Keypad Design Guide

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Contents

This guide aims to provide sufficient information on how to construct a switch product, minimising or even eliminating the need for design changes.

Contents (continued)

1.0 General Properties of Silicone Rubber

Silicone Rubber is a special synthetic elastomer that provides a unique balance of chemical and mechanical properties required by many of today's more demanding industrial applications.

Silicone rubber attributes:

- **High temperature stability**
- **Low temperature flexibility**
- **Chemical resistance**
- **Weatherablility**
- **Electrical performance**
- **Sealing capability**
- **Compression Set**
- **Bending Fatigue**
- **Colouration**
- **Corrosion Resistance**

In addition, because of its relative purity and chemical makeup, silicone rubber displays exceptional biocompatibility which makes it suitable for many health care and pharmaceutical applications.

Compared to many organic elastomers, silicone rubber offers superior ease of fabrication resulting in high productivity and cost effectiveness for extended service reliability.

2.0 Silicone Rubber Applications

TV/Audio/Video
High/Low end Remote controls
Wireless Keyboards

Office Peripherals
Internet peripherals
Computer Keyboards

Business Communication
Phone Consoles
Faxes
Conference Units
Digital and Analog Dictators

Telecommunication
Mobile handsets
Cordless phones
Corded phones
Analog phones
Dect phones
Phone Base stations

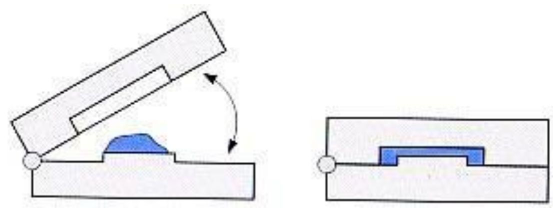
Automotive
Driver Seat Window Adjustment Modules
Passenger Seat Window Adjustment Modules
Mirror adjustment Modules
Auto Door Lock/Unlock Modules
Car Audio Systems

3.0 Manufacturing Techniques

3.1 Compression Moulding

Compression moulding is the most widely used method for moulding silicone rubber parts.

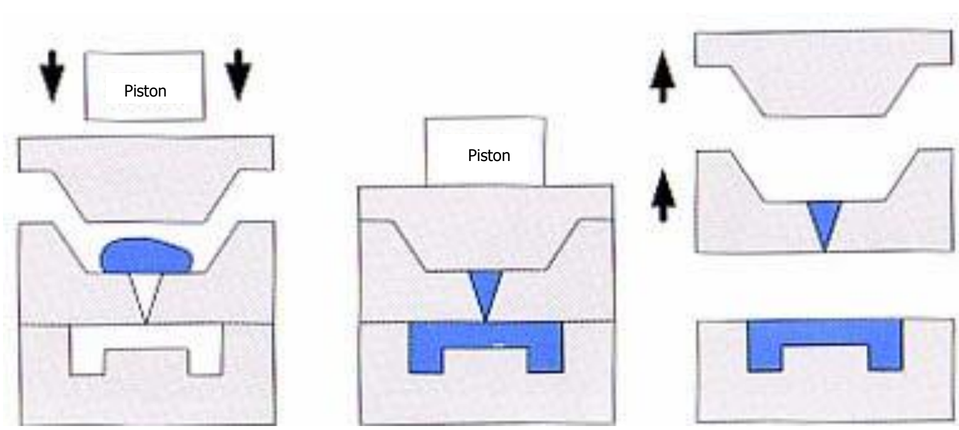
The stock is usually pre-formed first to the approximate size and weight of the final part and then placed in the heated cavity of the mould where it is cured under heat and pressure.



3.2 Transfer Moulding

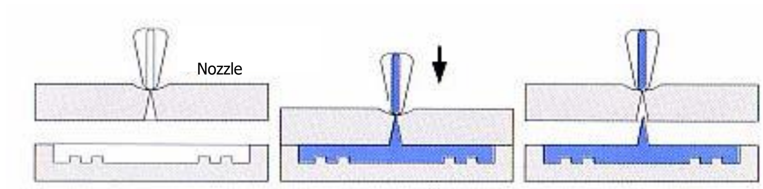
A rubber compound is placed into the upper cavity of the transfer mould. When placed in the press, the rubber is squeezed through a small aperture to fill the second cavity, having the required shape, where the rubber is vulcanized.

This method is used for precision work which justifies the high mould cost and relatively slow throughput. Short runs are feasible and the method is particularly useful for components having metal inserts (such as engineering components).



3.3 Injection Moulding

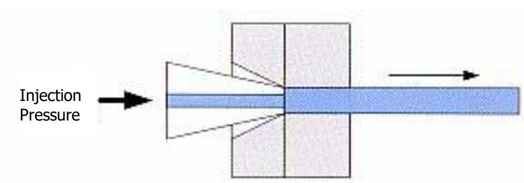
This is a semi-continuous process in which rubber is extruded from a heated barrel of a screw or ram machine through a nozzle. The work of extrusion produces a further rise in temperature, before the rubber is forced into a heated mould where the rubber is vulcanized. Because the rubber reaches the mould at a high temperature, vulcanization times are short and thick articles are homogeneously vulcanized. The high capital cost is justified by the use of the machine for long runs of articles of good quality, particularly those which are difficult to mould by compression moulding.



3.4 Extrusion

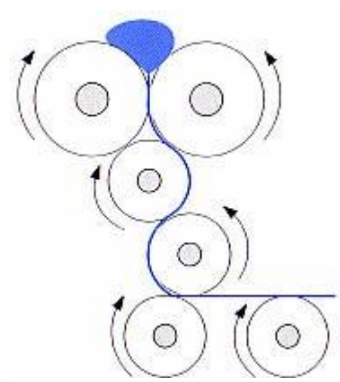
During extrusion, compounded rubber is passed from a short screw extruder through a die of appropriate shape. Vulcanization is a separate process, and can be performed in a variety of ways;

- batches in a steam or air autoclave
- continuously in steam or hot air,
- in a bath containing a eutectic mixture of molten metal salts or in a fluidized bed. Simple or complex sections, either solid or sponge, may be extruded.

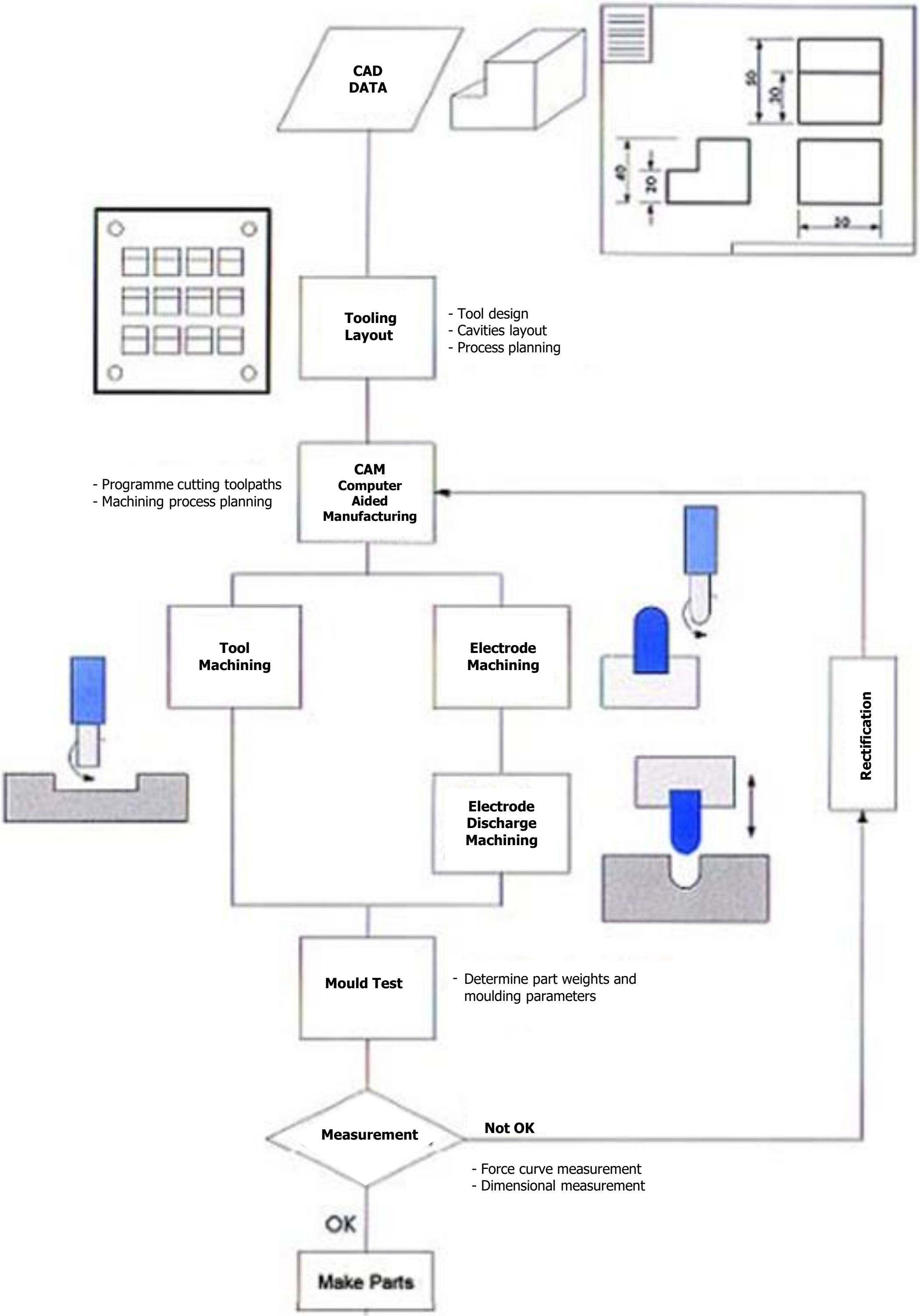


3.5 Calendaring

In the calendaring process, rubber is passed through a three-or-four-roll calendar either to produce a sheet of controlled thickness or to force the rubber into close contact with a textile or metal cord.



