

# A General Specifications

## Electrical Capacity (Resistive Load)

**Logic Level:** 0.4VA maximum @ 48V AC/DC maximum  
(Applicable Range 0.1mA ~ 0.1A @ 20mV ~ 48V)  
Note: Find additional explanation of operating range in Supplement section.

## Other Ratings

**Contact Resistance:** 50 milliohms maximum  
**Insulation Resistance:** 1,000 megohms minimum @ 500V DC  
**Dielectric Strength:** 1,000V AC minimum between contacts for 1 minute minimum;  
1,500V AC minimum between contacts & case for 1 minute minimum  
**Mechanical Life:** 100,000 operations minimum for bat lever models  
50,000 operations minimum for locking lever models  
**Electrical Life:** 50,000 operations minimum  
**Contact Timing:** Nonshorting (break-before-make)  
**Angle of Throw:** 24°

## Materials & Finishes

**Toggle/Lever:** Brass with chrome plating  
**Bushing:** Brass with nickel plating  
**Support Bracket:** Straight PC: phosphor bronze with tin plating; right angle & vertical: brass with tin plating  
**Housing:** Polybutylene terephthalate (PBT) (UL94V-0)  
**Base:** 1- and 2-pole GFR polyamide (UL94V-0); 4-pole liquid crystal polymer (LCP) (UL94V-0)  
**Movable Contacts:** Phosphor bronze with gold plating  
**Stationary Contacts:** Brass with gold plating  
**Terminals:** Brass with gold plating

## Environmental Data

**Operating Temp Range:** -10°C through +70°C (+14°F through +158°F)  
**Humidity:** 90 ~ 95% humidity for 240 hours @ 40°C (104°F)  
**Vibration:** 10 ~ 55Hz with peak-to-peak amplitude of 1.5mm traversing the frequency range & returning in 1 minute; 3 right angled directions for 2 hours  
**Shock:** 50G (490m/s<sup>2</sup>) acceleration (tested in 6 right angled directions, with 5 shocks in each direction)

## PCB Processing

**Soldering:** Wave Soldering recommended. See Profile A in Supplement section.  
Manual Soldering: 1- & 2-pole: 3 seconds maximum @ 350°C maximum;  
4-pole: 4 seconds maximum @ 410°C maximum  
**Cleaning:** Hand clean locally using alcohol based solution.  
See Cleaning specifications in Supplement section.

## Standards & Certifications

**Flammability Standards:** UL94V-0 rated housing & base  
The D2 Series toggles have not been tested for UL recognition or CSA certification.  
These switches are designed for use in a low-current, logic level circuit.  
When used as intended in a logic level circuit, the results do not produce hazardous energy.

# Distinctive Characteristics

Base of heat resistant resin meets UL94V-0 flammability rating.

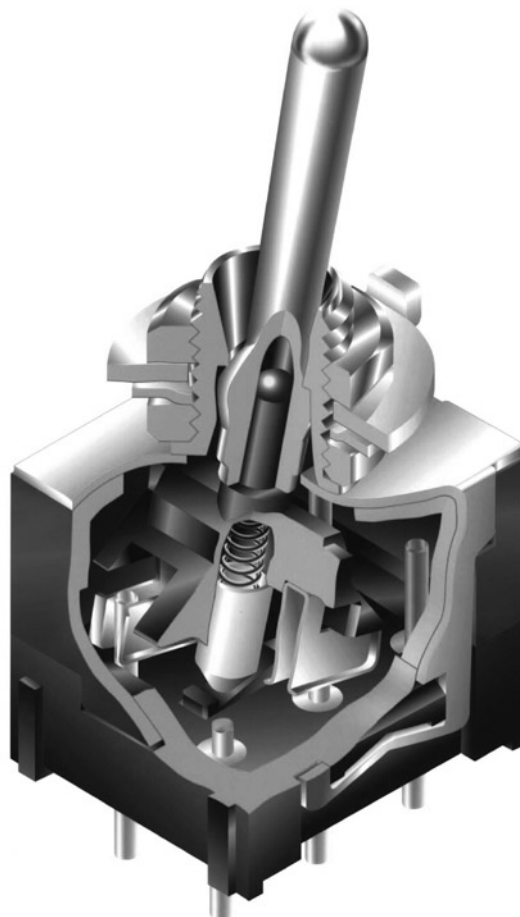
Maximized voltage capability of 48V allows use in medium source applications and increases operating life.

