

Panasonic

LIGHT TOUCH SWITCH DESIGN GUIDE



High Durability



Long Life



Water Resistant

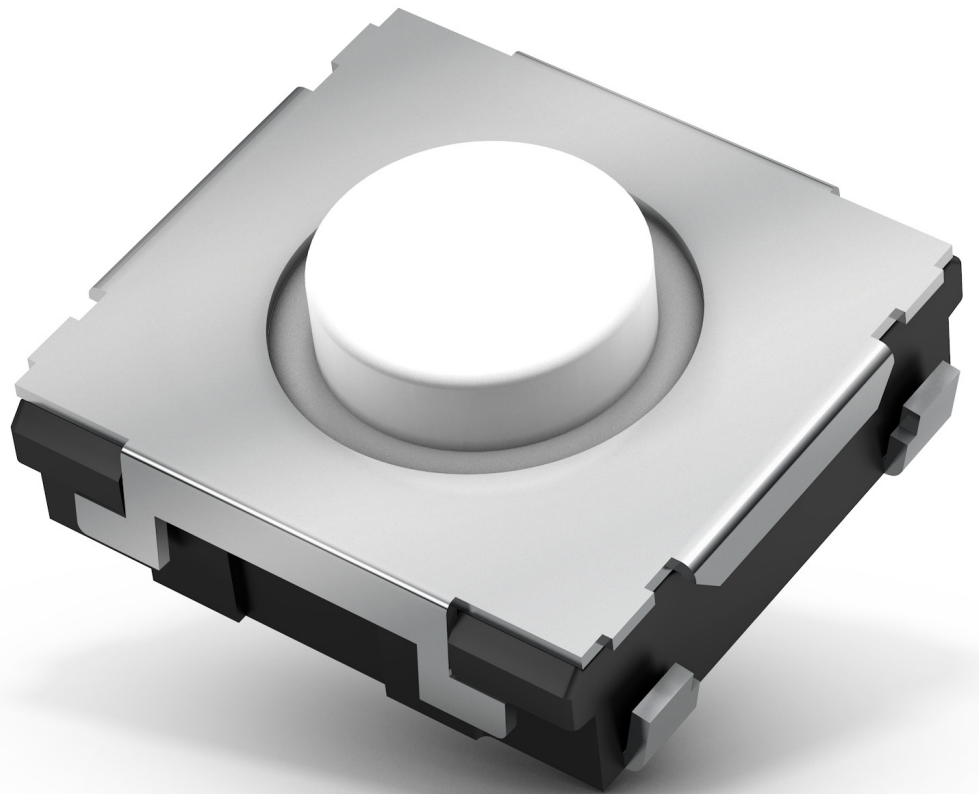


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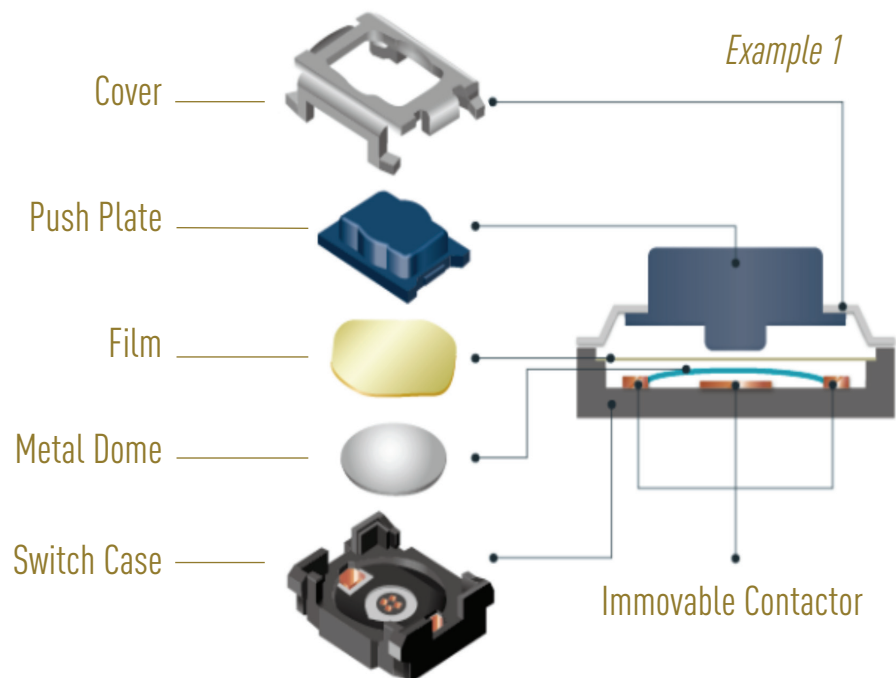
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Construction

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Structure Of A Panasonic Light Touch Switch

A Panasonic Light Touch Switch usually consists of a Cover, Push Plate, Film, Metal Dome, Switch Case and Immovable Contactor, shown in *Example 1*. These parts combine to provide superior tactile feel, push force and travel in the finished Switch.



