



General data

RF 15 (15 x 15 mm) and RF 19 (19 x 19 mm) with distinct key click, for use under an overlay or with RK 90 keycaps. Can be fully illuminated.

Content

RF 15 short-travel keyswitch	4 - 26
RF 15 short-travel keyswitch, non-illuminated	4 - 28
RF 15 short-travel keyswitch, fully illuminated with 2 LEDs	4 - 29
RF 15 short-travel keyswitch, 1 LED spot-illumination	4 - 30
RF 15 N short-travel keyswitch	4 - 32
RF 15 N short-travel keyswitch, non-illuminated	4 - 35
RF 15 R short-travel keyswitch	4 - 36
RF 15 R low short-travel keyswitch, non-illuminated	4 - 39
RF 15 R high short-travel keyswitch, non-illuminated	4 - 39
RF 15 R low short-travel keyswitch, 1 LED spot-illumination	4 - 40
RF 15 R high short-travel keyswitch, 1 LED spot-illumination	4 - 41
RF 15 H short-travel keyswitch	4 - 42
RF 15 H short-travel keyswitch, non-illuminated	4 - 44
RF 15 H short-travel keyswitch, fully illuminated	4 - 45
RF 15 signal indicator	4 - 46
RF 15 signal indicator, fully illuminated, 1 LED	4 - 48
RF 19 short-travel keyswitch	4 - 50
RF 19 short-travel keyswitch, non-illuminated	4 - 53
RF 19 short-travel keyswitch, fully illuminated with 2 LEDs	4 - 54
RF 19 short-travel keyswitch, 1 LED spot-illumination	4 - 55
RF 19 short-travel keyswitch, 1 NC + 1 NO	4 - 56
RF 19 short-travel keyswitch, non-illuminated	4 - 58
RF 19 H short-travel keyswitch	4 - 60
RF 19 H keyswitch, non-illuminated	4 - 62
RF 19 H short-travel keyswitch, fully illuminated	4 - 63
RF 19 signal indicator	4 - 64
RF 19 signal indicator, 1/2 x 1-module	4 - 66
RF 19 signal indicator, 1/2 x 2-module	4 - 66
RF 19 signal indicator, 1 x 1-module	4 - 67
RF 19 signal indicator, 1 x 2-module	4 - 67
PCB Keyswitches	4 - 23

RF special accessories

Extension plunger for RF 15 N, round head	4 - 68
Extension plunger for RF 15 N, round head, with recess for LED	4 - 69
Keycap for RF 15, snap-on, for overall height 12.5 mm	4 - 69
Spacers, round	4 - 70
Spacers, triangular	4 - 71
LED spacer for RF 15 N	4 - 72

Specifications LED

3 mm LED

(valid for 25 °C)	Red LED	Green LED	Yellow LED
Max. forward current I _F :	30 mA	30 mA	20 mA
Current reduction from: T ₀ = 50 °C:	approx 0.5 mA/°C	approx 0.5 mA/°C	approx 0.2 mA/°C
Wavelength typ:	635 nm	565 nm	586 nm
Forward voltage U _F /I _F typ:	2 V/10 mA	2 V/10 mA	2 V/10 mA
Reverse voltage U _R /I _F typ:	5 V/100 µA min.	5 V/100 µA min.	5 V/100 µA min.
Ambient temperature, operating:	- 20 °C ... + 80 °C	- 20 °C ... + 80 °C	- 20 °C ... + 80 °C
	Blue LED	White LED	Green LED superbright
Max. forward current I _F :	20 mA	25 mA	30 mA
Current reduction from: T ₀ = 50 °C:	approx 0.6 mA/°C	-	-
Wavelength typ:	470 nm	-	510-545 nm
Forward voltage U _F /I _F typ:	2.7 V/10 mA	3.6 V/20 mA	3.5 V/20 mA
Reverse voltage U _R /I _F typ:	5V/100 µA min.	-	-
Ambient temperature, operating:	- 20 °C ... + 80 °C	- 20 °C ... + 80 °C	-30 °C ... + 100 °C