Award-winning STC contact mechanism with benefits unavailable in conventional mechanisms: smoother positive detent actuation, increased contact stability, and unparalleled reliability. (Additional STC details under Terms and Acronyms in the Supplement section.)

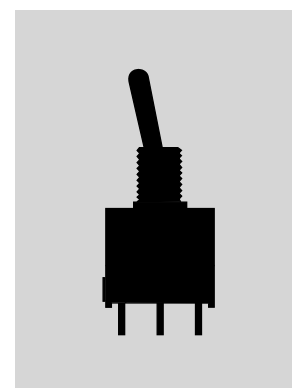
Round .031" (0.8mm) diameter PC terminals for easy PCB assembly.

Terminal spacing conforms to standard .100" (2.54mm) PC board grid spacing.

Molded-in terminals prevent entry of flux, solvents, and other contaminants.



Actual Size



|   |                |
|---|----------------|
| A | Toggles        |
|   | Rockers        |
|   | Pushbuttons    |
|   | Illuminated PB |
|   | Programmable   |
|   | Keylocks       |
|   | Rotaries       |
|   | Slides         |
|   | Tactiles       |
|   | Tilt           |
|   | Touch          |
|   | Indicators     |
|   | Accessories    |
|   | Supplement     |

### TYPICAL SWITCH ORDERING EXAMPLE

**D220**

**1**

**2**

**P**

#### Poles

|           |      |
|-----------|------|
| <b>1</b>  | SPDT |
| <b>2</b>  | DPDT |
| <b>*4</b> | 4PDT |

\* Combines with ON-NONE-ON circuit only & not available with Right Angle

#### Actuators

|                |                                         |
|----------------|-----------------------------------------|
| <b>No Code</b> | .413" (10.5mm)<br>Bat Lever             |
| <b>L</b>       | .200" (5.1mm) Diameter<br>Locking Lever |

#### Circuits

|          |      |      |      |
|----------|------|------|------|
| <b>2</b> | ON   | NONE | ON   |
| <b>3</b> | ON   | OFF  | ON   |
| <b>5</b> | ON   | NONE | (ON) |
| <b>8</b> | (ON) | OFF  | (ON) |
| <b>9</b> | ON   | OFF  | (ON) |

( ) = Momentary

#### PC Terminals

|          |                       |
|----------|-----------------------|
| <b>P</b> | Straight              |
| <b>B</b> | Straight with Bracket |
| <b>H</b> | Right Angle w/Bracket |
| <b>V</b> | Vertical with Bracket |

### DESCRIPTION FOR TYPICAL ORDERING EXAMPLE

**D22012P**

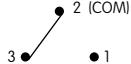
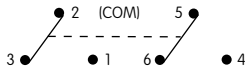
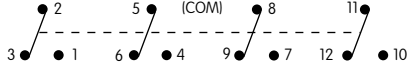
.413" (10.5mm)  
Bat Lever



SPDT  
ON-NONE-ON Circuit

Straight PC Terminals

## POLES & CIRCUITS

| Pole | Model  | Toggle Position<br>( ) = Momentary                                                        |                                                                                             |                                                                                         | Connected Terminals                                                                       |                                                                                             |                                                                                         | Throw & Schematics                                                                          |
|------|--------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|      |        | Down<br> | Center<br> | Up<br> | Down<br> | Center<br> | Up<br> |                                                                                             |
| SP   | D22012 | ON                                                                                        | NONE                                                                                        | ON                                                                                      |                                                                                           |                                                                                             |                                                                                         | SPDT<br> |
|      | D22013 | ON                                                                                        | OFF                                                                                         | ON                                                                                      |                                                                                           |                                                                                             |                                                                                         |                                                                                             |
|      | D22015 | ON                                                                                        | NONE                                                                                        | (ON)                                                                                    | 2-3                                                                                       | OPEN                                                                                        | 2-1                                                                                     |                                                                                             |
|      | D22018 | (ON)                                                                                      | OFF                                                                                         | (ON)                                                                                    |                                                                                           |                                                                                             |                                                                                         |                                                                                             |
|      | D22019 | ON                                                                                        | OFF                                                                                         | (ON)                                                                                    |                                                                                           |                                                                                             |                                                                                         |                                                                                             |
| DP   | D22022 | ON                                                                                        | NONE                                                                                        | ON                                                                                      |                                                                                           |                                                                                             |                                                                                         | DPDT<br> |
|      | D22023 | ON                                                                                        | OFF                                                                                         | ON                                                                                      |                                                                                           |                                                                                             |                                                                                         |                                                                                             |
|      | D22025 | ON                                                                                        | NONE                                                                                        | (ON)                                                                                    | 2-3 5-6                                                                                   | OPEN                                                                                        | 2-1 5-4                                                                                 |                                                                                             |
|      | D22028 | (ON)                                                                                      | OFF                                                                                         | (ON)                                                                                    |                                                                                           |                                                                                             |                                                                                         |                                                                                             |
|      | D22029 | ON                                                                                        | OFF                                                                                         | (ON)                                                                                    |                                                                                           |                                                                                             |                                                                                         |                                                                                             |
| 4P   | D22042 | ON                                                                                        | NONE                                                                                        | ON                                                                                      | 2-3 5-6<br>8-9 11-12                                                                      | OPEN                                                                                        | 2-1 5-4<br>8-7 11-10                                                                    | 4PDT<br> |