Panasonic's Unique Manufacturing Capabilities

Design – All Light Touch Switch parts are designed by Panasonic including the Metal Dome, Panasonic's core technology.

Die Making – Panasonic has extensive experience in high precision die making.

Assembly – All Panasonic Light Touch Switches are assembled by Panasonic.

High Volume Production – Allows Panasonic to pass on cost savings.

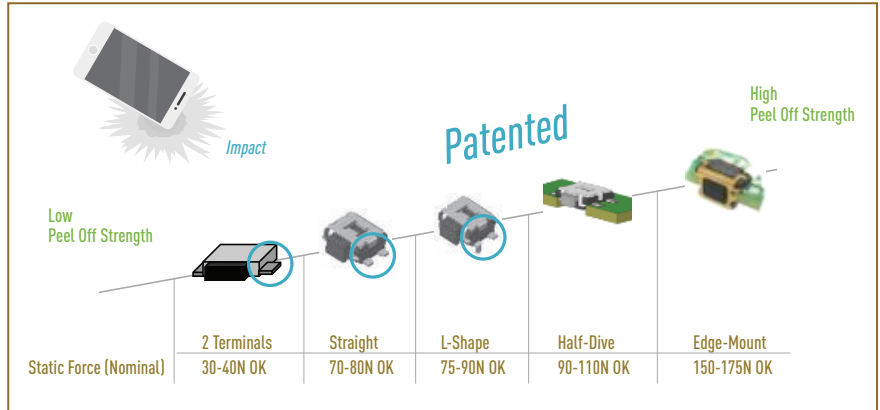
Features And Benefits

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High Durability

Panasonic's experience in portable electronic devices has provided the expertise to develop Light Touch Switches with one of the highest peel-off strengths in the market.

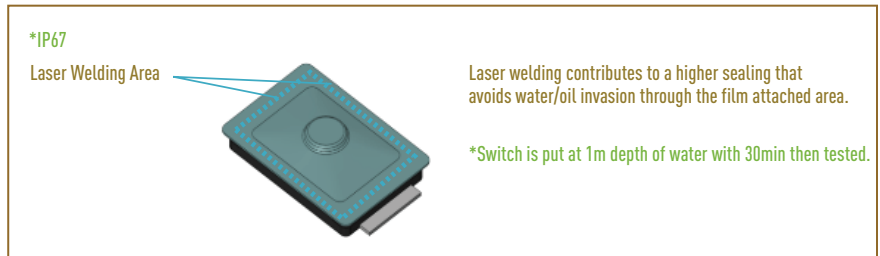
Peel Off Strength



Long Life

The Metal Dome, Panasonic's core technology, allows a long cycle life and excellent tactile feel.

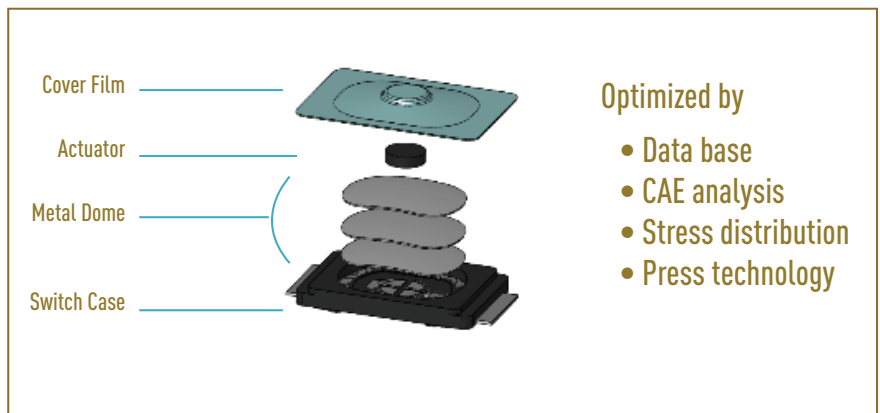
Ingress Protection Through Panasonic's Laser Welding Technology



Water Resistance

A patented laser welding technology allows Panasonic's Light Touch Switches to achieve an IP67 Rating while maintaining a sharp tactile feel.

In-House Metal Dome

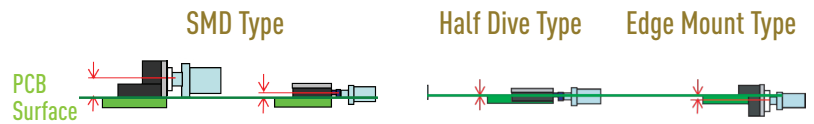


Light Touch Switch Types

Panasonic offers a wide assortment of Light Touch Switches in various direction, push position and size types.

Direction Switches

Panasonic offers both Top Push Type and Side Push Type Light Touch Switches.



