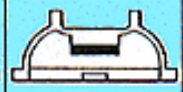
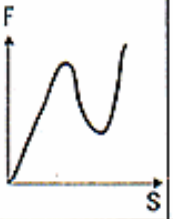
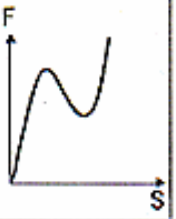
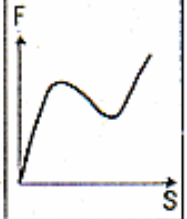
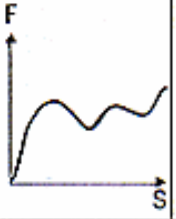
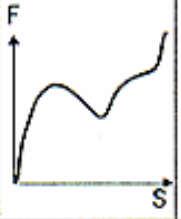
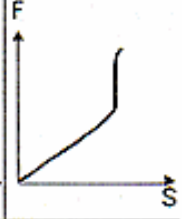
F1. Peak force
F2. Contact force
F3. Return force
F4. Return-peak force

Click ratio=(F1-F2)÷F1×100 %

F3>=15g

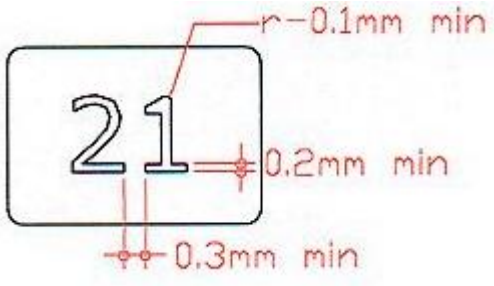
***Poor tactile feeling when click ratio is less than 0.50

***Good tactile feeling when click ratio is higher than 0.50

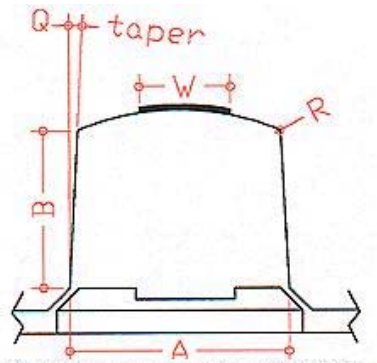
Structure						
Force—Stroke Curve						
Force Range (grams)	20~350	30~250	30~150	30~80	30~200	20~80
Stroke Range (mm)	0.5~3.0	7~1.5	0.5~3.0	2.0~4.0	1.0~2.5	0.2~1.0
Cycle Life (kk)	0.5~2.0	0.5~2.0	1.0~5.0	5.0~20	0.5~3.0	0.5~1.0
Typical Uses	Telephone, Remote Control, Automotive, Radio, Toys, Calculator, ···etc.	Telephone, Remote Control, Toys, Games, Calculator···etc.	Telephone, Remote Control Toys, Measuring Instruments, Office Machine ···etc.	Computer, Typewriter, ··· etc.	Telephone, Typewriter, Test Instruments··· etc.	Remote Control Calculator, Typewriter, Computer···etc.

Information about silk-screen printing

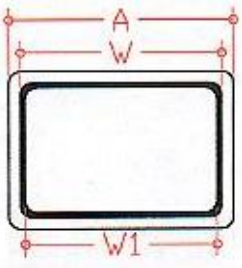
★Various colors of graphics are possible.
★Best results will be obtained with a flat-key top surface.
★Graphics can be printed positively or negatively.