4.0 Compression Tool Manufacturing Process



5.0 Silicone Rubber Material

Major Silicone material suppliers are listed as below:

- Shinetsu
- Dow-Corning
- Toray
- Toshiba
- GE
- Wacker
- Bayer

5.1 What is a Durometer?

A method of measuring the hardness of rubbers and plastics.
The material is placed on a scale, which measures resistance to deformation of an indenture of specific size and shape under a known load.
The scales used most commonly in the silicone industry are
Shore 00, Shore A and Shore D, in order of increasing hardness.
Durometers are built to various standards from ASTM, DIN, JIS and ISO.
Available hardness of Silicone rubber is between 30JIS-90JIS for rubber keypads.
Commonly used hardness is between the range of 50JIS-60JIS.
Specific gravity of Silicone Rubber is between 1.10g/cm3 to 1.47g/cm3.

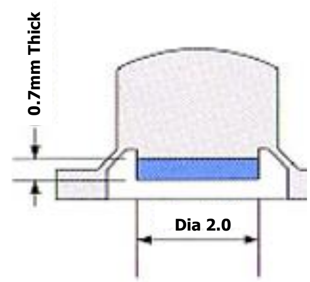
5.2 How to specify material on drawings for a Silicone Keypad

Material	Insulated Silicone Rubber
Contact Surface	Carbon Impregnated Silicone rubber (see detail on Contact Resistance)
Material Hardness	50+/-3 60+/-5 70+/-5 80+/-5 (scales units = ShoreA or JIS)
Colour	Pantone PMS Codes, RAL, DIC, SP

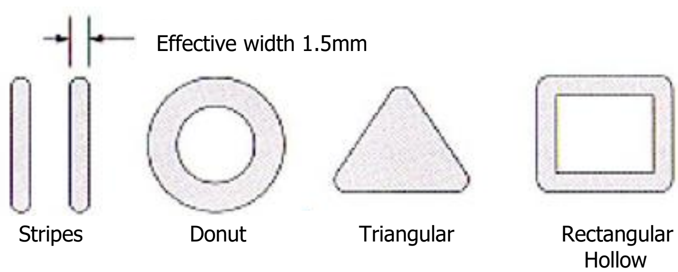
5.3 Contact Resistance

Carbon contact in a silicone keypad comes in 2 forms; pill and ink.
General thickness for the pill is 0.7mm thick and the recommended diameter to use is minimum 2.0mm.
General hardness for the carbon pill is 70JIS.

Type	Resistance	
Carbon Pill	<100	>30
Carbon Ink	<250	>100

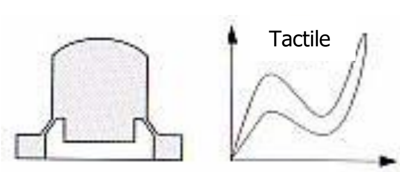


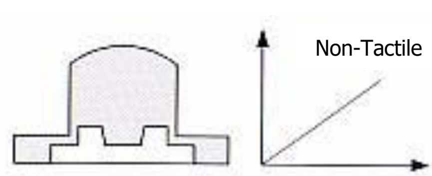
Conductive ink can be of various shapes and the coated thickness is 15-50 microns.



6.0 Technical Resources

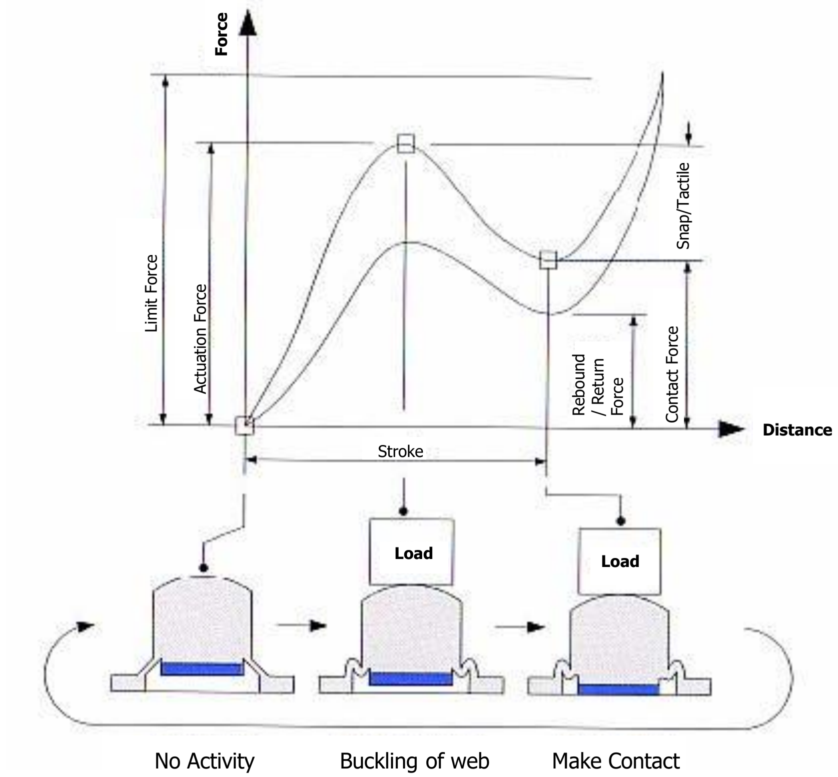
Two commonly used web structures are the tactile and non-tactile type. The non-tactile structure is often used as a reset function or combined with Polydome/Metaldome array as an assembly.





6.1 How to interpret a Force Curve

The figure below shows the various terms used in a force curve of a knob when activated



Actuation force This is the force that you need to specify to cause the web to buckle.

Contact force This is the force when the conductive make contact and complete the designated stroke.

Rebound/Return Force This is the force needed to ensure the knob can regain its rest position.

Stroke/Travel/Hub This is the designated distant for the plunger/actuator to meet the contact surface.

Snap/Tactile Refers to the sensation feeling when a knob is depressed and returned to origin position.

Snap/Tactile Is calculated using the standard formula (Actuation Force-Contact Force)/(Actuation)

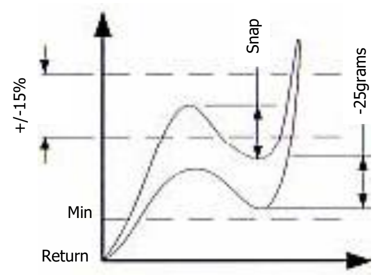
Value of 0.4-0.6 will be ideal for your product to have tactile.
The wider the snap (see force curve) the better the tactile of the knob.
**Actuation force, travel and return force are 3 main factors that affect the snap of a button

6.2 How do I calculate the snap?

Required parameters are Actuation force w/tolerance, return force and the contact force.
Contact force, general rule= (Return force +25grams)

Exercise

Actuation force	= 180+/-30 grams, 180g-210g
Return force	= 40 grams
Contact force	= 40+25=65 grams, minimum
Snap 1	= (150-65)/150 = 0.56
Snap 2	= (210-65)/210 = 0.69



**Snap 1&2 are based on minimum return force of 40. If return force is higher by 20 grams, thus the contact force now is 85 grams.
Worst scenario is low actuation force and high return force, thus the snap=(150-85)/150=0.43
The above exercise shows that the specification is able to meet the snap of 0.4-0.36. If the required snap cannot be achieved, then specification for Actuation force, Travel or Return force needs to be altered.

6.3 What is the tolerance for Actuation force?

The general rule for the tolerance of Actuation force is +/-15%

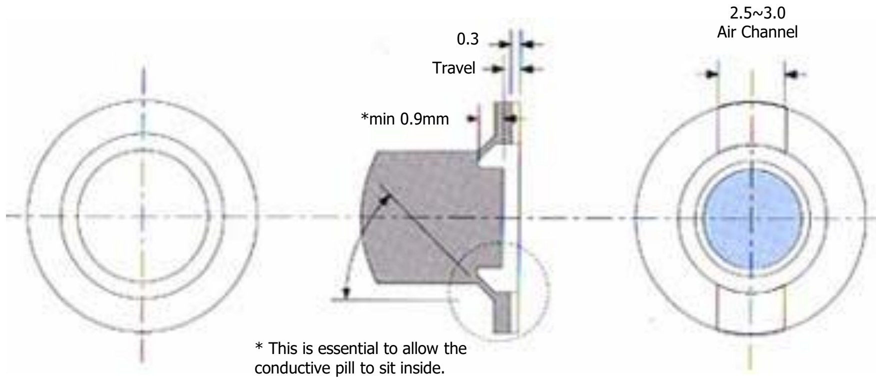
E.g.	Force	Tolerance+/-
	150 grams	~25 grams
	250 grams	~40 grams
	350 grams	~55 grams

6.4 How much should I specify for a return force?

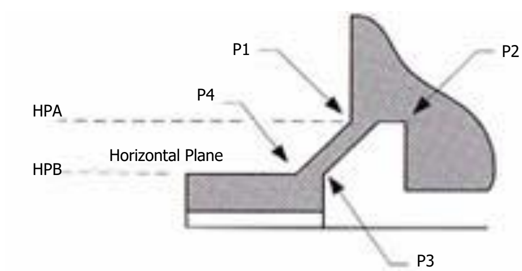
Return force has a contributing factor to the snap ratio. As the return force goes up, the snap reduces (see force curve).
Therefore, return force needs to be sufficient enough to cause the knob to return and yet not too much to cause the snap to deteriorate.
The recommended value is minimum 30 grams and above.
Return force can be proportional to actuation force as along as snap is taken into consideration.

E.g.	Actuation Force	Return Force
	120 grams ~180grams	min 30 grams
	200 grams~250 grams	min 50 grams
	280 grams~350 grams	min 70 grams
	380 grams~450 grams	min 100 grams

6.5 How is a knob cross section constructed?



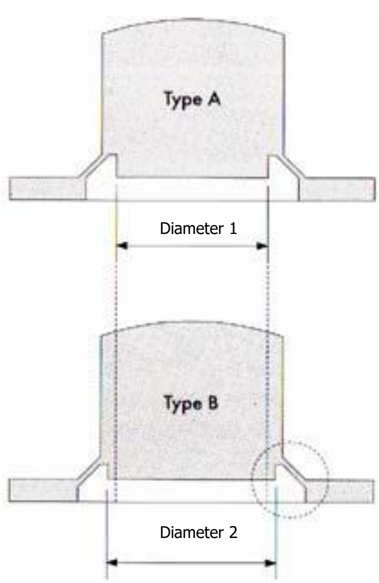
Note:
P1 and P2 are on the same plane, HP A
P2 and P4 are on the same plane, HP B

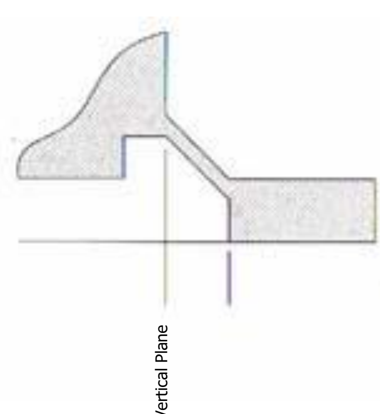


6.6 Why construct in this manner?

Recommended construction as above

In type B, the P1-P4 are not in the horizontal plane. Such construction makes the conductive size bigger but in actual application, this size is not used, resulting in specification change.