Push Position Switches

Side Push Switches are available in SMD Type, Half Dive and Edge Mount Types.



Small Footprint Switches

Panasonic provides one of the world's smallest Light Touch Switches in both Top Push Type and Side Push Type.

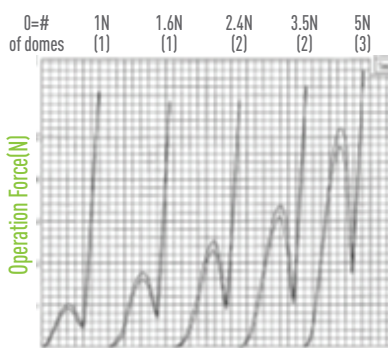


Light Touch Switch Characteristics

Panasonic Light Touch Switches have excellent tactile characteristics for click feeling, click sound and travel.

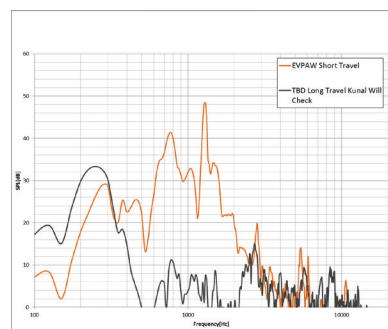
Operation Force Varieties

Control operation force by the number of Metal Domes.



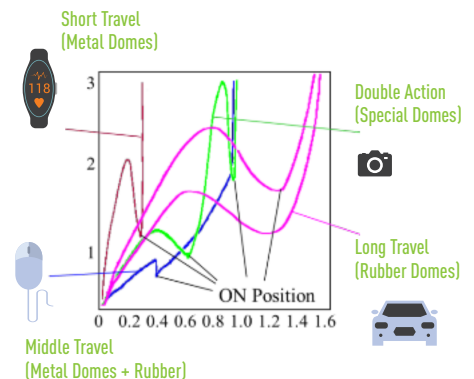
Click Sound Varieties

Control sound by selecting various travel and push force.



Travel Varieties

Panasonic offers a wide variety of travel to accommodate different applications.