Minimum graphics thickness

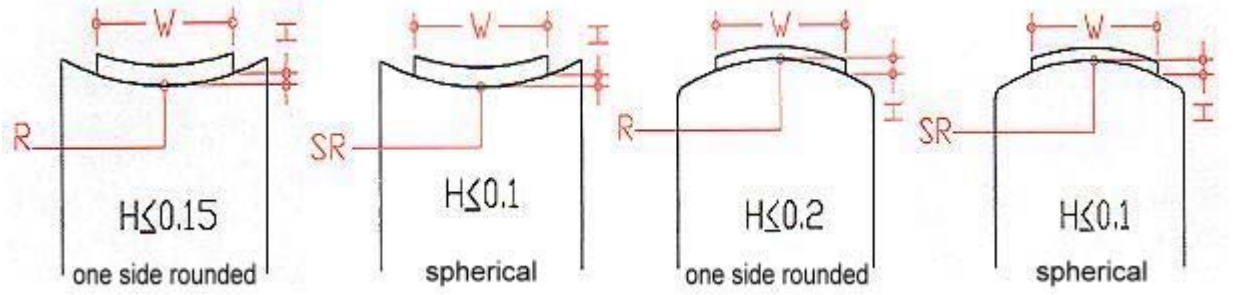


W≤A-(2xBxtanQ+2xr+0.53)[mm]



w : printing area(colors)
w1 : graphics area
Maximum graphics area W1<=W-0.4[mm]

For maximum printing area,refer to figure below.



Concave shape	Convex shape

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BackLite Series (1)

The BackLite Series has been developed in order to improve visibility in the dark as well as in daytime. The BackLite Series is mostly suitable for designs with back-light requirements.
The BackLite Series is made from translucent silicone rubber. The transmissive underlayer colors are oversprayed or printed followed by opaque black or dark coating to highlight the graphics.
Various colors of graphics are possible. Graphics per customer's artwork film are made by either laser etching or chemical erosion. The chemical erosion process is suitable for flat keytop surface only. Laser etching process is suitable for any key shape.
The backLite Series is always combined with our Duracoat Series for the best reliability and distinctive finish.

Features:

★Good light shielding on keypad surface
★Superior visibility on graphics
★Available for any key shape
★Temperature range: - 40°C ~ + 90°C

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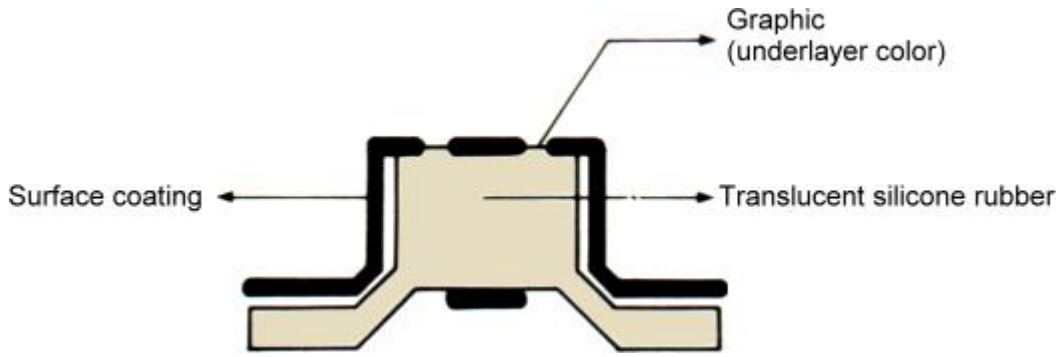
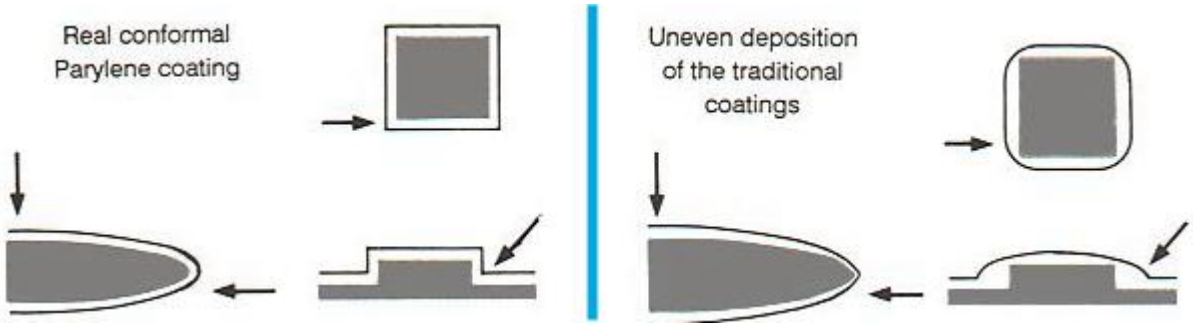
BackLite Series (2)