2 mm LED

(valid for 25 °C)	Red LED	Green LED	Yellow LED
Max. forward current I _F :	30 mA	30 mA	50 mA
Current reduction from: T ₀ = 50 °C:	0.5 mA/°C	0.5 mA/°C	0.8 mA/°C
Light current f _v /I _F typ:	-	-	250 mIm/20 mA
Wavelength typ:	637 nm	569 nm	590 nm
Forward voltage U _F /I _F typ:	1.8 V/20 mA	2.1 V/10 mA	1.9 V/20 mA
Reverse voltage U _R /I _F typ:	5 V/100 µA min.	5 V/100 µA min.	5 V/100 µA min.
Ambient temperature, operating:	- 55 °C ... + 100 °C	- 40 °C ... + 100 °C	-40 °C ... + 100 °C
	Blue LED	Multi-colour LED	
Max. forward current I _F :	30 mA	30 mA	
Current reduction from: T ₀ = 50 °C:	-	approx 0.6 mA/°C	
Light current f _v /I _F typ:	-	-	
Wavelength typ:	464-485 nm	635/565 nm	
Forward voltage U _F /I _F typ:	3.6 V/20 mA	2 V/10 mA	
Reverse voltage U _R /I _F typ:	-	-	
Ambient temperature, operating:	- 20 °C ... + 80 °C	- 20 °C ... + 80 °C	

Calculating the series resistor:	Rated power of series:	Example for 5 Volt:
$R_V = \frac{U_B - U_F}{I_F}$	$P_V = I_F^2 \times R_V$	$R_V = \frac{5V - 2.0 V}{0.02 A} = 150 \Omega (= \text{standard value})$

RF 15 short-travel keyswitch



General data

Low-profile keyboards with RF 15 components should be designed with a 19.05 mm grid. With this grid, frame webs remain free between the individual keys. The overlay can be glued onto these frame webs; we recommend area embossing over the keys for the overlays.

Technical data

General information

Colour of lens see order block
 Recommended key grid 19.05 mm

Dimensions

Length 15 mm
 Width 15 mm
 Overall height 9.7 mm

Mechanical design

Mounting soldering into PCB
 Terminals contacts tin-plated, fix contact Ag plated
 Contact system snap-action contact
 Contact arrangement 1 NO
 Contact materials Au/Ag
 Illumination spot-/fully illuminated
 LED colour see order block
 LED type see order block

Mechanical characteristics

Operating force max. 2 ... 3 N
 Operating travel 0.5 mm
 Switching travel 0.5 mm
 Robustness min. with through-plated PCB
 100 N

Electrical characteristics

Rated voltage min. Au: 0.02 V, Ag: 3 V
 Rated voltage max. Au: 42 V, Ag: 50 V
 Rated current min. Au: 0,01 mA, Ag: 0,1 mA
 Rated current max. Au: 100 mA, Ag: 250 mA

Rated power max. (ohmic load) Au: 2 W, Ag: 12.5 W
 Contact resistance when new max. 100 mΩ
 Contact resistance acc. to life max. 3 Ω
 Insulation resistance 10⁹ Ω
 ESD strength (underneath overlay) 15 kV
 Bouncing time max. 5 ms

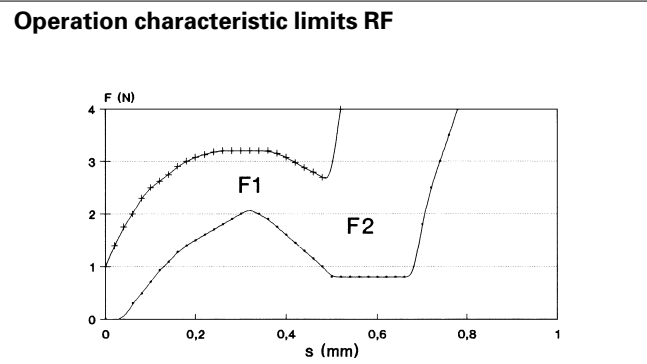
Other specifications

Ambient temp. operating min. -25 °C
 Ambient temp. operating max. +70 °C
 Storage temperature min. -40 °C
 Storage temperature max. (product) +80 °C
 Storage temperature max. (in tube) +50 °C
 Resistance to constant environment according to IEC 600 68-2-3 and 2-30
 Resistance at variable environment according to IEC 600 68-2-14 and 2-33
 Operating life min. 1,000,000
 Soldering time max. 2,5 sec.
 Soldering temperature max. 250 °C
 Flammability of materials UL 94 HB