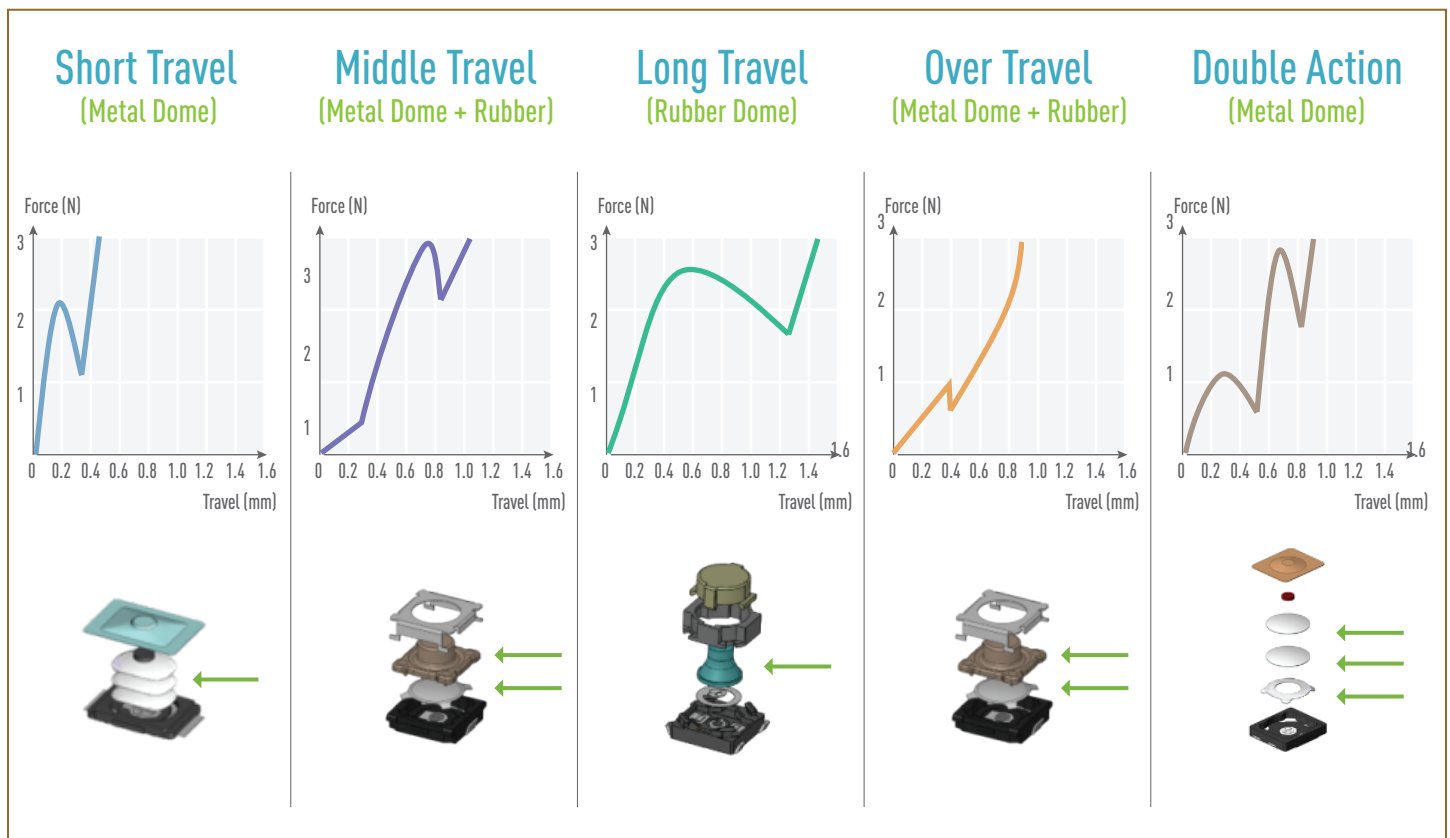


Choose The Right Switch

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Travel And Click Ratios

Panasonic offers a wide selection of Light Touch Switches with various click ratios. Reference the diagram below showing the relationship between various travel and force, the assembly of different travels and applications for each travel.

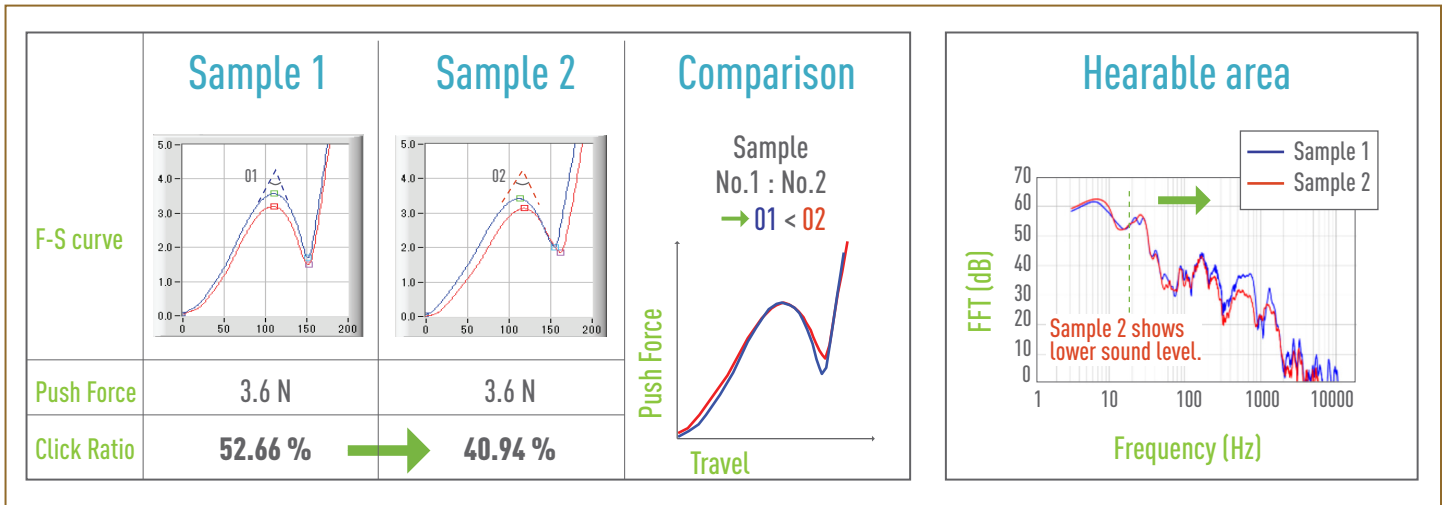


Note: Click ratio is the relationship between push force and travel and is primarily used to measure the feel of a Switch.