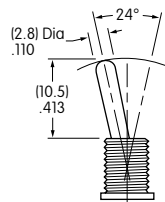
Note: Terminal numbers are not actually on the switch.

## ACTUATORS

**No Code**

**.413" (10.5mm)  
Bat Lever**

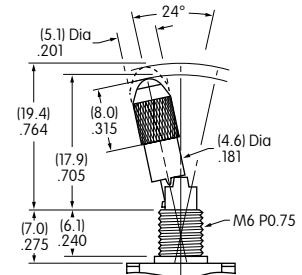
Material:  
Chrome over brass



**L**

**.413" (5.1mm) Diameter  
Locking Lever**

Material:  
Chrome over brass



## PC TERMINALS

**P**

**Straight**



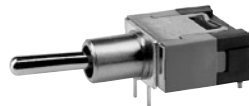
**B**

**Straight with Bracket**



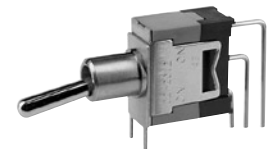
**H**

**Right Angle with Bracket**



**V**

**Vertical with Bracket**

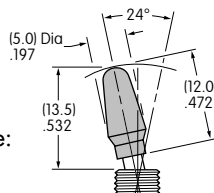


## OPTIONAL CAPS & CAP COLORS

**AT415  
Bat Lever Cap**

Material:  
Polyethylene

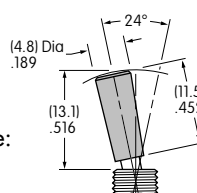
Colors Available:  
A B C E F G



**AT444 Bat Lever  
Conical Cap**

Material:  
Polyethylene

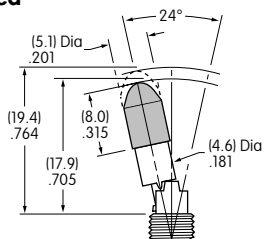
Colors Available:  
A B C E F G



**AT427 Cap Supplied  
with Locking Lever**

Material:  
Anodized Aluminum

Colors Available:  
A C G



Colors Codes: A Black B White C Red E Yellow F Green G Blue

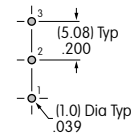
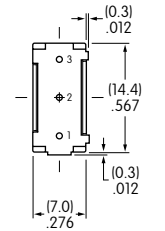
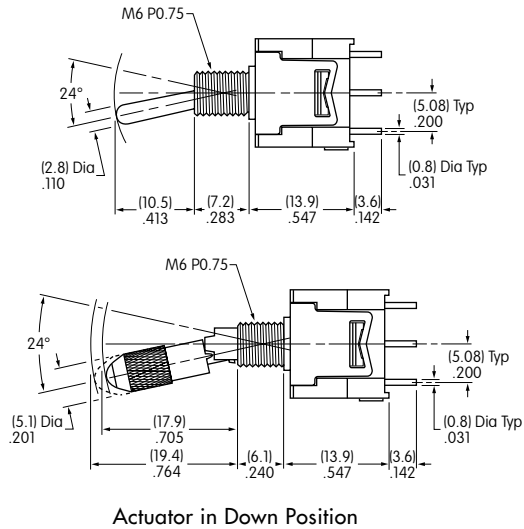
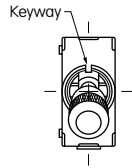
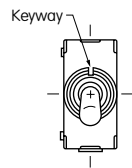
### TYPICAL SWITCH DIMENSIONS