6.7 What is the relationship between Travel and Actuation Force?

Travel is proportional to actuation force.
Minimum Travel for a keypad with snap is 0.8mm+/-0.1 and the actuation force shall be <200grams.

See table for Actuation force and Travel; general guide:

Force	Travel
<200 grams	0.8mm
<250 grams	1.0mm
<350 grams	1.15-1.20mm
<450 grams	1.25-1.40mm
<550 grams	1.50-2.0mm
<650 grams	2.0-2.25mm

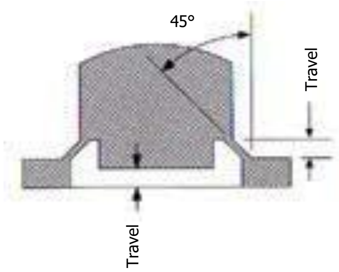
6.8 Dimension Tolerance

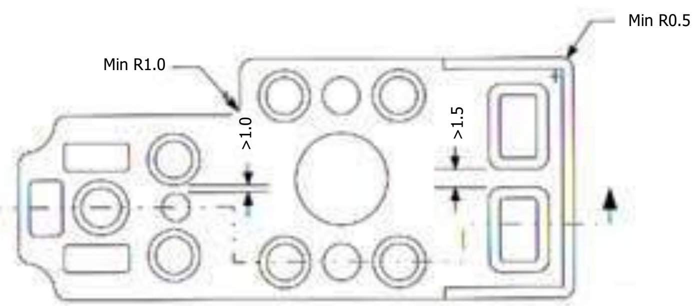
Silicone rubber tolerance is not as tight compared to plastic, therefore, the tolerance is generally wider, see table below in mm

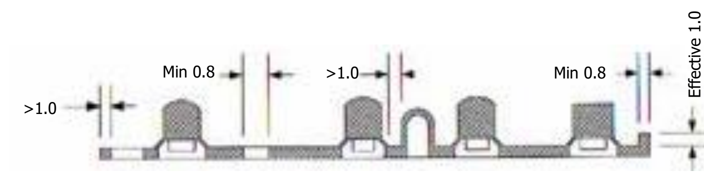
Dimension	0	3>	6>	10>	18>	30>	50>	80>	120>	180>	250>	315>	400>	500>	630>	800>	1000>	1250>	1600>
	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	≥3	≥6	≥10	≥18	≥30	≥50	≥80	≥120	≥180	≥250	≥315	≥400	≥500	≥630	≥800	≥1000	≥1250	≥1600	≥2000
Tolerance	±0.07	±0.09	±0.11	±0.14	±0.17	±0.20	±0.23	±0.27	±0.32	±0.36	±0.41	±0.45	±0.49	±0.55	±0.63	±0.70	±0.83	±0.98	±1.15

6.9 What is the distance between the knob and its surrounding features?

Sketches shown below are guidelines to follow to ensure that a better product is designed. These guides will help to prevent future design changes due to space constraints.

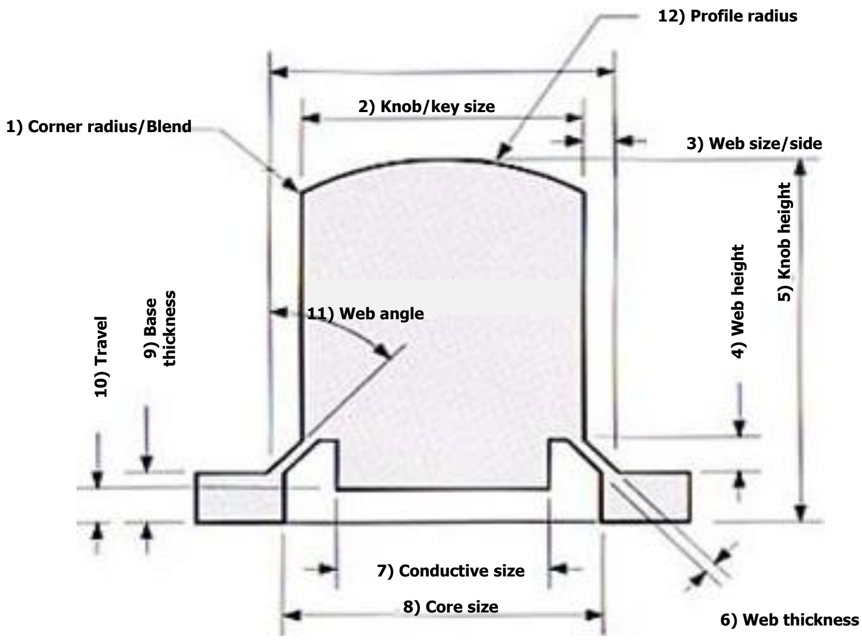






It is advisable to use 45° web angle and web height=travel as a rule to design web structure.
Final web detail shall be at supplier's discretion to achieve actuation force and tactile.

7.0 Terminology used to describe a Knob



1) Corner radius/blend

Minimum radius for most parts shall be 0.3mm

2) Key size

3) Web size/side

Web size shall be determined by the supplier to achieve the desired force specifications. Web size = knob size + (2x web size per size)

Typically, web size/side should be equivalent to the travel of the knob.

4) Web height

For design verification purposes, we recommend that web height = travel. Final web height shall be determined by the supplier.

5) Knob height

Generally, try to keep this height to 15.0mm and below.

6) Web thickness

General value ranges from 0.25-0.35mm. When constructing the knob, you may use either value.

7) Conductive size

General rule for determining conductive size: key size – 1.0mm.

8) Core size

This can be determined after constructing the cavity side and then applying the web thickness.

9) Base thickness

General thickness is 1.0mm and minimum is 0.8mm. If the actuation force is greater than 200g, we recommend that you increase the base thickness to 1.2mm. Therefore, the higher that force, the thicker the base. This is to stabilize the keypad.

10) Travel

See earlier section on relationship on Actuation force and Travel.

11) Web angle

This is one of the factors that affect snap. For design purposes, please use 45

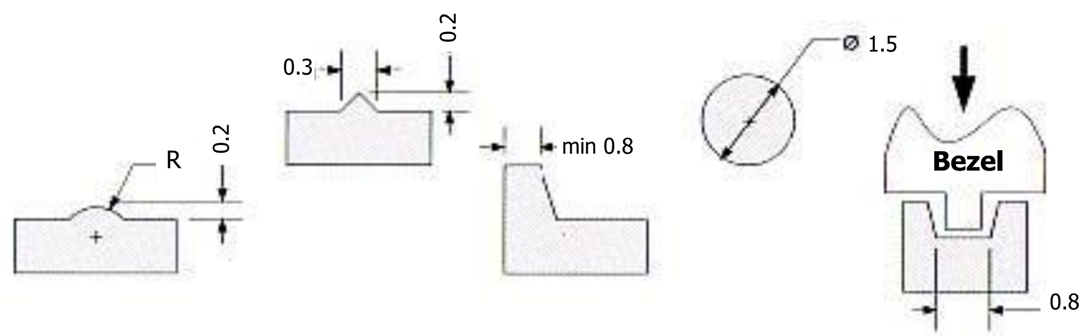
12) Profile radius

For better abrasion resistance, the minimum radius shall be R30.

8.0 Features in a Keypad

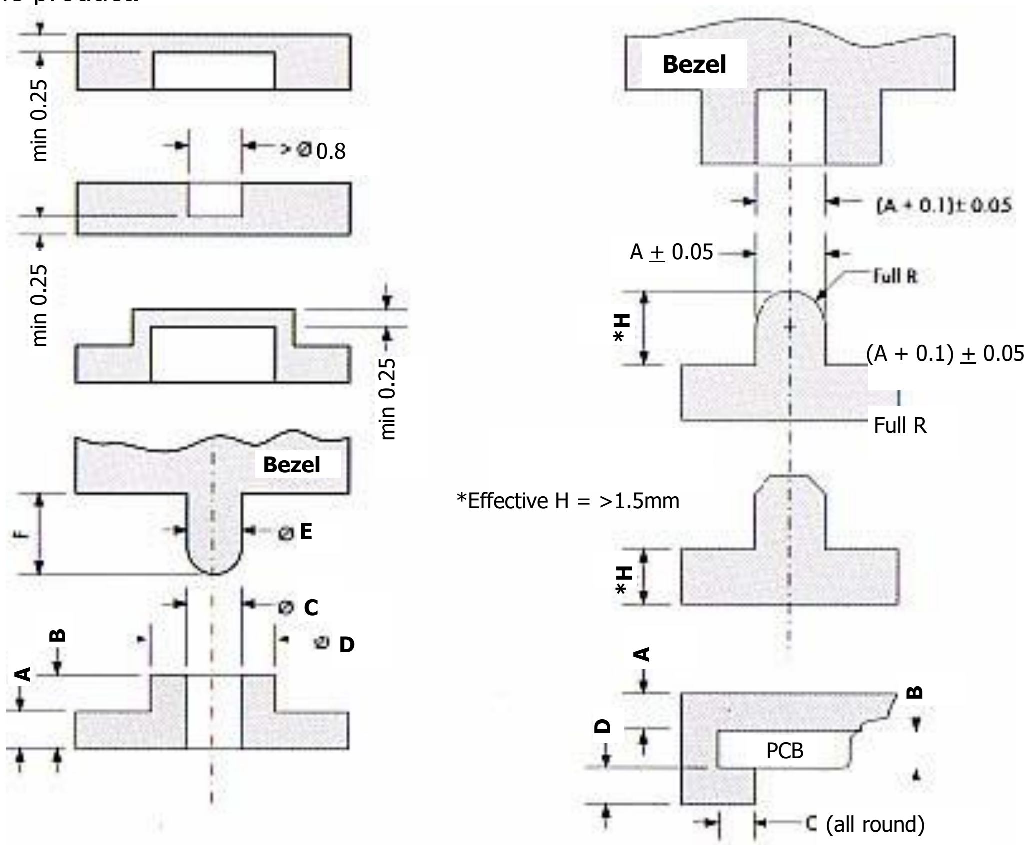
Many features can be incorporated into a keypad design to help enhance its functional and mechanical properties.