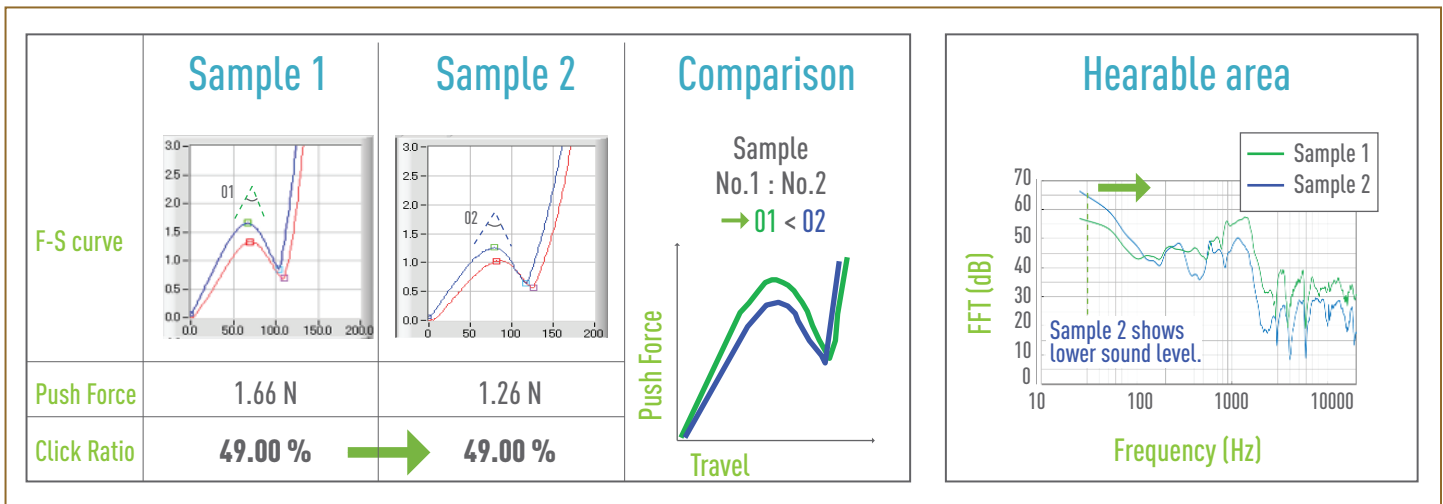
Click Sound Control

Click Sound should be considered when selecting a Switch for an application. The charts below show by selecting a Switch with a lower click ratio or lower push force, the Switch will have a lower Click Sound.

Click Sound Control by Click Ratio



Click Sound Control by Operation Force



Design Recommendations

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Structure Of A Panasonic Light Touch Switch

When designing in a Light Touch Switch, Mechanical Design, Click Feel and Reliability should be considered.

Mechanical Design

Thin and Small Design



Thin Bezel To Increase Battery Volume



Mechanical Design considers the length, width and height of the Switch, along with other dimensional characteristics and push direction.

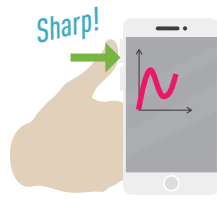
- Thin And Small Switch Package
- Various Push Direction and Position

Supported By

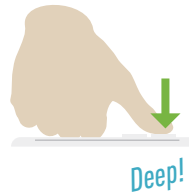
- Molding Technology
- Mechanical Design Skill

Click Feel

Click Feel



Travel



Click Feel considers the click ratio, travel and sound.

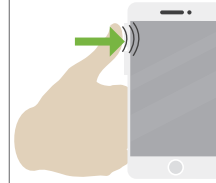
- High Click Ratio
- Middle Travel
- Various Click Feeling

Supported By

- Panasonic Metal Dome Technology
- Laser Welding Technology

Reliability

Life Cycle



Water Resistance



Reliability considers life cycle, ingress protection and solder rise.

- High Life Cycle Performance
- Resistance Against Water
- Resistance Against Flux Intrusion

Supported By

- Panasonic Metal Dome Technology
- Laser Welding Technology
- Original Blast Process Technology