#### Straight PC • Single Pole



D22012P

D22012LP



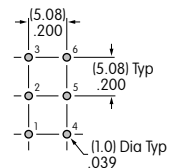
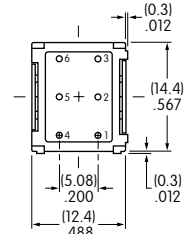
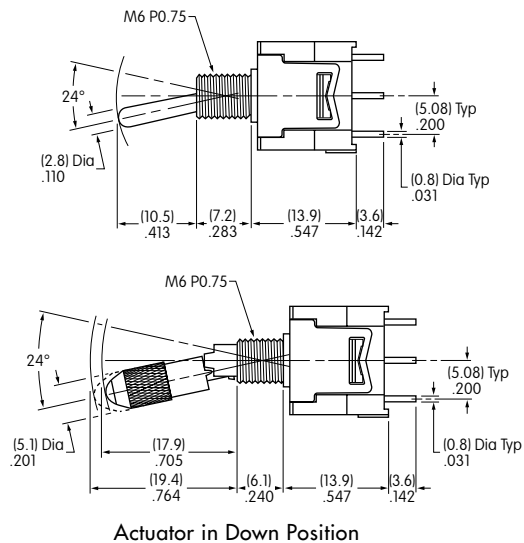
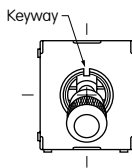
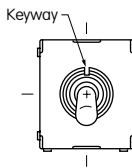
Actuator in Down Position

#### Straight PC • Double Pole



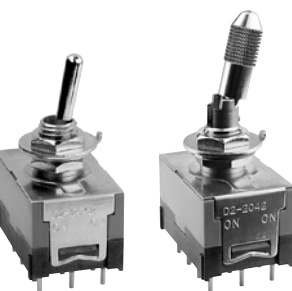
D22022P

D22022LP



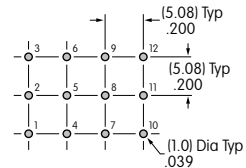
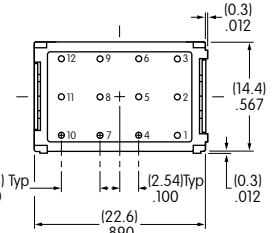
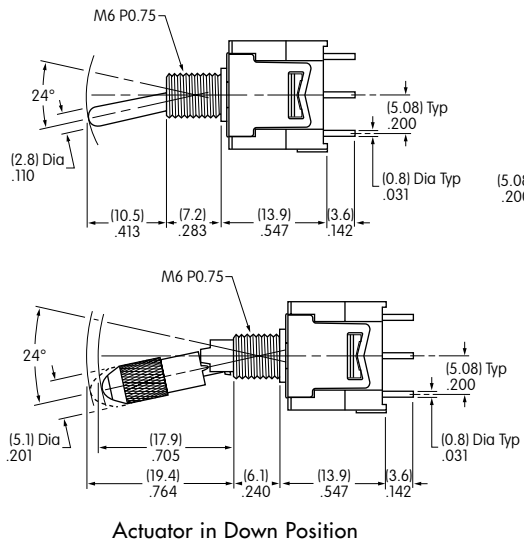
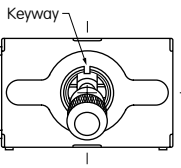
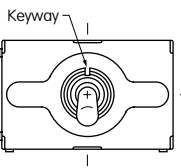
Actuator in Down Position

#### Straight PC • Four Pole



D22042P

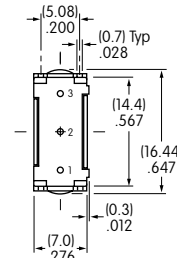
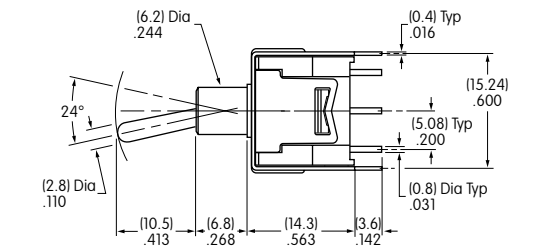
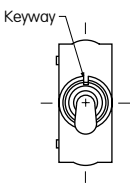
D22042LP