8.1 Sealing Features



8.2 Locating Features

These features also prevent the product from having holes, enhancing the sealing property of the product.

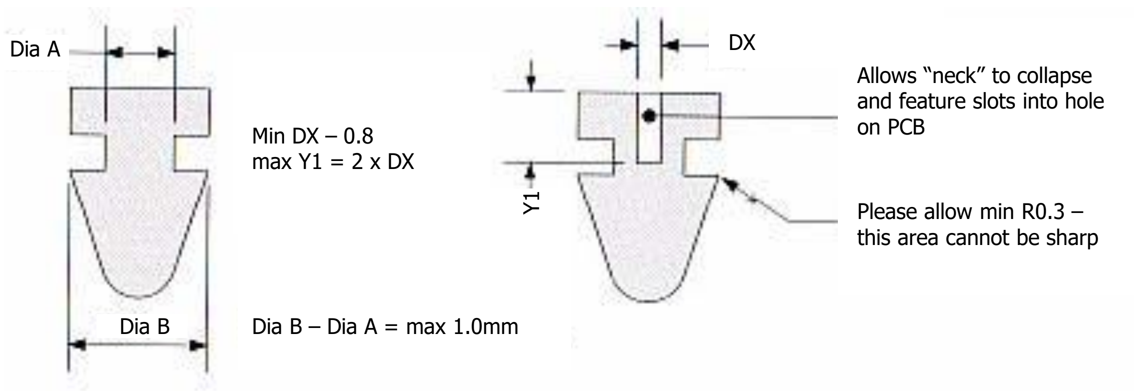


A = min 0.8mm
B = >A
¢C = (¢E + 0.1) ± 0.05¢
D = 2* ¢E ¢
E = Diameter of boss
F = B or greater

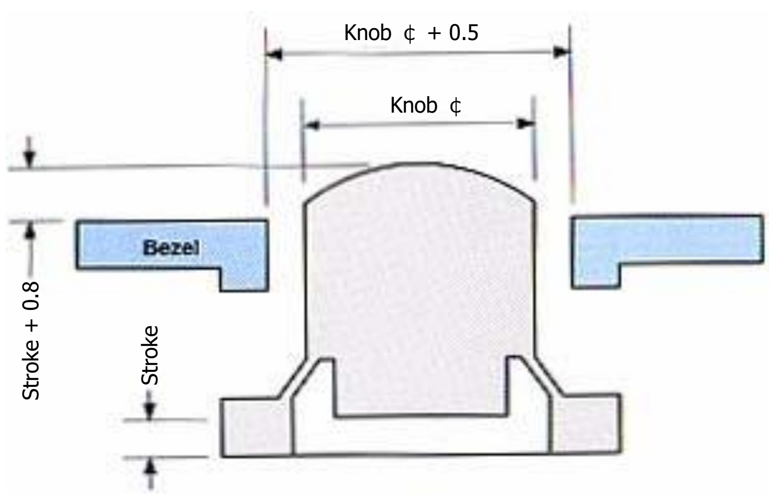
A = Base Thickness
B = PCB Thickness
C = maximum 2.0mm
D = >1.0mm

8.3 Undercuts

Used to hold down the keypad onto PCB.



9.0 Clearance between Knobs and Plastic Housing



10.0 Clearance between toggle knob and plastic housing

Clearance for toggle knob needs to be more as it tilts greater towards the plastic housing, causing collision (see Fig.1)
Distance “Y” is necessary to enhance the tactile feel. For a toggle knob that is 20mm or less, it is advisable to have “Y” at 0.5mm.

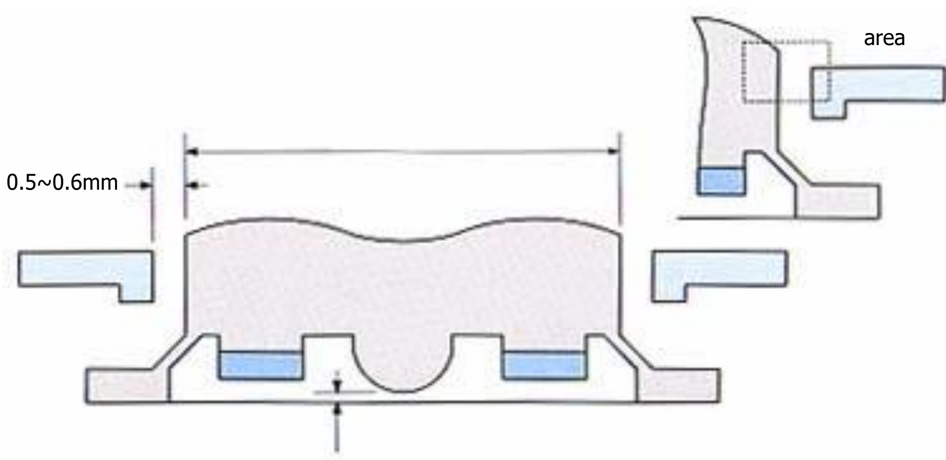
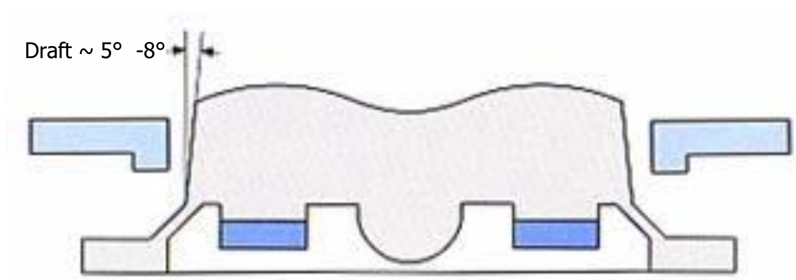
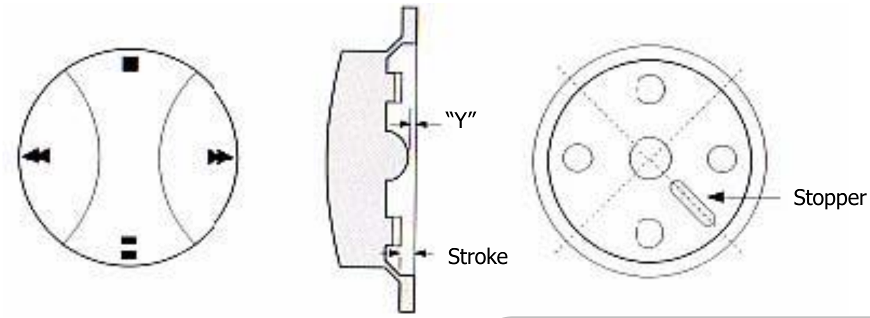


Fig.1

Alternative method is to draft angle
to the knob to increase the clearance



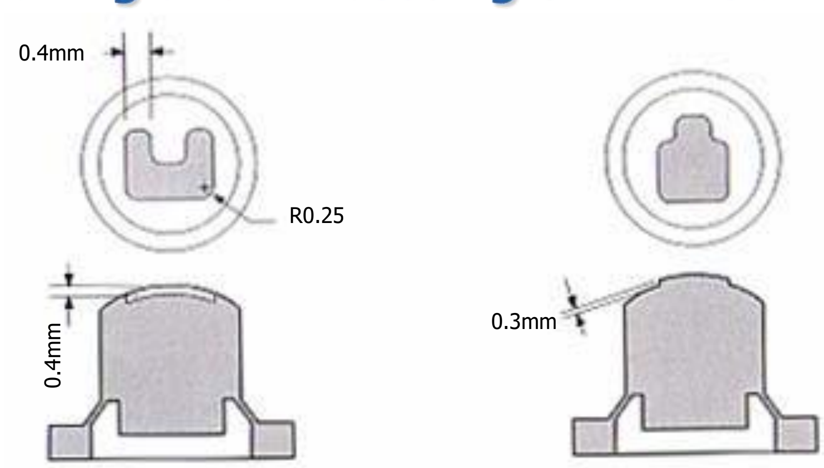
11.0 Multi Functional/Directional Knobs



A multi functional knob is similar to a toggle knob. Please refer to toggle knob guidelines for clearance and tactile feel enhancement.

An additional "stopper" can be added to prevent dual activation. This is often at the expense of tactile feel. The stroke for the stopper is calculated as:
(Knob stroke + 0.2)

12.0 Engraving and Embossing on a Knob



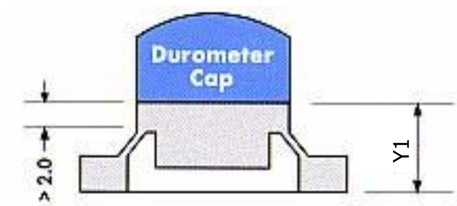
Recommended engraving depth is 0.4mm for best definition of the legend

Recommended minimum embossing depth is 0.3mm for best definition of the legend

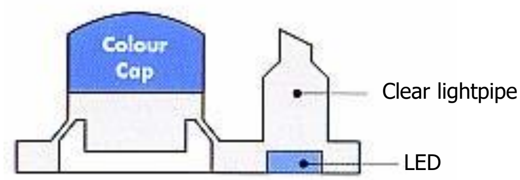
13.0 Durometer Cap/Colour Cap

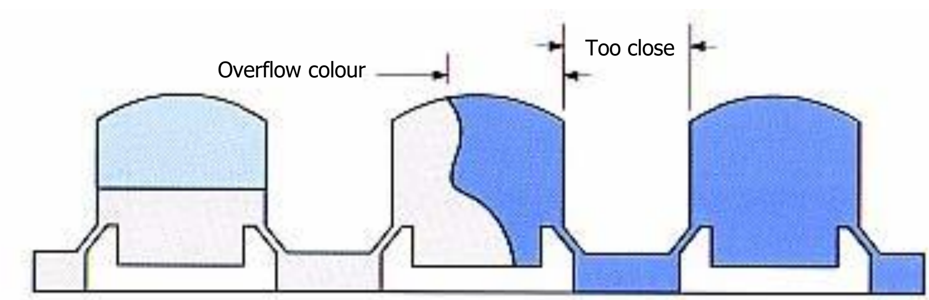
A durometer cap is used when a higher durometer feel is required. The durometer cap is premoulded in a separate tool and then moulded with a lower durometer material in the main tool.