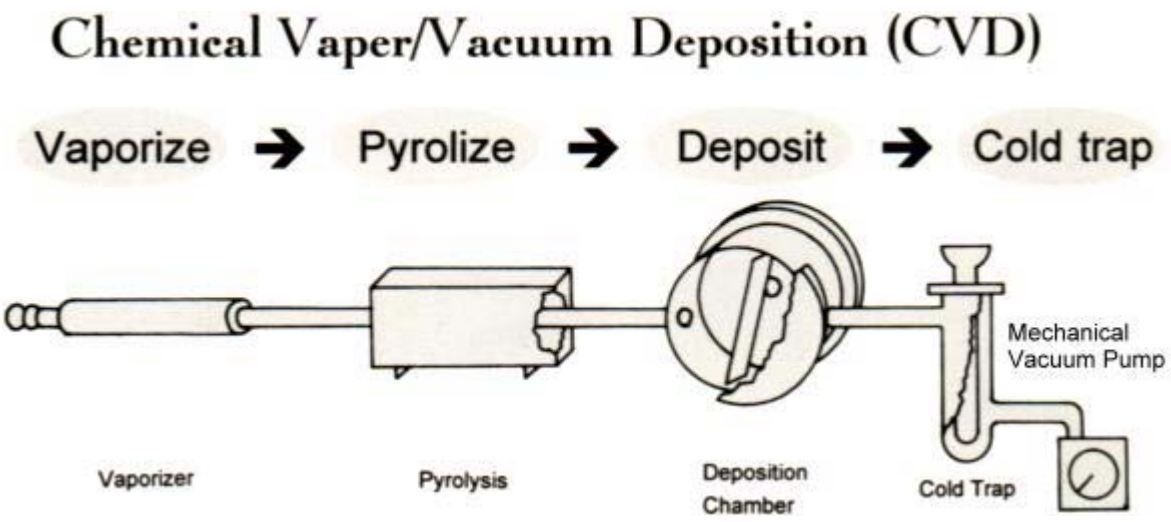
SCS Parylene Coating (1)

Parylene Conformal Coating System(Qualify by Mil-I-46058C)
The Parylene Coating provides a real conformal protecting layer.



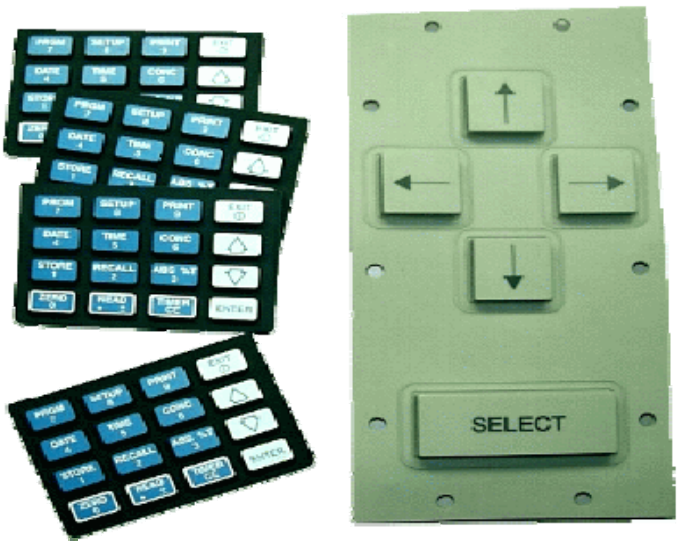
1. High crystallinity & molecular weight (~500k)
2. Survives continuous exposure to air at 100°C for l0 years (100,000hrs)
3. Insoluble in any organic solvent up to l50°C
4. Good vacuum stability (weight loss<0.3% under 10^{-6} torr,50°C)
5. Superior resistance to chemicals & γ -rays.
6. Excellent dielectric properties(Volumn resistivity >8.8 x 10^{16} ohm-cm)
7. Withstands impacts of more than 100 in-lb at-160ºC
8. Lowest moisture transmission rate (10 times better than epoxy under 90% RH,37ºC)