4

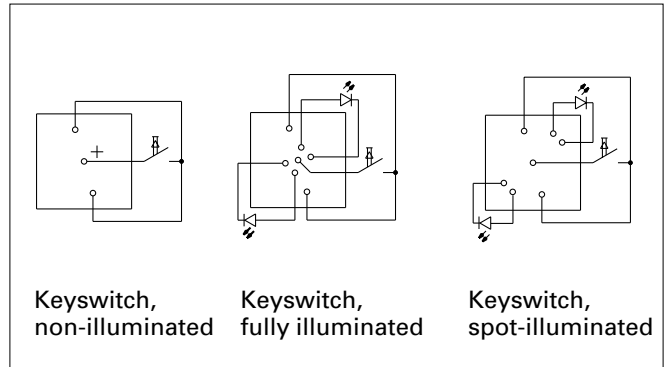
RF

Force/Travel Diagram – Keyswitch RF 15

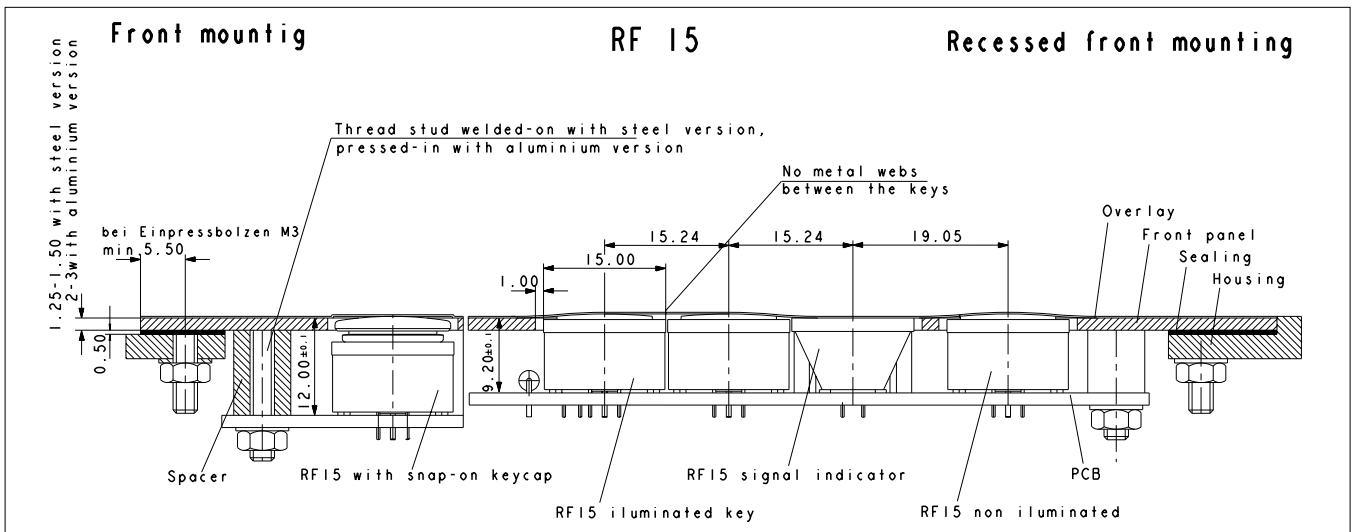


F 1 = Max. operating force
 F 2 = Force at contact
 F 2 is max. 55% of F 1

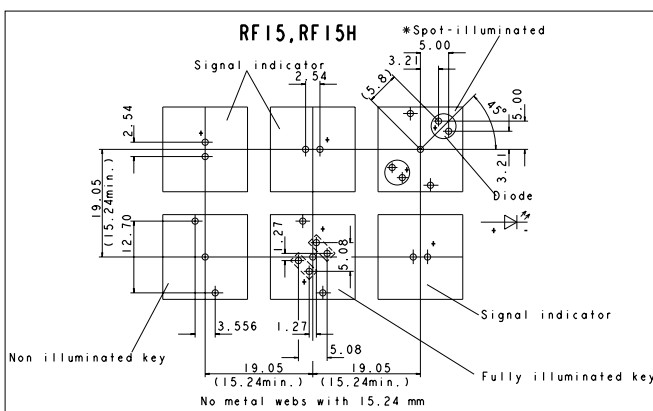
Circuit Diagram – Keyswitch RF 15



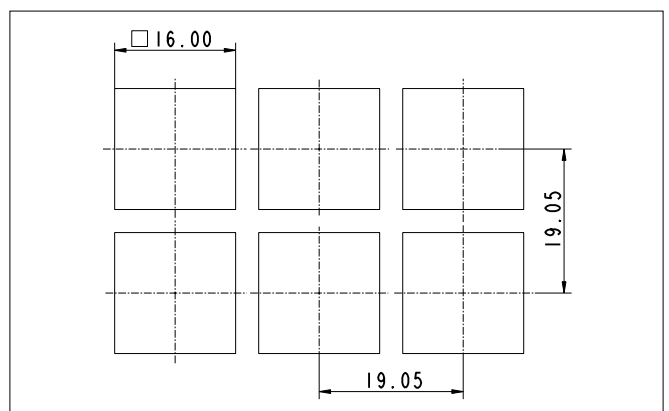
Dimensional Drawing RF 15



Hole Pattern RF 15



Hole Pattern – Front Panel