There needs to be a sufficient gap between the two different durometer/colour materials for bonding. If Y1 is not specified, we will take the liberty of controlling it. If control is needed, please specify from the base of the keymat to the base of the cap.



A coloured cap is used in the following circumstances:
- knob to knob distance too close
- close to surrounding features (e.g. lightpipes)
- when the product has too many colours
- control flow of material colours



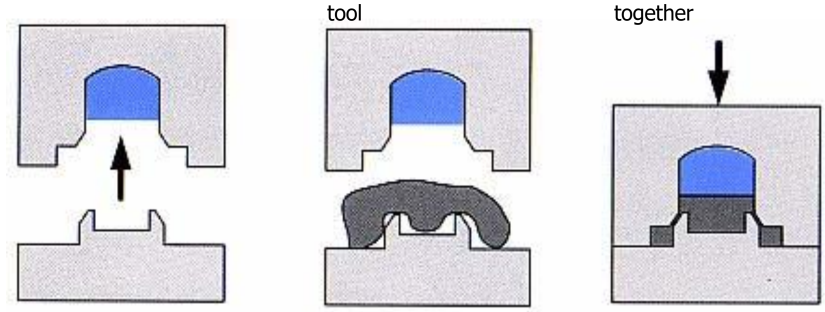


14.0 Cap Moulding Process

A pre-moulded cap is loaded into the cavity of the main tool

Base material of the keymat is placed on the core of the main tool

Mould is compressed and the different materials bond together

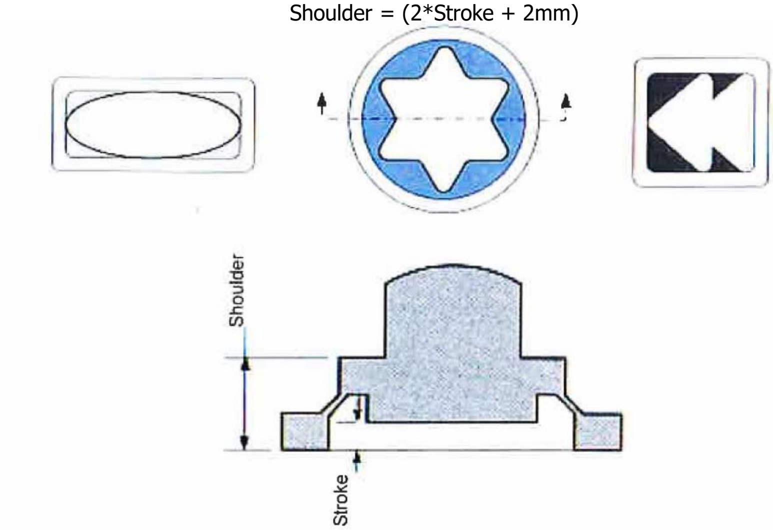


1 2 3

15.0 Stabilizing a Knob

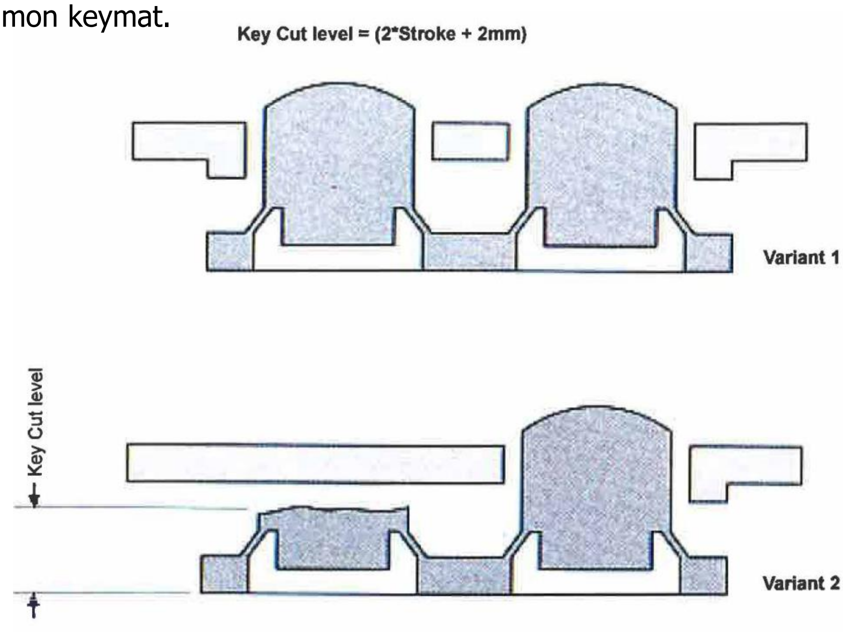
Some shapes of knobs make them susceptible to toppling over and need to be stabilized. Adding a shoulder to the knob can enhance the activation and tactile of a knob.

Shoulder = (2*Stroke + 2mm)



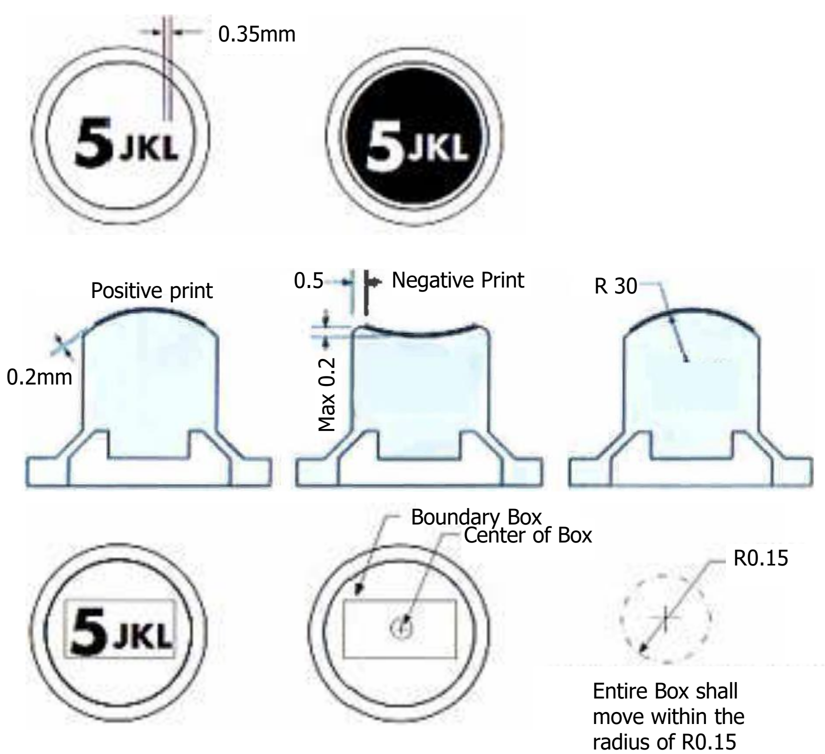
16.0 Key Cut

Key cutting is economical when there is a need to derive a few versions of the product from a common keymat.



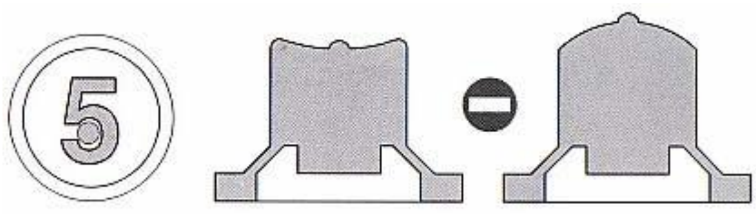
17.0 Printing Guidelines

Profile curvature is important to the abrasion resistance of the ink printed on the knob surface. The smaller the radius of the profile, the lesser the contact area, however the pressure per contact area will be higher.

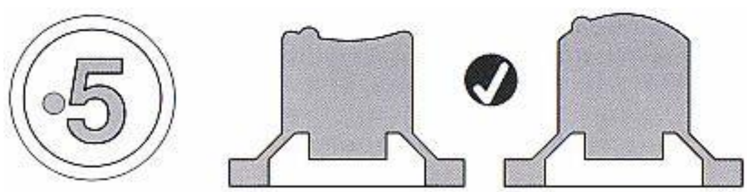


18.0 Blind Dot

The location of the blind dot affects the quality of silk screen printing on the rubber. It is advisable to locate the blind dot away from the graphic print.



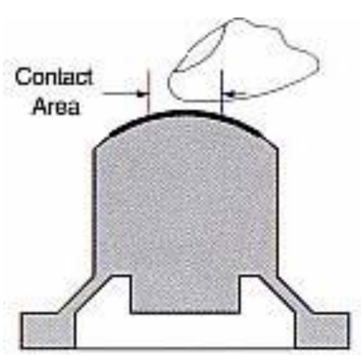
Having the dot in the centre of the graphic causes difficulties in printing. The shape of the graphic appears deformed. The blind dot on a concave profile has greater difficulty than a convex profile and moreso if the print type is negative.

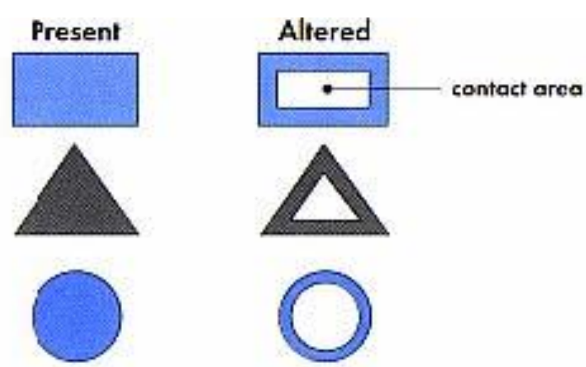


Placing the blind dot away from the graphic allows the silk screen mesh to press against the top surface of the knob easily. The imprinted graphic will be well defined without distortion.