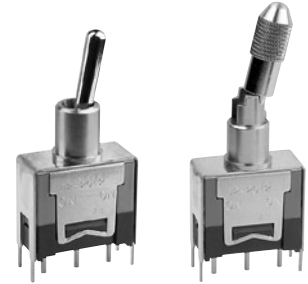
Actuator in Down Position

## TYPICAL SWITCH DIMENSIONS

**A** Toggles

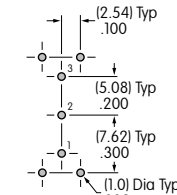
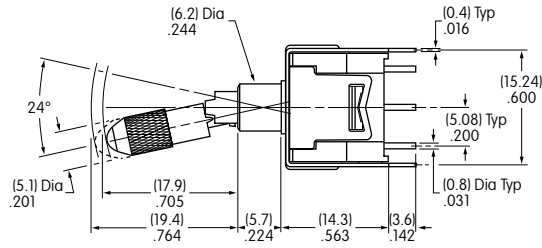
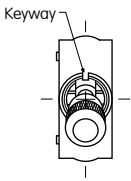


**Straight PC • Bracket  
Single Pole**



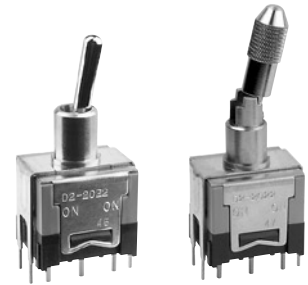
**D22012B**

**D22012LB**



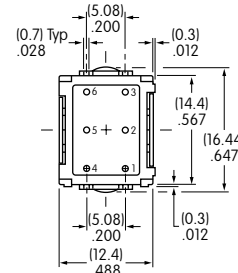
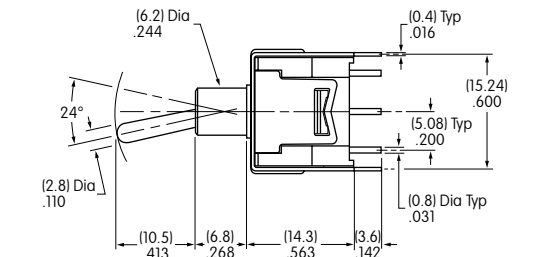
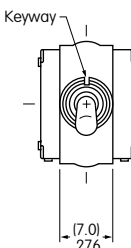
**Actuator in Down Position**

**Straight PC • Bracket  
Double Pole**



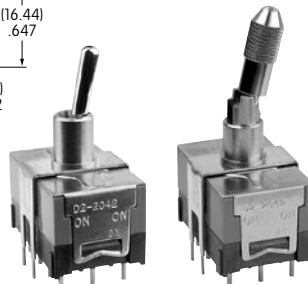
**D22022B**

**D22022LB**



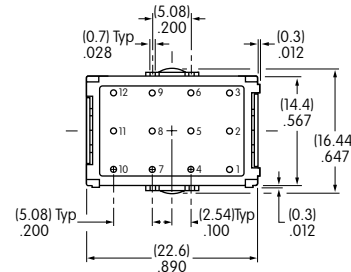
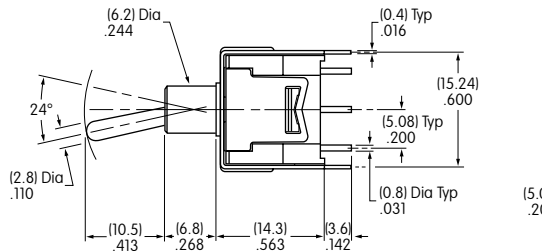
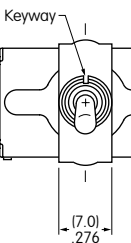
**Actuator in Down Position**

**Straight PC • Bracket  
Four Pole**

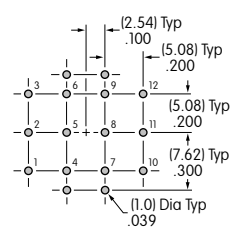
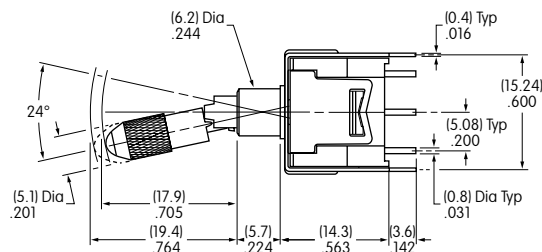
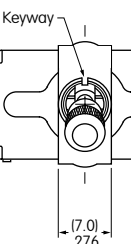