SCS CVD Process (2)



Dimer(DPX)	Monomer(PX)	Polymer(PPX)	
150°C, 1.0 torr	680°C, 0.5 torr	35°C, 0.1 torr	-70°C, 0.001 torr

1. Provide precise thin film coating (0.2µm to 75µm).
2. Can be coated on almost any material surface.
3. Without curing step that cause no inner stress.
4. Almost no limitation to the complex shape surface.
5. Flamable material can be coated. (ex.paper).
6. Pin hole free coating because no solvent needed.



Duracoat series (1)

Duracoat Series offers a sprayed polymer layer on a silicone rubber keypad surface. After application, the polymer layer is bonded to the surface by a vulcanization process at approximate 200 degree C.
The silicone rubber keypad can have a simulated "Plastic Moulded" finish after Duracoat treatment.
This special process further protects keytop printing and reduces friction between key and frame, avoiding sticking keys.

Features:

★Simulated plastic finish
★Reduced friction to prevent keys sticking
★Enhanced keytop printing protection
★Excellent abrasion resistance : over 100 cycles on RCA tester

Options:

★Glossy finish
★Matte finish

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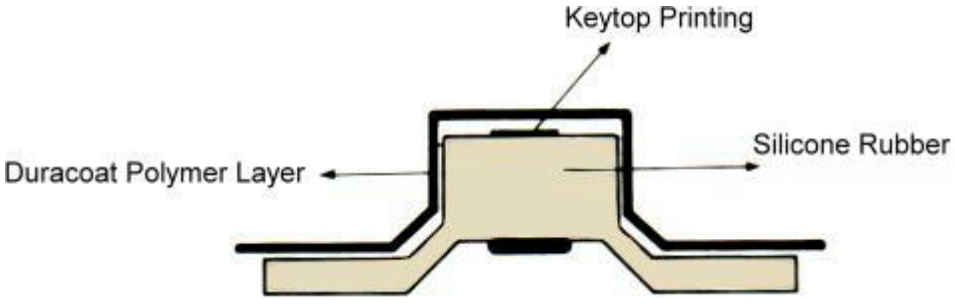
Duracoat series (2)



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Encap Series (1)

Encap Series is a revolution in silicone rubber keypad industry. Encap Series apply complex material; liquid polymer with special surface treatment on silicone rubber keypad.
Encap Series put all advantage of silicone rubber keypad and plastic together.
It provides clear, simulated plastic finish on rubber keytop.

Features

★Simulated clear plastic finish.

★Protected keypad printing.

★Assembly cost savings.

★Excellent abrasion resistance.

★Excellent bond between silicone rubber and polymer.

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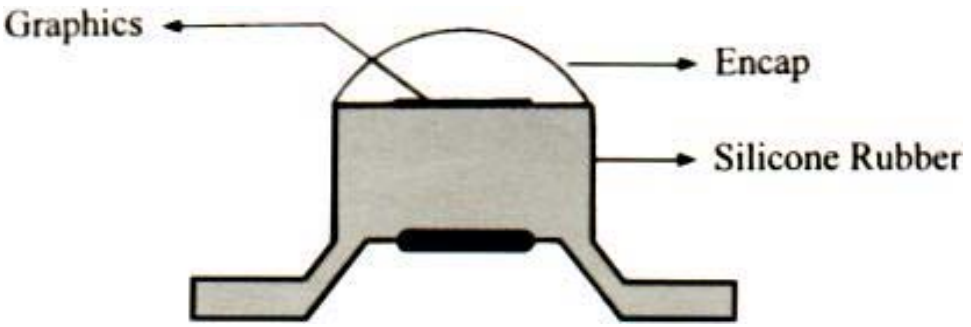
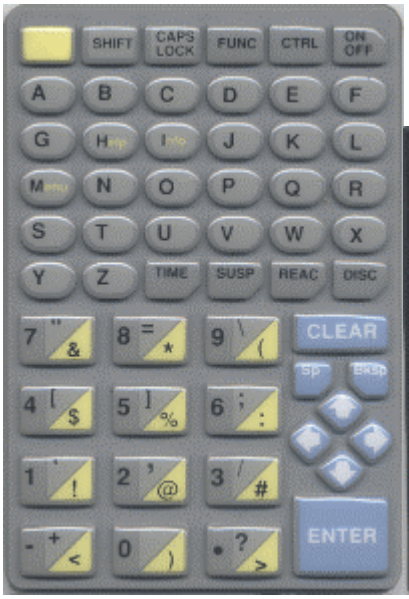
Encap Series (2)