19.0 Improve Imprinted Graphic Abrasion Resistance

The finger will contact the graphics over a specified area of the knob. The graphics can be altered to reduce contact with the finger, increasing the abrasion resistance of the ink.





20.0 Graphics File Transfer

Artwork film has been the basic means to convey the graphics to be printed on the surface of the rubber mat.
Rather than the often time-consuming and costly method of posting Artwork hardcopies, sending artwork files electronically is possible and much faster.
Corel draw, Adobe Illustrator and Freehand are the most commonly used software for graphics.

The file extensions are as follows:
Corel Draw=cdr
Adobe Illustrator=ai
Freehand=fh8 (version 8)

In order to communicate across different software readers, you may convert your files to EPS (Encapsulated PostScript).
EPS is a format that is ideal for use in professional printing. An EPS file can contain vector graphics, bitmap images, or both. EPS is the best file format for preserving prepress-readycolour.

Before exporting the files to EPS, you have to convert the graphic's path. By doing so it changes the selected text into editable vector objects.
Vectorised objects consist of mathematical objects that usually appear as outlines with control points.

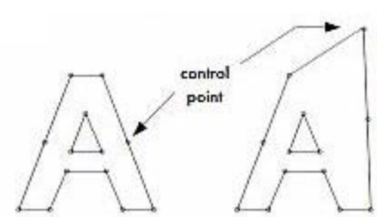
This prevents the desired fonts from being substituted when the reading party does not have similar fonts in the system.

Customer sends file containing Font "**A**" **ABCDEFG** → Fonts not Vectorised → Supplier reads file Font "**A**" substituted ABCDEFG

Customer sends file with Font "A" ABCDEFG → Fonts not Vectorised → Supplier reads file ABCDEFG

Font before converting path/vectors

(Only font type and size can be changed)



Vectorised object with control points

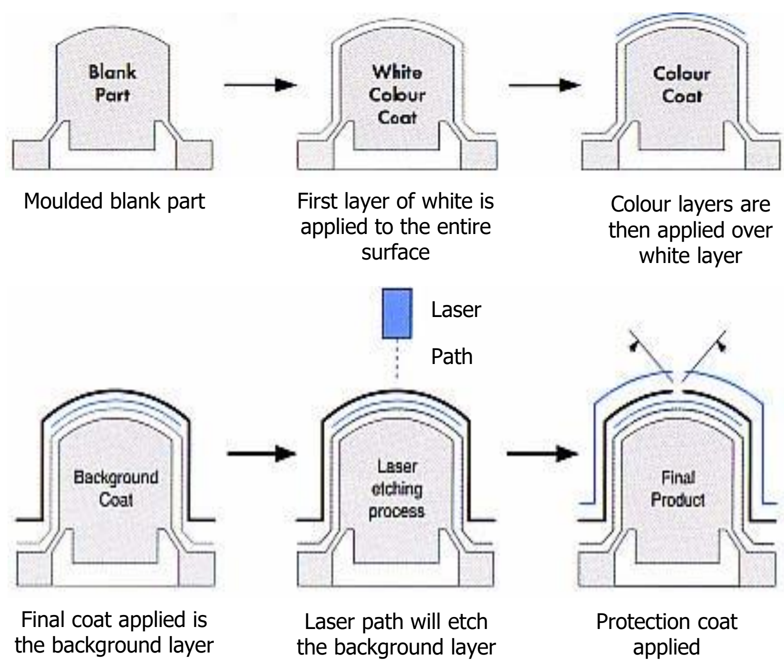
(Cannot change font type and can only scale and move control points)

21.0 Laser Etched/Back Lighting

Laser etching allows the legend to have a "back light". This can be found in applications such as:

- Mobile communications
- Mobile computing
- High end remote controls
- Automotive parts such as window modules, mirror modules, car radio knobs, global positioning systems, etc.

21.1 Laser Etching Process



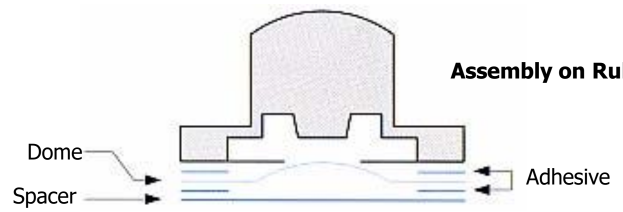
White Layer – often serves as the basic colour for alphanumeric characters.
Colour layer – used for special function knobs such as "send", "power", "end", etc.
Background coat – the background colour is usually black. If you would like to use other colours, please contact us for feasibility due to the wavelength of these different colours.

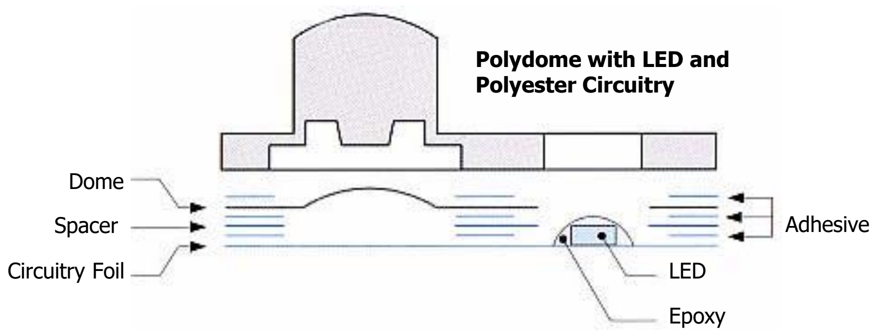
****CAD format is the preferred format for etching graphics: DXF or IGES****

22.0 Polydome and Metaldome

Both products allow tactile feel to be achieved, despite high actuation force and a short travel distance.
The overall product is compact, reducing packaging size and package weight.
Both Polydome and Metaldome can be combined with EL (Electroluminescent) lamps, LEDs, Flexible Printed Circuits (FPC) or Polyester Flexible Circuits to form a sub-unit.
Assembled with IMD (In-Mould Decoration) array or a Silicone Keypad, they form a complete unit ready to be assembled onto the plastic housing.

22.1 Polydome

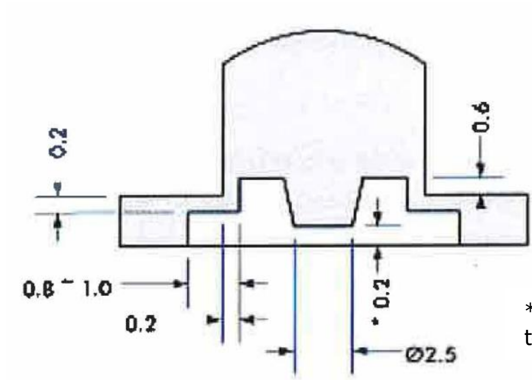




22.2 Polydome Specifications

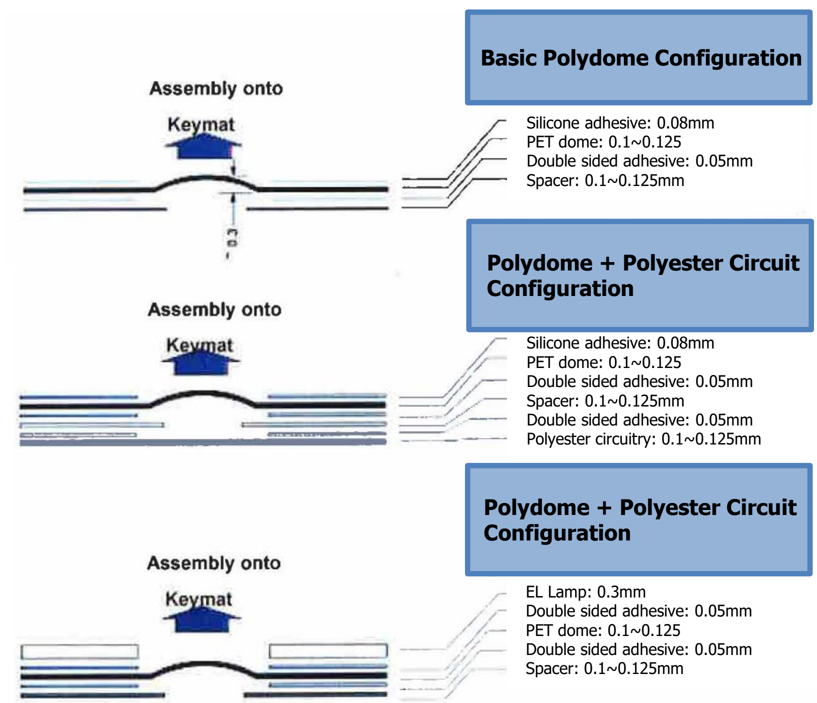
Material	PET (Polyethylene Terephthalate)
Dome Diameter	¢ 4.5~ ¢ 6.0mm
Storage Temp	-45°C~85°C
Operating Temp	0°C~85°C
Actuation Force	As required
Rebound Force	As required
Total Travel	0.5+/-0.1
Click Ratio	50+/-20%
Contact Lift	Min 500,000 cycles
Contact Resistance	Below 10 Ohms
Maximum Current	20 Mil Amperes
Maximum DC Voltage	30 VDC

22.3 Web Structure Design Guide for Polydome/Metaldome Array



* this may vary according to product assembly

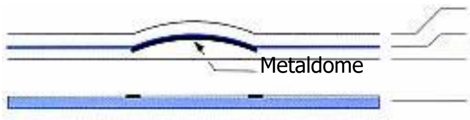
22.4 Polydome Assembly Thickness Reference Guide



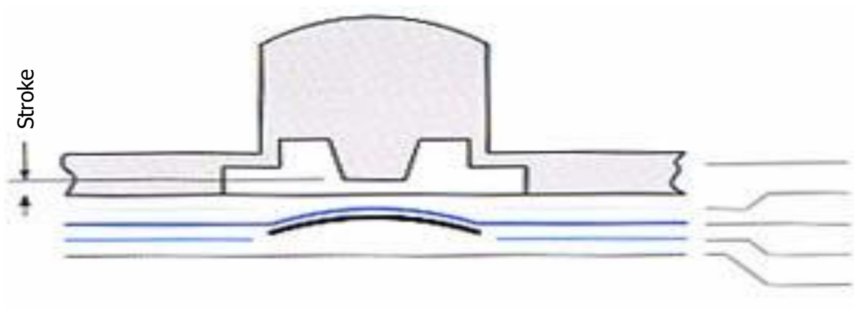
22.5 Metal dome

Metal dome products are able to withstand higher operating temperatures and have a longer life cycle compared to polydome. They have a shorter travel distance compared with polydome products. It is often used together with a PC board and can be mounted onto either a PCB or rubber mat.
A thin layer of aluminium foil can be included on the metal dome array to shield against EMI (Electromagnetic Interference).