**D22042B**

**D22042LB**



**Actuator in Down Position**



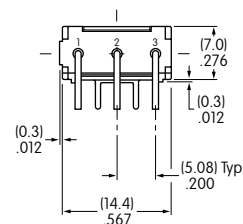
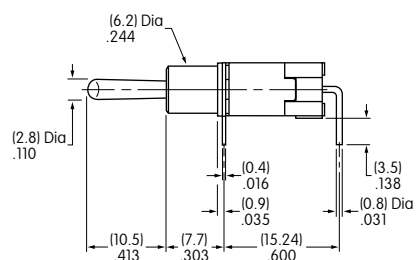
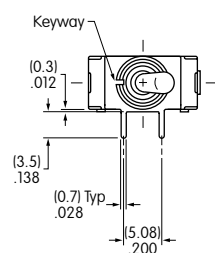
Rockers  
Pushbuttons  
Illuminated PB  
Programmable  
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Tilt  
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Accessories  
Supplement

### TYPICAL SWITCH DIMENSIONS

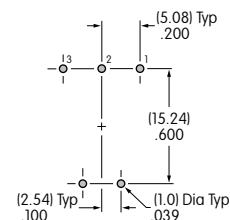
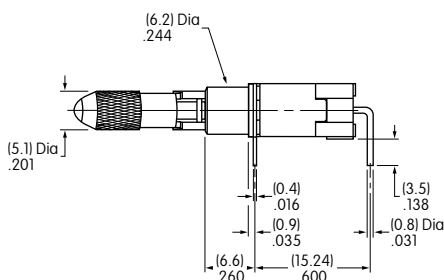
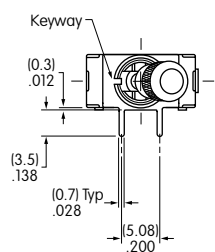
#### Right Angle PC • Single Pole



D22012H

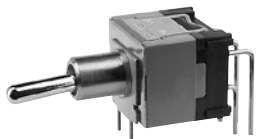


D22012LH

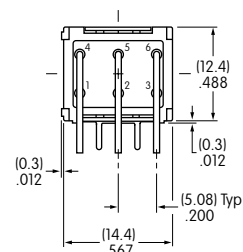
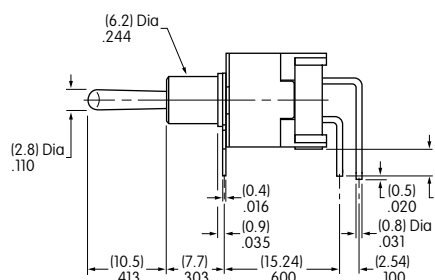
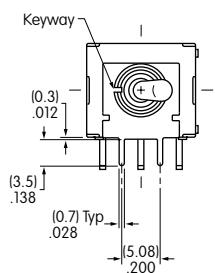


Actuator in Down Position

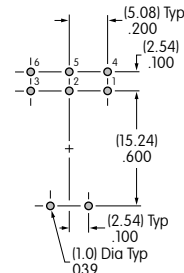
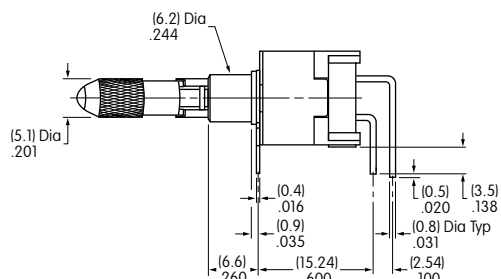
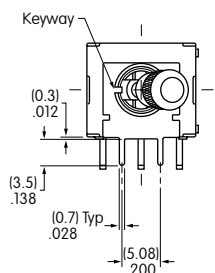
#### Right Angle PC • Double Pole