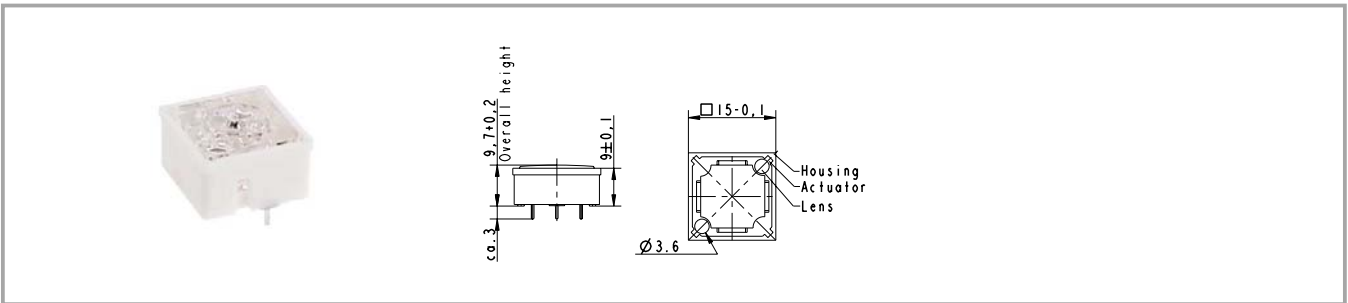


View on component side, all hole diameters 1,1 +/- 0,1 mm

4

RF

RF 15 short-travel keyswitch, non-illuminated



Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Ag	not illuminated	transparent			3.14.100.006/0000
Au	not illuminated	transparent			3.14.100.001/0000

Technical data see page 4 - 26

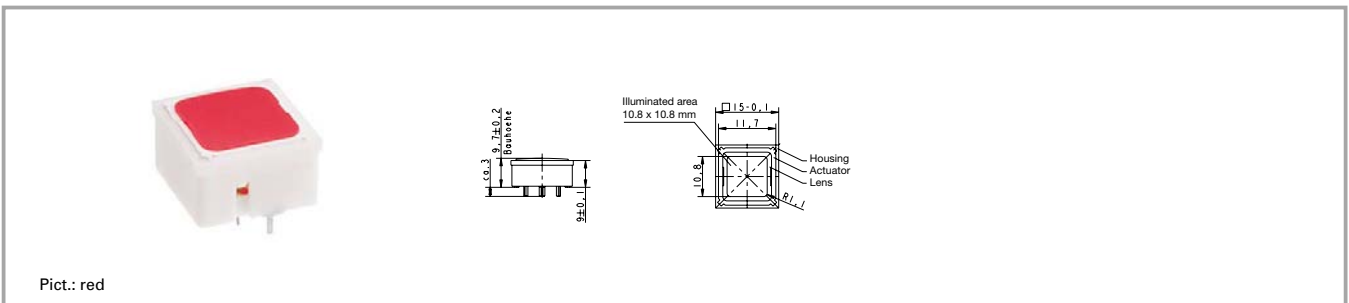
Accessories:

Keycap for RF 15, snap-on, for overall height 12.5 mm: 5.46.654.059/0227

For keycaps, refer to chapter accessories and system RK 90.

If exchangeable legends are required, or if an overall height of 12.5 mm is required, a keycap can be mounted on the non-illuminated keys. The keycap legend is visible through a window in the overlay. You can change the legend by replacing the keycap.

RF 15 short-travel keyswitch, fully illuminated with 2 LEDs



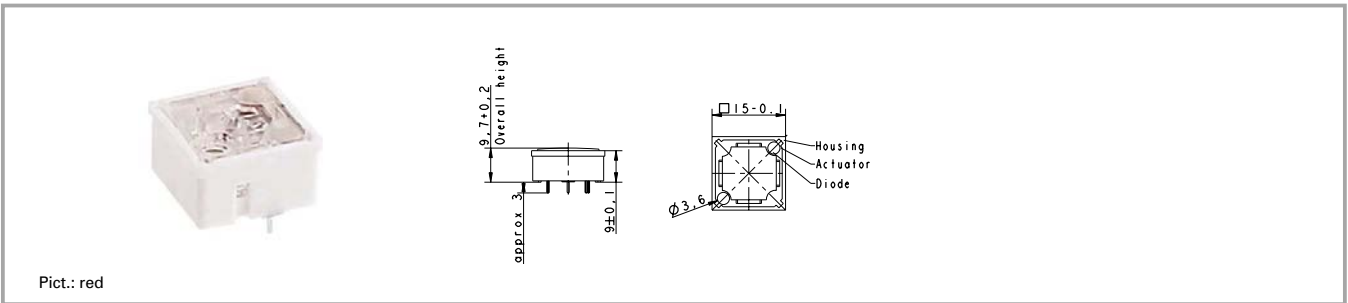
Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Ag	fully illuminated 2 LEDs	red	red	2 mm	3.14.200.021/0000
Ag	fully illuminated 2 LEDs	green	green	2 mm	3.14.200.022/0000
Ag	fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.200.023/0000
Ag	fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.200.024/0000
Ag	fully illuminated 2 LEDs	blue	blue	2 mm	3.14.200.025/0000
Au	fully illuminated 2 LEDs	green	green	2 mm	3.14.200.012/0000
Au	fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.200.013/0000
Au	fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.200.014/0000
Au	fully illuminated 2 LEDs	blue	blue	2 mm	3.14.200.015/0000

Technical data see page 4 - 26

For keycaps, refer to RK 90 system design.

Technical data of LED see separate page at the beginning of this chapter.

RF 15 short-travel keyswitch, 1 LED spot-illumination



Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Ag	spot illumination 1 LED	opaque white	blue	3 mm	3.14.100.040/0000
Ag	spot illumination 1 LED	transparent	red	3 mm	3.14.100.041/0000
Ag	spot illumination 1 LED	transparent	green	3 mm	3.14.100.042/0000
Ag	spot illumination 1 LED	transparent	yellow	3 mm	3.14.100.043/0000
Au	spot illumination 1 LED	opaque white	blue	3 mm	3.14.100.030/0000
Au	spot illumination 1 LED	transparent	red	3 mm	3.14.100.031/0000
Au	spot illumination 1 LED	transparent	green	3 mm	3.14.100.032/0000
Au	spot illumination 1 LED	transparent	yellow	3 mm	3.14.100.033/0000

Technical data see page 4 - 26

Double-spot LED illumination available on request
 Technical data of LED see separate page at the beginning of this chapter.