22.6 Assembly by PCB



22.7 Assembly with Rubber



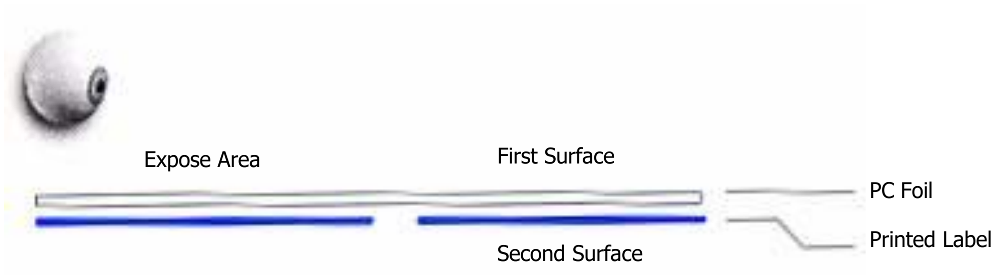
Assembly	Type Stroke
With PCB	0.20mm
With Rubber	0.12mm

22.7 Metaldome Specifications

Material	SUS30
Dome Diameter	¢4.5~¢6.0mm
Storage Temp	-40°C~+105°C
Operating Temp	-40°C~+105°C
Actuation Force	As required
Rebound Force	As required
Total Travel	0.3+/-0.05
Click Ratio	50+/-20%
Contact Lift	Min 1,000,000 cycles
Contact Resistance	Below 1 Ohms
Maximum Current	40 Mil Amperes
Maximum DC Voltage	24 VDC

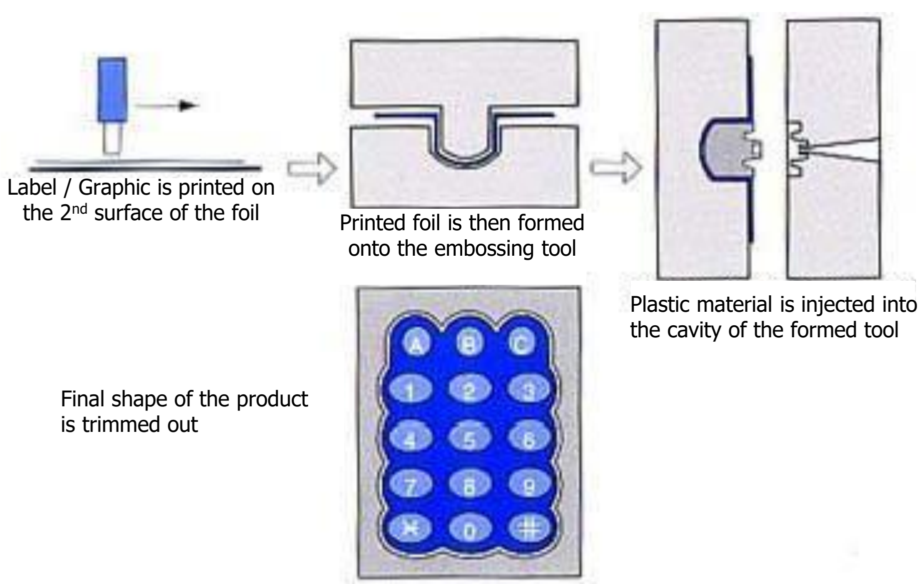
23.0 Film Insert Moulding/In-Mould Decoration (IMD)

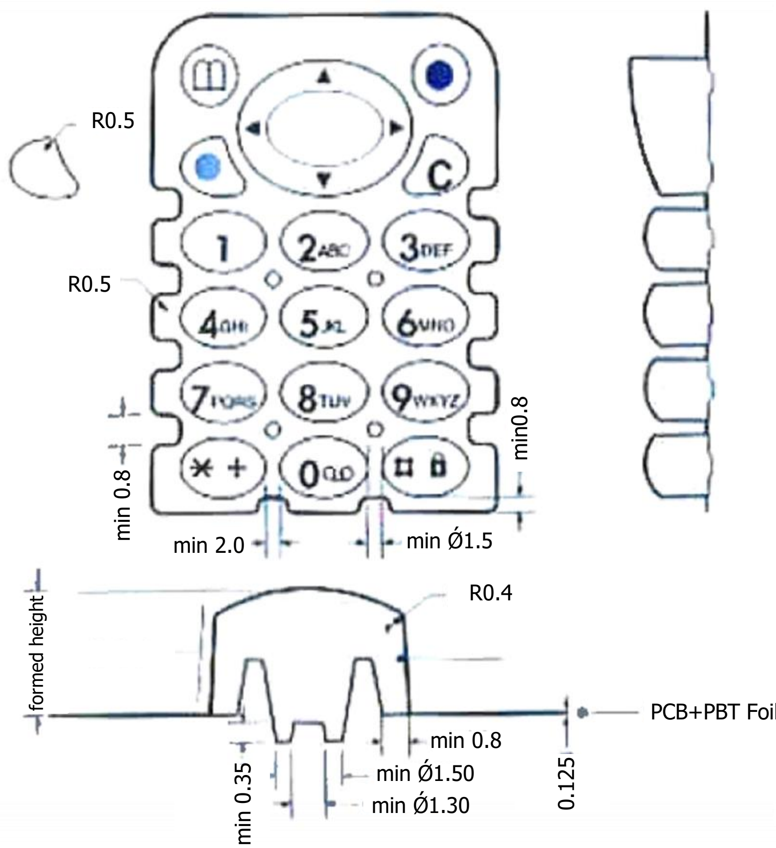
Any technology that applies text, pattern or images to a moulding as part of the moulding process, qualifies to be IMD.
IMD in its simplest form can merely be the printing of a small flat label which locates into the injection mould and bonds into place during the moulding process. Labels printed on the second surface offer the best protection against abrasion.



23.1 Advantages of IMD over Injection Moulded Part

- No influence of flow direction
- No flow lines
- Rapid change of decor through silk screen printing
- Graphics are well protected under the second surface of foil
- Wide range of decoration possible





The guideline for the formed height shall be 5.0mm.
For anything higher than 5.0mm, please consult us for feasibility

23.2 Plastic Materials

ABS (Acrylonitrile-Butadiene-Styrene Copolymer)

- good impact strength
- good stiffness
- good mechanical properties
- good chemical resistance
- good dimensional stability
- easy processing & easy colouring

SAN (Acrylonitrile Styrene Copolymer)

- excellent physical properties
- excellent toughness
- very good heat resistance
- fair chemical resistance
- transparent
- moderate to high price
- fair processing

PMMA (Poly Methyl Meth Acrylate)

- transparent(>90% transmission)
- hard
- stiff material
- excellent UV stability
- low water absorption
- high abrasion resistance
- outstanding outdoor weather resistant properties

PC(Polycarbonate)

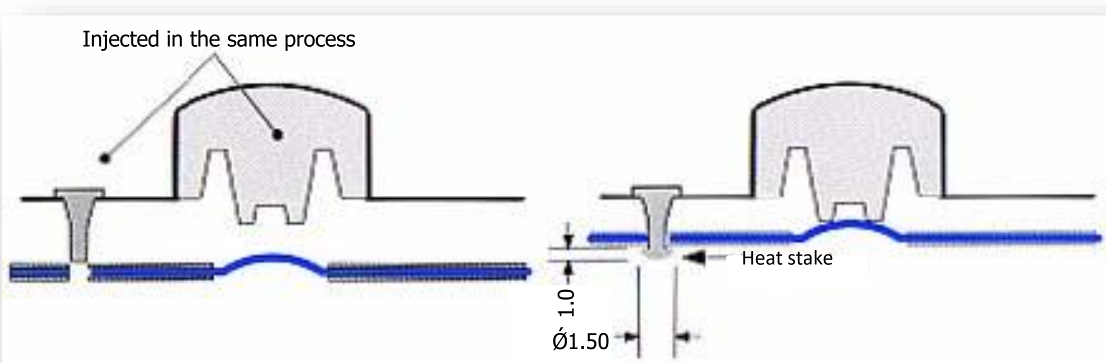
- excellent physical properties
- excellent toughness
- very good heat resistance
- fair chemical resistance
- transparent
- moderate to high price
- fair processing

PC+PBT Foil

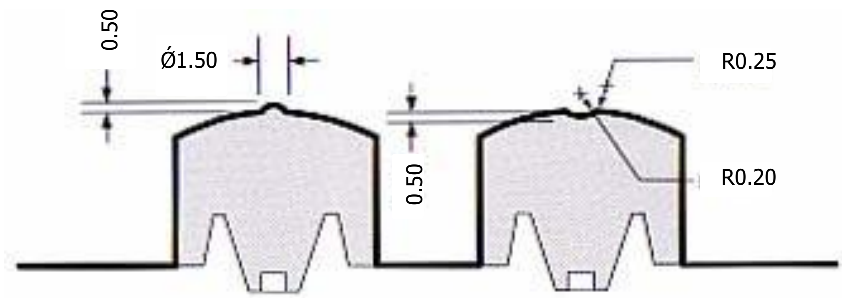
- scratch resistant textured surface
- good ink adhesion
- chemical resistance
- excellent forming properties
- good light transmission
- high dynamic strength

23.3 IMD Assembly

IMD products can be combined with polydome or metaldome array to form a sub-unit of assembly.



