ELASTOMER SERIES
SILICONE RUBBER KEYPADS

If you next project requires a keypad, EECO's elastomer keypads deliver a "custom" look and feel at a very "standard" price.

Made from durable silicone rubber, EECO Elastomer keypads are available in either conductive or non-conductive configurations to suit any design requirement. The keypad may interface directly with a printed circuit board (conductive) or with a membrane or other type of switch (non-conductive). Applications are limitless.

There are two basic types of elastomer keypad:

INTEGRAL: One-piece construction incorporating the keys and the keymat. This type may be constructed in one or several colors, and with or without legends or other special features. This type of keypad is designed to fit directly into a bezel, typically in hand held devices.

INNER: A keymat designed to act as a switching or spring layer between the keys and a PCB or membrane switching circuit. This type of design is now very common in full travel keyboards, and has replaced the traditional mechanical switch keyboard.

EECO integral keypads are offered with or without legends, and in solid colors or natural, translucent rubber. Translucent keypads are used for back lit applications. The keys may be field-lighted (solid legend on a translucent, lighted background) or reverse field lighted (illuminated legend on a solid background.

All EECO elastomer keypads are compression molded to exacting standards. Molds may be single cavity tools for prototype or low volume production, or large, multi-cavity tools for high volume requirements. EECO will assist you in your design to find the most economical financial solution.

EECO elastomer keypads offer the design engineer a wide range of colors, shapes, and finishes to enhance the beauty and functionality of the product.

EECO SWITCH is one of the few manufacturers of both electro-mechanical switches and elastomer keypads. Our elastomer keypads are found in the most demanding applications worldwide. Rely on EECO SWITCH for the quality and reliability your demand. Why trust your elastomer keypad design to anyone else?

CHOOSING A KEYPAD

There are three basic types of keypads used to interface with the switching mechanism.

1. Membrane or flat keypads ("micro travel"). Used in occasional input applications, to select one or a few values. Suitable for low volume, physically large panels. Naturally moisture resistant.
2. Elastomer keypads ("medium travel"). Normally found in applications requiring frequent input, such as cell phones or remote controls. Superior tactile response, and may be molded in complex shapes.
3. Mechanical keypads/keyboards ("full travel") are used for frequent usage applications, such as computers and data entry devices. Usually consists of plastic keycaps, a circuit layer (may be a membrane switch or a PCB) and an elastomer layer acting as the spring mechanism. Offers long life and good tactile feedback.

TACTILE FEEL

The majority of elastomer keypads are designed to give a tactile response when pressed, although non-tactile versions are sometimes used. Creating the correct tactile "feel" is the art of elastomer keypad design and manufacturing. Defining tactile feel is a very complex task as so much of the final design decision is based upon subjective information. The skill of the manufacturer is critical in ensuring the final keypad has the correct feel, and this aspect remains consistent over different batches.

Four major features found in elastomer keypads are interactive in determining the tactile feel of the finished product: *actuation force, key travel, contact force and return force.* The key element arising from this combination is the ***Snap Ratio***, which is defined as:

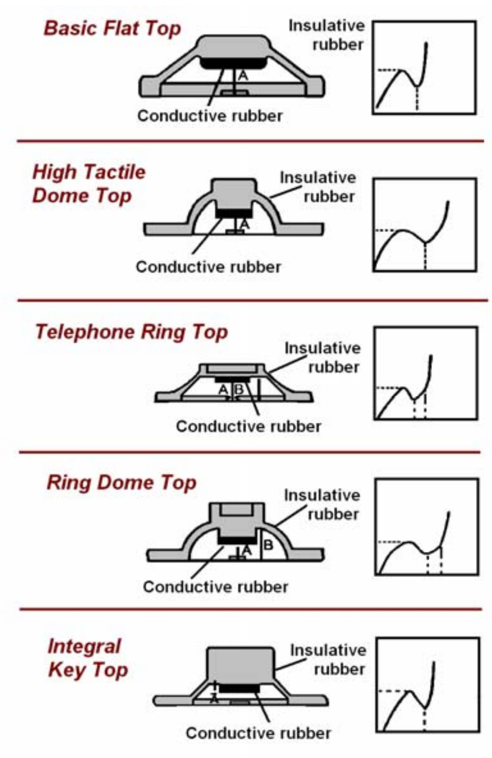
$$\frac{F1-F2}{F1}$$

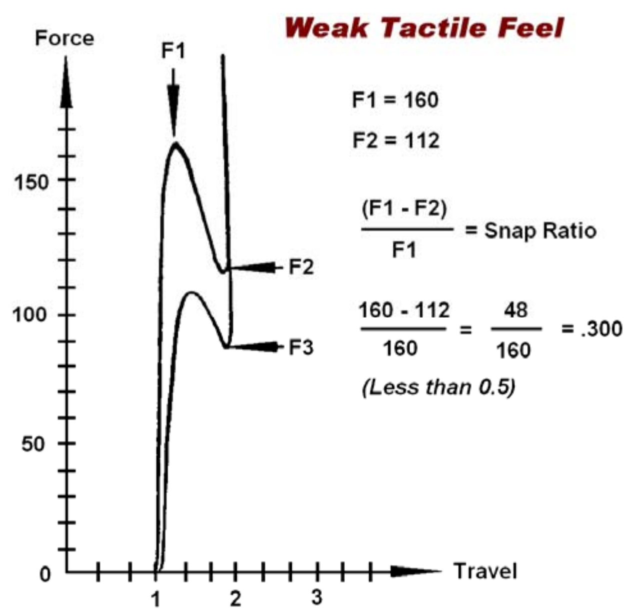
Where F1 = ***Actuation (or Peak) Force*** and F2 = ***Contact Force***.