RF 15 N short-travel keyswitch



General data

The RF 15N keyswitch provides a minimum overall height of 6.2 mm. The overall height can be varied by extension plungers which are inserted into the cross-like notches on the actuator tops.

LEDs can only be arranged separately next to the keyswitches up to an overall height of 10 mm (i.e. without plunger or with small plunger).

Keyswitches with overall heights of 12 mm or more can be provided with a maximum of 2 LEDs which are inserted into the recesses of the keyswitch housing. LEDs of keyswitches with overall heights of 12.5 mm or more should be placed onto LED spacers in order to obtain satisfactory illumination.

Technical data

General information

Colour of lens see order block
Recommended key grid 19.05 mm

Dimensions

Length 15 mm
Width 15 mm
Overall height 6.2 mm

Mechanical design

Mounting soldering into PCB
Terminals contacts tin-plated, fix contact Ag plated
Contact system snap-action contact
Contact arrangement 1 NO
Contact materials Au/Ag
Illumination external 3 mm LED possible if height < 12 mm

Mechanical characteristics

Operating force max. 2 ... 3 N
Operating travel 0.5 mm
Switching travel 0.5 mm
Robustness min. with through-plated PCB 100 N

Electrical characteristics

Rated voltage min. Au: 0.02 V, Ag: 3 V
Rated voltage max. Au: 42 V, Ag: 50 V
Rated current min. Au: 0,01 mA, Ag: 0,1 mA
Rated current max. Au: 100 mA, Ag: 250 mA
Rated power max. (ohmic load) Au: 2 W, Ag: 12.5 W

Contact resistance when new max. 100 mΩ
Contact resistance acc. to life max. 3 Ω
Insulation resistance 10⁹ Ω
ESD strength (underneath overlay) 15 kV
Bouncing time max. 5 ms

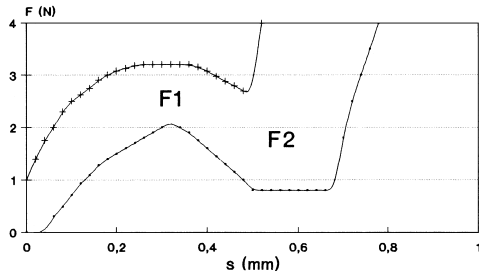
Other specifications

Ambient temp. operating min. -25 °C
Ambient temp. operating max. +70 °C
Storage temperature min. -40 °C
Storage temperature max. (product) +80 °C
Storage temperature max. (in tube) +50 °C
Resistance to constant environment according to IEC 600 68-2-3 and 2-30
Resistance at variable environment according to IEC 600 68-2-14 and 2-33
Operating life min. 1,000,000
Soldering time max. 2,5 sec.
Soldering temperature max. 250 °C
Flammability of materials UL 94 HB

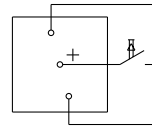
Force/Travel Diagram – Keyswitch RF 15 N