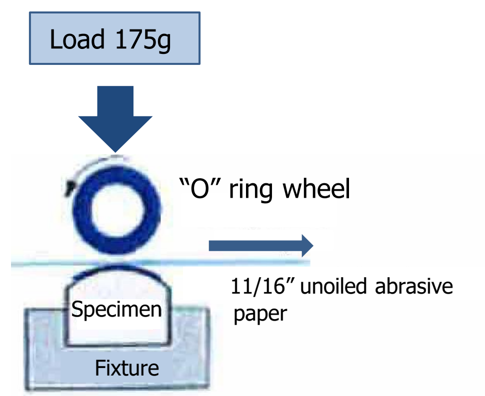
Guide for Blind Dot and Groove in IMD



Blind Dot **Groove**

24.0 Abrasion

Below is a Norman Tool Tester. This is used to determine the abrasion resistance of the printed labels on the knobs' surface.



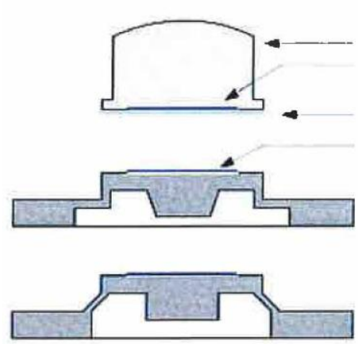
24.1 Abrasion Testing Procedure

The specimen is placed in the fixture. A load of 175g is applied, as shown above.
The unoiled abrasive paper sits on the specimen. The tape will then travel at 4cm per cycle. Upon completion of the designated number of cycles, the tape is inspected for an ink presence. The length of the tape is then measured (from the beginning of the tape to the point where ink particles are found) to determine the number of cycles it can withstand abrasion.

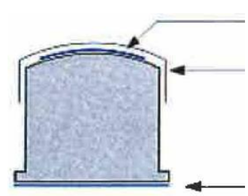
25.0 Plastic Cap and Rubber mat Assembly

Such assembly offers a hard feel and excellent abrasion resistance for the graphics label. The plastic cap can be bonded to the rubber by either:

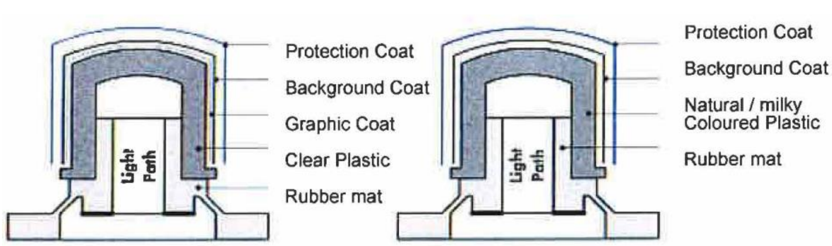
- Adhesive bonding
- Direct insertion onto the rubber knobs



When the plastic height is too tall, the graphics layer (if printed on the base) will appear distorted. This is why the graphics layer has to be printed on the top of the plastic surface with a protective coating.



Alternatively, you may use laser etching technology on the plastic rubber assembly.



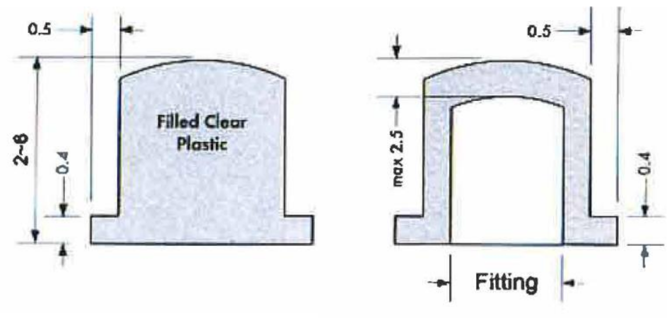
Example A Example B

*The above illustrations are for a white graphic label

Example A – When the plastic cap is clear, it is necessay for a a layer of white graphics, followed by a background coat and protective layer.

Example B – When the plastic cap is a natural or creamy colour, only the background coat is needed, followed by the protective layer.

26.0 Guides for Plastic Cap



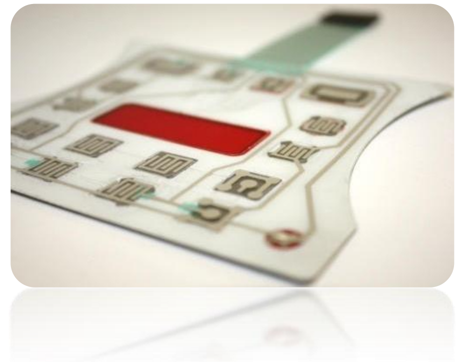
Fitting between the rubber mat and plastic caps will be taken care of by our staff – the general requirement is that when the keymat assembly is turned upside-down, the plastic caps must not drop off.

27.0 CAD Data Exchange

There are several Data Exchange products used to help users exchange data to and from different CAD/CAM tools.

- **STEP (Standard for the Exchange of Product Model)**
  In short, STEP is used to communicate solid models instead of surface models. File sizes of solid models are much small and editing them is much easier than surface models. STEP will be the preferred method to use for 3D models.
- **IGES (Initial Graphics Exchange Specifications)**
  IGES translator supports wireframe geometry, surface geometry, text and dimensions, attributes, views and drawings.
  Most CAD/CAM products have IGES translators and are widely used.
- **DXF (Data Interchange Format)**
  Commonly used to communicate 2D data such as drawings and AutoCAD data.
  DXF is widely used to exchange engineering drawings to convey specifications and dimensions so that the suppliers can use to submit engineering reports.
  CAD Data is exchanged via the internet instead of storage media.

28.0 Membrane Keypads



What is a Membrane Keypad?

In it's most basic form, a membrane keypad consists of one or more keys within a flat panel (less than 1mm thick). Each key consists of an open contact between two tracks (or wires) that exit at the back of the panel in the form of a tail that can then be connected directly to a PCB (Printed Circuit Board).

Each key is graphically represented on the top panel – to operate, all that is required is a simple press of a finger on the designated key to momentarily short the contact.

Membrane Keypad technology has been around for more than 20 years and has proven to be simple, reliable, economical and above all attractive both in design and function. It is the design capability that has let the membrane keypad stay modern in the present day and age.

Despite advances in new manufacturing processes, the basic functional design and working principles of the membrane keypad have not changed.

28.1 Graphics and Embossing

The graphic layer has many possibilities. Because the raw material is clear and all the colours are printed individually, it is possible to leave clear areas in the graphic that can create any shape of window for displays or LED ports. Colour combinations are endless but remember colours are individually printed, resulting in cost implication.
A basic unit typically starts with two colours, one colour for the detail and the second colour for the background. Colours normally vary from two colours to five colours but there is no limit. Solid colours are preferred as half-tone printing is limited and can lead to extra expense.

The printing process is currently restricted in this way but digitally printed graphics with full colour resolution may soon be possible. For colour references we use the universal pantone colour chart as a guide to the finished product.

It is possible to raise certain areas of the graphic to create either ridges around the keys or the whole key itself. The process is mostly cosmetic but is very popular and the results are aesthetically pleasing.

28.2 EMI/RFI Shielding

An extra layer, either solid or in a grid pattern, can be incorporated between the graphic and the upper circuit. This layer facilitates the cancellation or dissipation of electrostatic build up on a person's finger. Electrostatic discharge can interfere with or damage sensitive electronic components. RFI shielding used on non conducting composite casing materials to shield sensitive electronic devices from radio frequency electromagnetic interference.

28.3 Circuit Design Options

The circuit assembly consists of two layers, an upper circuit and a lower circuit, separated by a spacer material. The keys only make contact when the upper circuit is pressed down onto the lower circuit. Both circuits are joined at a single connector on the end of the tail.

Unlike PCB boards, the tracks are printed with conductive ink onto a clear polyester film. This allows many options but also limitations on spacing of keys and circuit layout e.g. a membrane switch with up to 7 keys can have a single common track on one layer and then 7 more tracks, one to each key on the other layer resulting in a tail with 8 tracks leading off the membrane keypad. Where more keys are required for example a 12 key membrane it is preferable to use an X Y matrix configuration. In other words, one later will have 3 tracks for the columns and the other later will have 4 tracks for the rows resulting in a 3x4 matrix and 7-track tail. In this situation your microprocessor will interpret which key has been activated and the resulting response processed.

28.4 Tail/Connections

The tail is what connects the keypad to your interface, or processor. The tail can be manufactured to any length (normally 50mm-200mm) and have various connection options. The most popular option is the female type with housing at 2.54mm pitch and is suited to plug into a standard header on a PCB. Male solder tabs are also available to directly solder into a predrilled board. There are several PCB mount type connectors where the tail end can push fit into a connector already mounted on the PCB. Some of these PCB connectors offer a 1mm pitch for tight spaces and this would result in a more narrow width of the keypad tail.

28.5 Tactile/Non Tactile Structure

Standard construction of the membrane keypad offers no tactile feedback but an audio or visual display can satisfy most users. Where a physical feedback is required, tactile keys are an extra feature. These consist of metal clickers incorporated inside the membrane assembly that offer a positive click when pressed.

28.6 Integrated LEDs

Surface mounted LEDs can be located inside the membrane keypad either with their own circuit and tail or incorporated with the key circuit layer and become part of the single circuit layout. Normally, the graphic is embossed over the LED with the option of printed transparent colours to enhance the look of the LED on the graphic.

28.7 Information to provide when submitting your membrane keypad requirements

Please email or call us with your requirements using the following information:

+44 208 855 0991 / sales@gelec.co.uk

To avoid any time delays, it is best that the following information is provided:

Contact information:

1. Company Name
2. Contact Name
3. Telephone Number
4. Email Address

Requirements:

1. Outside dimensions (Xmm)
2. Outside dimensions (Ymm)
3. Number of keys/buttons
4. Metal domes required? Y/N
5. Polydomes required? Y/N
6. Number of solid colours including background
7. Number of clear LCD windows
8. Number of semi-clear LED windows
9. Number of semi-clear LED ports
10. Tail Exit Position and length
11. Type of connector required, if any
12. Number of prototypes
13. Quantity required
14. Embossing? Y/N
15. Integrated LEDs? Y/N
16. Total number of integrated LEDs
17. EMI Shielding? Y/N
18. Mounting Holes? Y/N
19. Number of holes and sizes
20. Cut outs? Y/N
21. Number of cut outs and sizes
22. Number of transparent colours

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