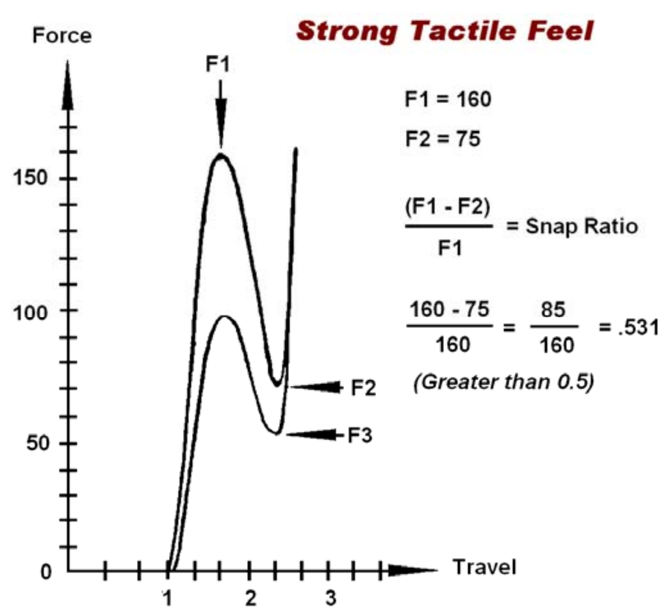
To design a keypad with a strong tactile feel the snap ratio must be a minimum of 0.4, and ideally 0.5 or greater. A snap ratio less than 0.4 will exhibit a weak tactile feel, but will have a longer life. This relationship may be expressed as a *Force Deflection Curve.*

Another important design consideration is the ***Return Force*** (F3), typically 25-30% of the Actuation Force but at least 30 gm to avoid sticking keys.

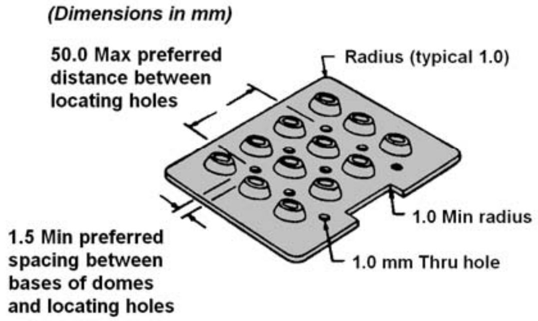
TYPICAL KEY PROFILES AND FORCE DEFLECTION CURVES

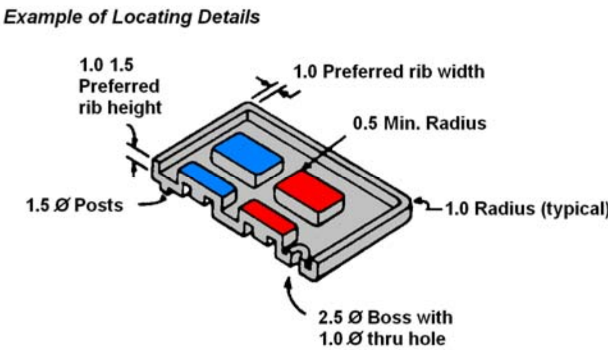






DESIGN GUIDELINES



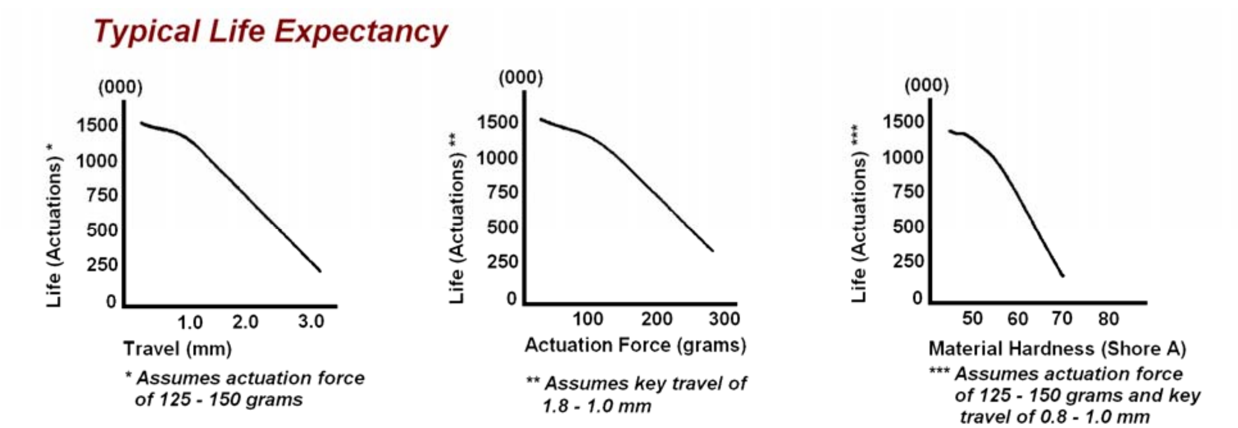


It is impossible to predict the exact travel actuation for and life expectancy for every single keypad design, but the majority will fall within these guidelines.