D22022H



D22022LH



Actuator in Down Position

## TYPICAL SWITCH DIMENSIONS

### Vertical PC • Single Pole

A  
Toggles

Rockers

Pushbuttons

Illuminated PB

Programmable

Keylocks

Rotaries

Slides

Tactiles

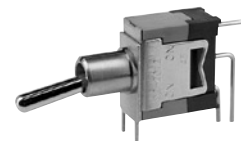
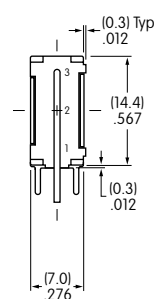
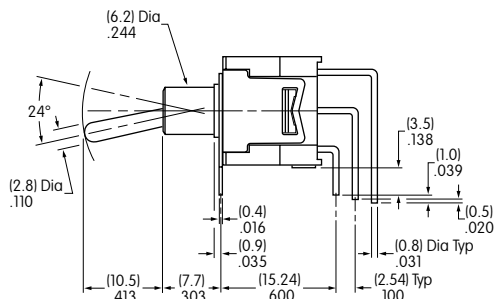
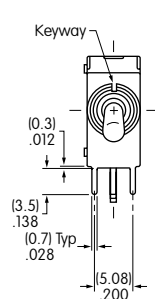
Tilt

Touch

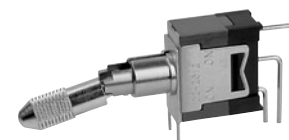
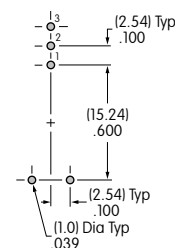
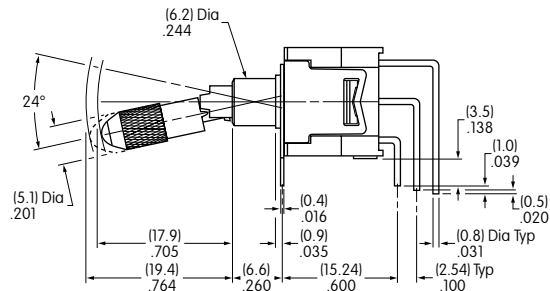
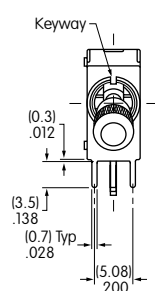
Indicators

Accessories

Supplement



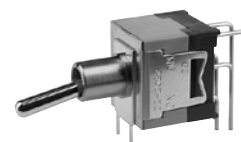
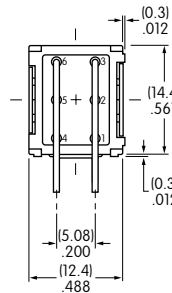
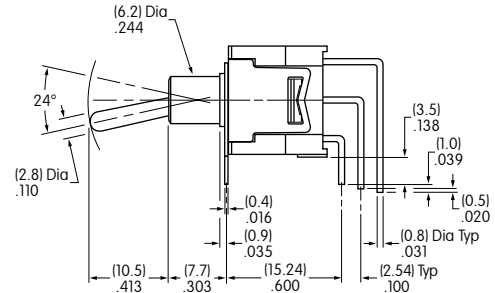
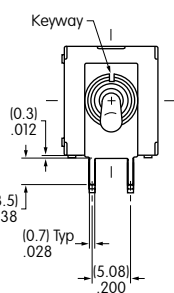
D22012V



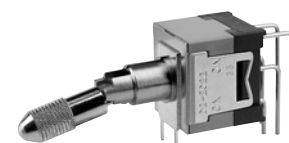
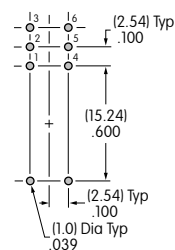
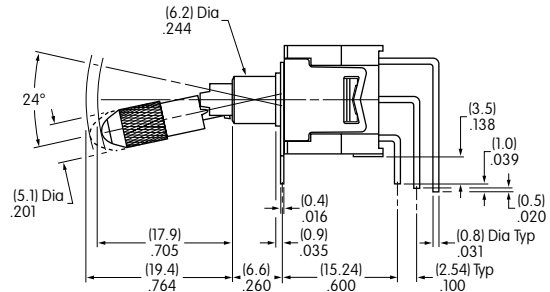
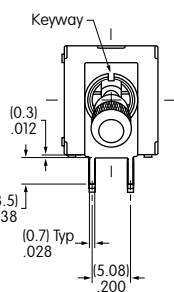
Actuator in Down Position