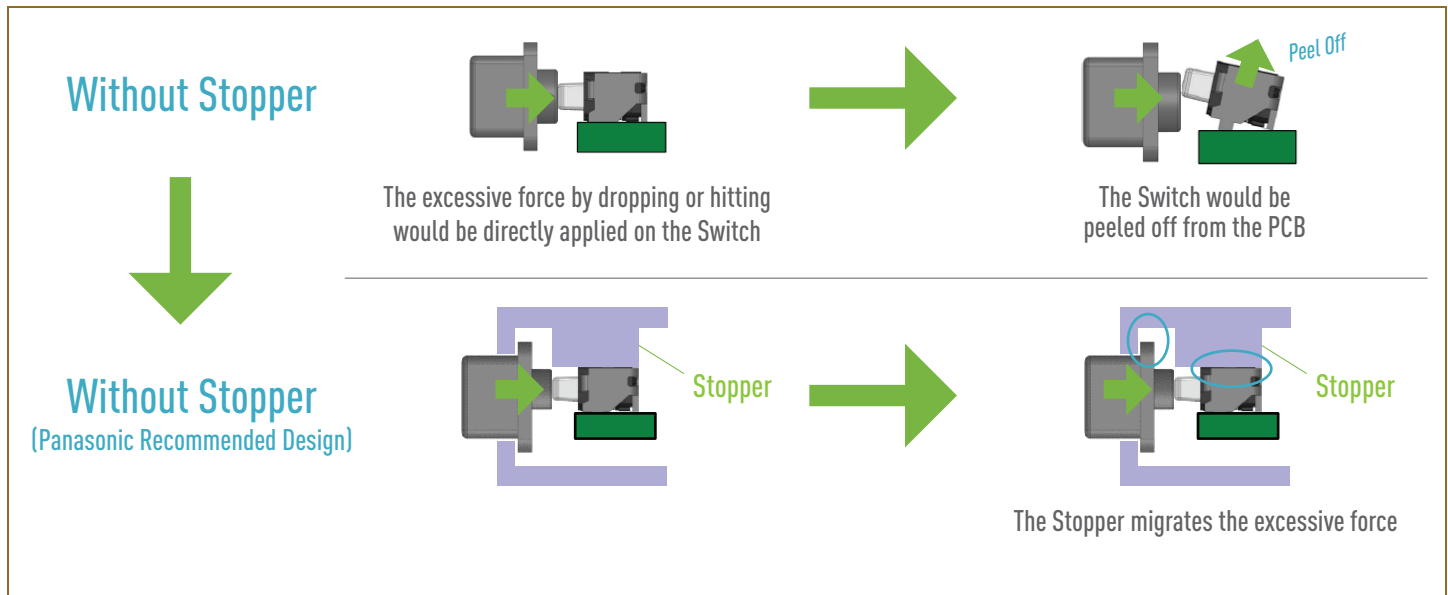
Peel Off Strength

All external forces that could be applied to the Switch need to be reviewed when considering which Switch to design in. In general, Panasonic Light Touch Switches have one of the highest Peel Off Strengths in the world. Peel Off Strength is the strength at which the Switch would be sheared off from the PCB due to a high force or impact. Panasonic Switches have various mounting constructions which enhances the Peel Off Strength. Please reference the chart below which displays the Peel Off Strength of various Panasonic Light Touch Switches.

		3.5 x 2.9 [mm] Side-op. SMD EVO-P7/P3 Series	3.5 x 2.9[mm] Side-op. Half Dive EVP-AN Series	Small-sized Side-op. SMD EVO-PU Series	3.8x1.9 [mm] Side-op. SMD EVP-AK Series	2.8x2.3 [mm] Side-op. EM EVP-AV Series	4.5x2.2 [mm] Side-op.EM EVP-AE Series	6.2 x 2.5 [mm] Side-op. EM EVO-P4 Series	6.2 x 2.5 [mm] Side-op. EM EVO-P4 Series	
Dimension (mm)										
PCB Cutout		No	Yes	No	Yes	No	Yes	Yes	Yes	
Size		3.5mm x 2.9mm	3.5mm x 2.9mm	4.7mm x 3.5mm	3.9mm x 2.05mm	2.8mm x 2.3mm	4.5mm x 2.2mm	6.2mm x 2.55mm	6.2mm x 2.55mm	
Operation Force (N)		1.0						O(ST:0.25mm)		
		1.3								
		1.6	O(ST:0.20mm)	O(ST:0.20mm)	O(ST:0.30mm)	O(ST:0.12mm)	O(ST:0.13mm)	O(ST:0.15mm)	O(ST:0.25mm)	
		2.4	O(2.2N ST:0.20mm)	O(2.2N ST:0.20mm)	O(2.2N ST:0.30mm)				O(ST:0.25mm)	
		2.5								O(ST:0.7mm)
		3.0						O(ST:0.15mm)		
		3.5							O(ST:0.25mm)	O(ST:0.7mm)
Click Ratio (Actual)		30-50%	30-50%	30-50%	40-60%	30-50%	35-55%	35-55%	10-30%	
Operating Part Strength (Actual)		72N Peel off	92N Peel off	102N Peel off	130N Metal dome deformed	95N Peel off Switch break	180N Metal dome deformed	150N Metal dome deformed	150N Metal dome deformed	
Operating Part Strength (Actual)		9N	4.5N	9N	20N	12N	30N	30N	30N	
Operation Life Cycle		100K	100K : 1.6, 2.2N 500K : 1.6N	100K	200K	300K	200K	200K : 3.5N 500K : 2.4N 1000K : 1.6, 1.0N	200K : 5.0N 500K : 3.5N 1000K : 2.5N	