Options

★Hard/Glossy Encap

★Soft/Glossy Encap





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Plas Series (1)

Plas Series glue the molded plastic keytop on silicone rubber keypad. Special adhesive makes it available for gluing silicone elastomer and molded plastic keytop. The adhesive bonds well between the two complex materials. PlaS Series combine all advantages of silicone rubber keypad and plastic together.

Features

★All key shapes available.
★Graphics on first or second surface.
★Assembly cost savings.
★Excellent bond between plastic and rubber

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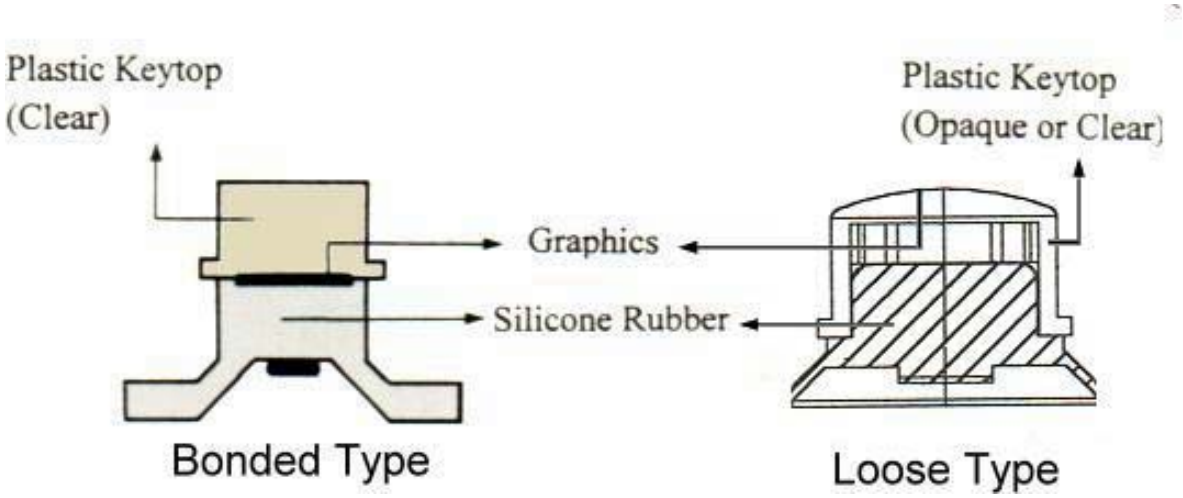
Plas Series (2)



Abrasion parameter of keypad printing

	Silk screen printing, all color except Black	Silk screen printing, Black	Silk screen clear coating	Sprayed silicone clear coating	Duracoat	Encap	Parylene
Abrasion resistance	**Poor**	**Fair**	**Good**	**Good**	**Excellent**	**Superior**	**Excellent**

Poor - under 10 cycles
Fair - 10 ~ 15 cycles
Good - 15 ~ 30 cycles
Excellent - 50 ~ 100 cycles
Superior - 100 ~ 200 cycles

Definition of failure:
Failure occurs when a printed line breaks or a second layer of color is exposed.

Abrasion test equipment:
RCA Abrasion Wear Tester:Norman Tool model **#7 IBB.**
Abrasion paper:Norman Tool paper type **#1189**

1 cycle of abrasion test equals about 10,000 times of finger press.