D22012LV

### Vertical PC • Double Pole



D22022V



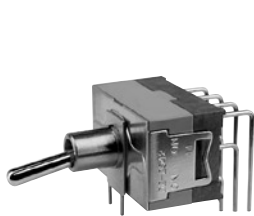
Actuator in Down Position

D22022LV

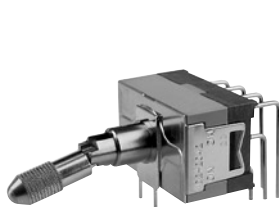
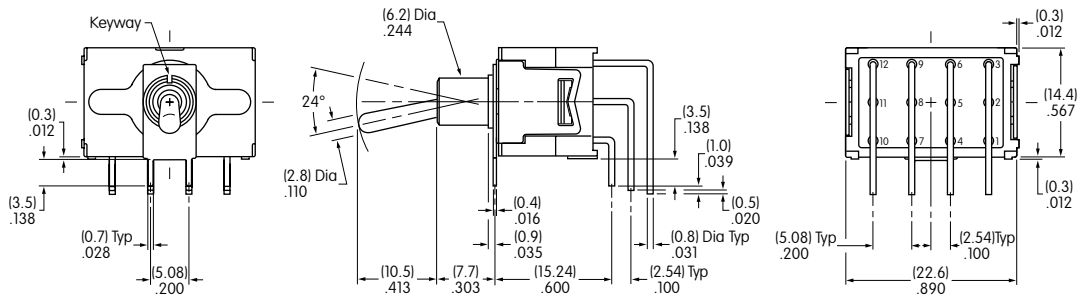


### TYPICAL SWITCH DIMENSIONS

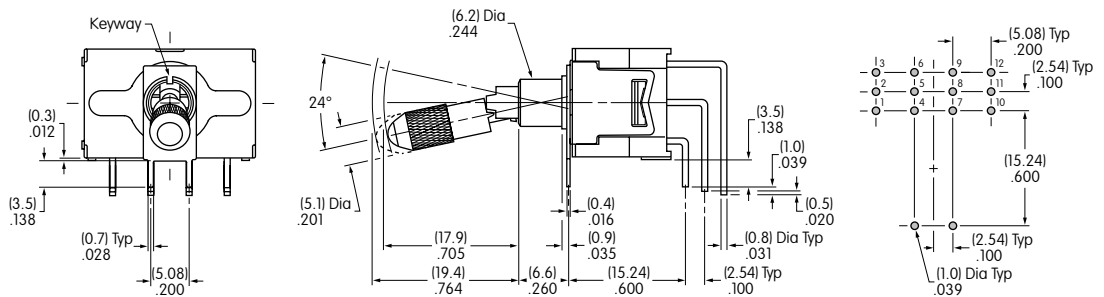
#### Vertical PC • Four Pole



**D22042V**



**D22042LV**



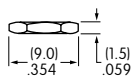
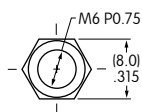
Actuator in Down Position

### STANDARD HARDWARE

#### AT513M

##### Hex Nut

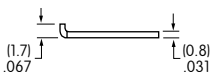
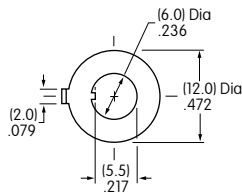
Brass with nickel plating  
2 supplied



#### AT507M

##### Locking Ring

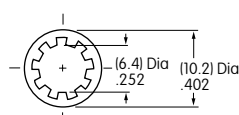
Steel with zinc/chromate  
1 supplied



#### AT509

##### Lockwasher

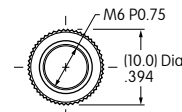
Steel with zinc/chromate  
1 supplied



#### AT501M

##### Knurled Face Nut

Brass with chrome plating



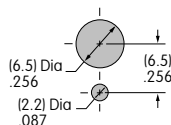
### OPTIONAL

### PANEL CUTOUTS & MAXIMUM PANEL THICKNESS

#### With Standard Hardware

.087" (2.2mm) for  
Standard Lever

.051" (1.3mm) for  
Locking Lever



#### Without Bottom Hex Nut

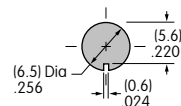
.154" (3.9mm) for  
Standard Lever

.110" (2.8mm) for  
Locking Lever

#### Without Locking Ring

.118" (3.0mm) for  
Standard Lever

.083" (2.1mm) for  
Locking Lever



#### Without Locking Ring & Bottom Hex Nut

.185" (4.7mm) for  
Standard Lever

.142" (3.6mm) for  
Locking Lever