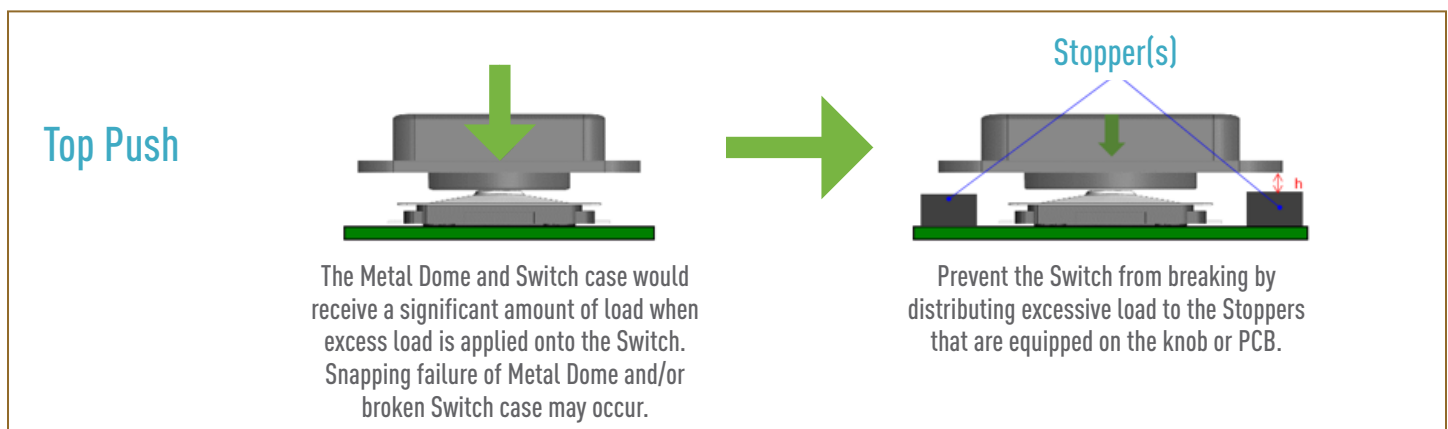
Stopper

Even though Panasonic Light Touch Switches have one of the highest Peel Off Strengths in the world, it is important to provide additional mechanical support. Panasonic recommends applying a stopper to the Light Touch Switch to migrate any excessive force, as described in the diagram below.



Note: If the edge of PCB has curvature (initial and reflow), it may have mounting failure and slanting operation may not maintain Switch characteristics.

For Top Push Type Switches, Panasonic also recommends applying a Stopper. The Stopper can relieve any excessive load that is applied to the Switch.



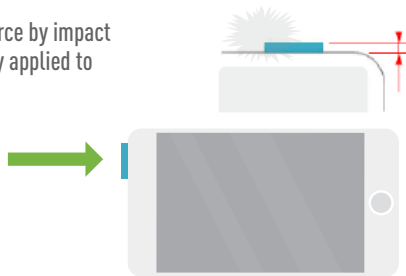
Knob

Avoid exposing the Set Knob outside of the housing when designing. If the Set Knob drops, the Switch may receive the impact and could become damaged.

Bad Example

The knob is exposed.

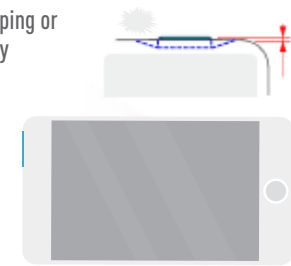
The excessive force by impact would be directly applied to the Switch.



Our Recommended Design

The knob is NOT exposed. (The housing would serve as the stopper.)

The excessive force by dropping or hitting would be migrated by "the Stopper".

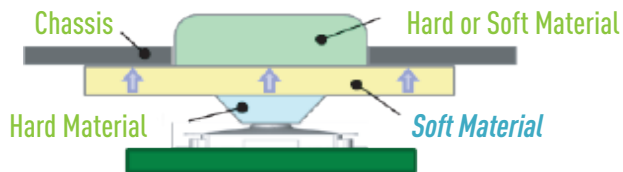


Pre-Load

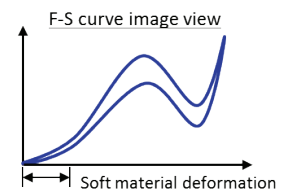
The Pre-load is force that is applied to a Switch before any user influence, this is especially important to consider for Short Travel Type Switches. There are two proposals below that minimize the Switch feeling by Pre-Load.

Proposal 1

Soft material absorbs the pre-load.

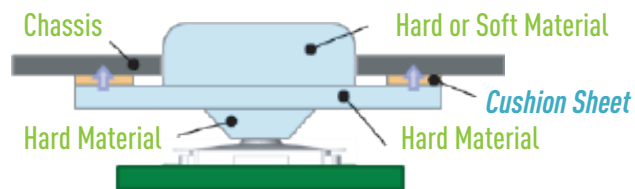


Suppress the rattling of the knob by the deformation of soft material

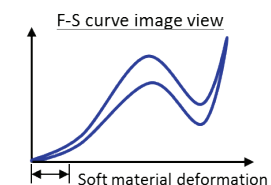


Proposal 2

Cushion sheet absorbs the pre-load.



Suppress the rattling of the knob by the deformation of Cushion sheet

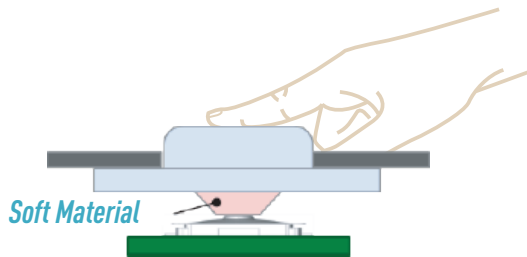


Knob Material

Avoid exposing the Set Knob outside of the housing when designing. If the Set drops, the Switch may receive the impact and could become damaged.