PRODUCT APPLICATION	TRAVEL (mm)	FORGE (gr.)	LIFE EXPECTANCY
Cell Phones	0.3 - 2.0	70 - 300	>10m
Remote Controls	0.4 – 1.5	50 - 150	0.5m To 10m
Handheld Instruments	0.4 – 1.5	50 - 150	0.5m To 10m
Automotive Panels	0.4 – 2.0	50 - 150	0.5m To 10m
Computers	2.0 – 4.0	40 - 90	>5.0m
Office Machines	0.5 – 3.5	50 - 200	>1.0m

SWITCH LIFE

Many factors influence switch life such as key design, material, actuation force, snap ration and key travel. Life expectancy may be reduced by such factors as increased shore hardness of the keymat, increased actuation force, and longer key travel.



SPECIFICATIONS **Industrial Grade Silicone Rubber**

Physical Characteristics	*Conductor * (Carbon Filled)*	*Insulator*
Specific Gravity at 21^0 C	1.05/1.10	1.10/1.40
UL Flammability Rating		94 HB
Hardness (^{0} Shore A)	50/65	40/70 **
Tensile Strength (Kg/cm^2)	50/65	50/70
Compression Set (%)	15/30	13/21
Volume Resistively (Ω-cm)	2.5 – 4.0	$3 \times 10^{14} – 4 \times 10^{15}$

* Contact pills larger than 8mm ∅ or equivalent will be silk screened carbon. Other contacts of plated gold, silver, or stainless steel are available to give lower contact resistance.

** Keypads are available in Dual Durometers for a harder feel. The keys are harder than the web and mat, typically 70^0 over 50^0.

>> Continued next page

SPECIFICATIONS

Industrial Grade Silicone Rubber (Continued)

Mechanical Characteristics

Key Travel	*0.30mm to 4.50mm*
Actuation Force	40 to 300 gr.
Operating Life (Typical)	1 Million Actuations
Operating Temperature	-40^0 To $+150^0$ C
Storage Temperature	-50^0 To $+240^0$ C
Resistance to concentrated acids and alkaline solutions	Very High
Resistance to most chemicals and solvents	High
Splash Proof Seal and/or Abrasion Resistance	Dependant upon design.

Electrical Characteristics

Contact Rating:	mA @ 12 VDC for 0.5 sec
Contact Resistance:	<200 Ω
Contact Bounce	< 12 m-sec
Insulation Resistance	<100 M Ω @ 500 VDC
Dielectric Withstanding Voltage	1 Min @ 500 VAC
Breakdown Voltage:	25 – 30 kV/mm

PRINTING

Printing Process	Typical Legend Life (Actuations)	Resistance To Abrasion (RCA Tester)
Silk Screened	*300,000*	> 15 Cycles
Silk Screened with Duracoat Spray Finish (Matte or Gloss)	1 to 2 Million.	> 500 Cycles:
Laser Etched	>1 Million	>100 Cycles

QUOTATION REQUIREMENTS

Please include the following design details when requesting a quote. A 3D CAD drawing is the preferred method for developing a quotation. EECO can read most common 3D CAD programs.

1. Overall keypad dimensions
2. Keymat thickness
3. Key details: Number of keys, shape and dimensions
4. Conductive or non-conductive key design. If conductive, specify the number of contacts (pills) required.
5. Number of rubber colors in keypad. Pantone Matching System (PMS) is the preferred color reference system.
6. Number of colors in legend (PMS preferred.
7. Actuation Force desired.
8. Key travel desired.
9. Quantity Required.

We will also offer a budgetary quotation based on your input if all details are not yet available. Please contact the factory for assistance.

LEAD TIMES

EECO Switch is sensitive to your production schedules. Our lead times are normally:

Prototype Tool and Samples: 30-40 days

Production Tool and First Article Samples: 45-50 Days

Production Units: 30-40 Days after acceptance of First Article

OTHER PRODUCTS

EECO offers many other products made from silicone rubber. In addition to our custom elastomer keypads, EECO also produces the Z Series Zebra Style Elastomeric Connectors for use with Liquid Crystal (LCD) displays. EECO also offers value-added assembly services up to turnkey product assembly and test. Please consult EECO for more information about our additional capabilities.

RoHS COMPLIANCE

EECO Switch is fully committed to complying with the European RoHS directive. EECO Elastomer Keypads are RoHS compliant.