Bad Example

The Knob material that interacts with the Switch actuator is a “soft material”.

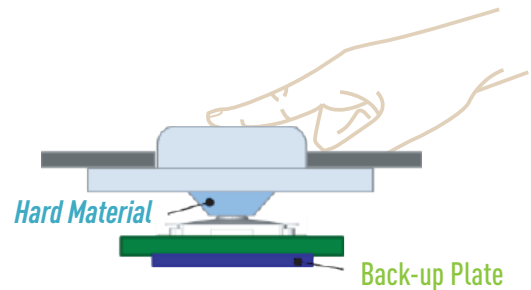


Weakness

- The soft material easily deforms
- The PCB would bend when pushed causing a louder click sound

Panasonic Recommended Design

The Knob material that interacts with the Switch actuator is a “hard material” with a “back-up plate”.



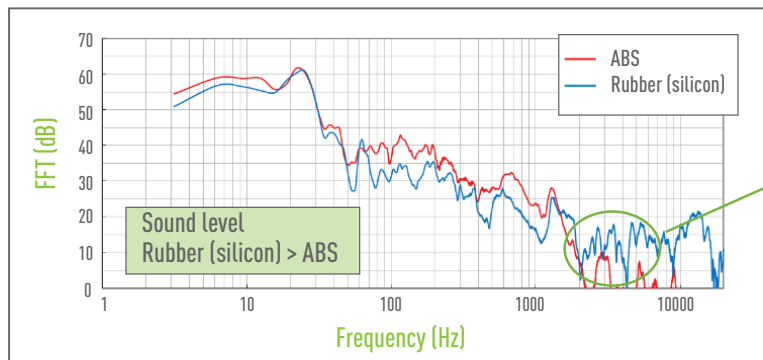
Strength

- Using a hard material will improve the tactile feel of the Switch
- Apply a back-up plate to reduce the PCB from bending

Note: When the quality of the material of an operation Knob is soft the actuator may be buried in the operation Knob and the tip may deform causing the Switch to lose its Travel. Panasonic recommends using hard material.

According to a Panasonic analysis, Knob material influences the Click Sound Level. The soft material provides a louder Click Sound in the high frequency domain.

Sound Level Analysis



Plunger: ABS $\phi 2.0$
 Rubber (silicon) $\phi 2.0$ → Hardness : 70
 Tested Sample: 4522EM LTSW *After reflow

Frequency (Hz) that people feel uncomfortable

***reference data of 4522 LTSW



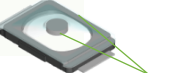
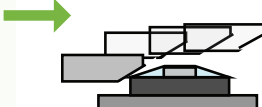
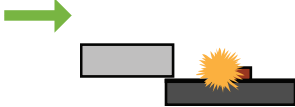



Ingress Protection

Another characteristic to consider when designing is the Switch IP Rating. The Switch IP Rating has two numerical digits. The first digit represents the level of solids Ingress Protection with 6 being the highest level of protection, mainly dust. The second digit represents the liquid Ingress Protection.

Solids (first number)		Liquids (second number)	
0	No Protection	0	No Protection
1	Protected against objects > 50mm (hands)	1	Protection against dripping water or condensation
2	Protected against objects > 12mm (fingers)	2	Protection against water spray 15 degree from vertical
3	Protected against objects > 2.5mm (tools/wires)	3	Protection against water spray 60 degree from vertical
4	Protected against objects > 1mm (small tools)	4	Protection against water spray from all directions
5	Protected against dust, limited ingress	5	Protection against low pressure jets of water
6	Totally protected against dust, limited ingress	6	Protection against high pressure water jets and heavy seas
7	N/A	7	Protection against the effects of immersion (6in to 3.3ft)
8	N/A	8	Protection against immersion

Waterproof

Panasonic's patented laser welding technology provides an Ingress Protection level of IP67. The benefits of using the laser welding Switch are Ingress Protection and Actuator Protection while maintaining a sharp tactile feel.

	Laser Welding	Film adhesive	
Water Proof / Oil Resistance Laser welding contributes to a higher sealing performance.	 The film is attached by dissolving (Laser Welding)	 The film is attached by Adhesive	 Laser Welding Area
Easy Assembling Inner actuator contributes to less damage caused by the actuator as assembling.	 Inner Actuator (The Actuator is under the cover film)	 The Actuator is sticking out on the surface	 Inner Actuator Laser Welding Area
Good Click Feel No adhesive contributes to a better feeling.	 Switch Click Feel = Metal Dome Click Feel	 Switch Click Feel = Metal Dome Click Feel + Adhesive Influence	Patent # 2011-195825 (JAPAN) 201210328277.8 (CHINA) PENDING (US)



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Learn more about Panasonic
Light Touch Switches.
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