Circuit Diagram – Keyswitch RF 15 N

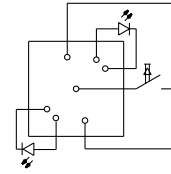
Operation characteristic limits RF



F 1 = Max. operating force
F 2 = Force at contact
F 2 is max. 55% of F 1

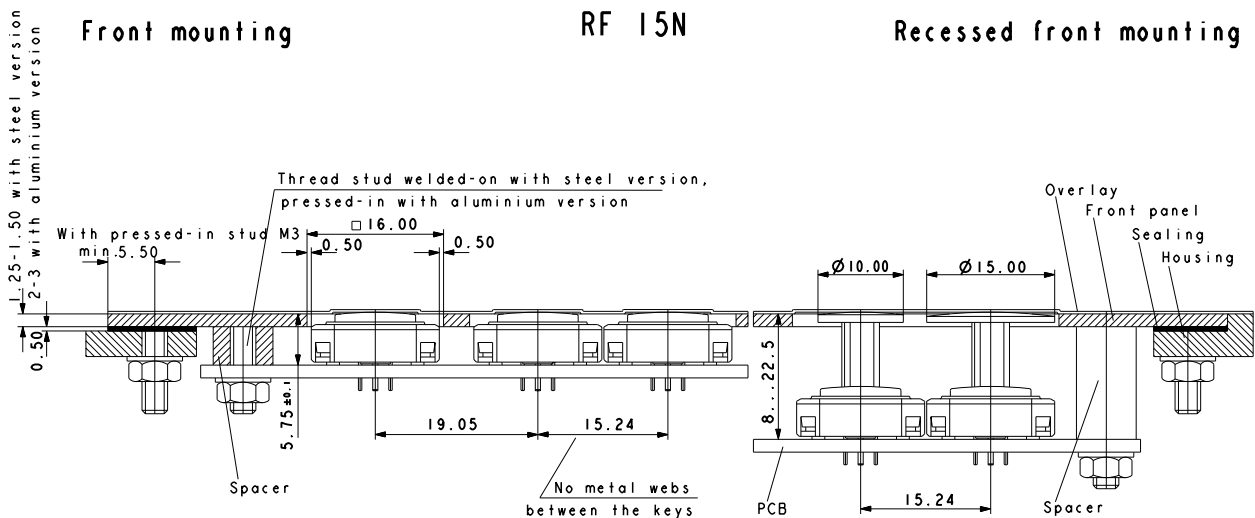
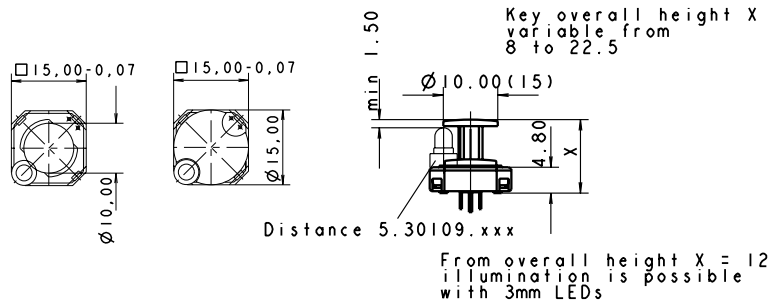


Keyswitch,
non illuminated



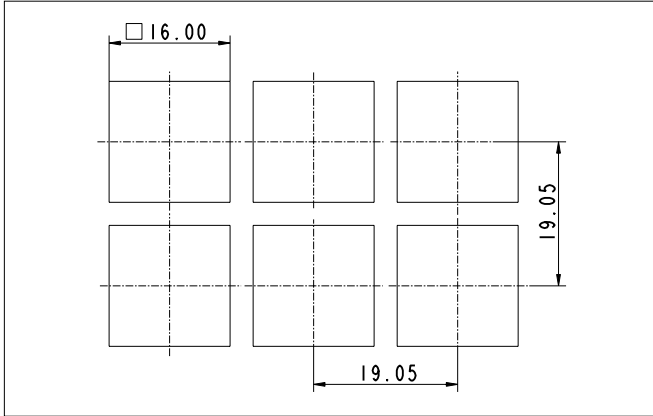
Keyswitch,
spot-illuminated

Dimensional Drawings RF 15 N

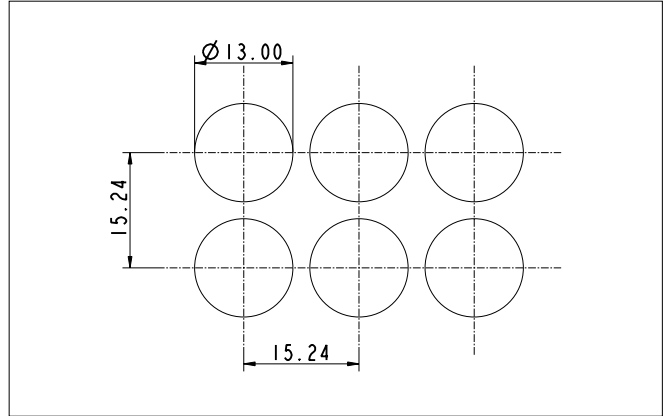


Hole Patterns – Front Panel RF 15 N

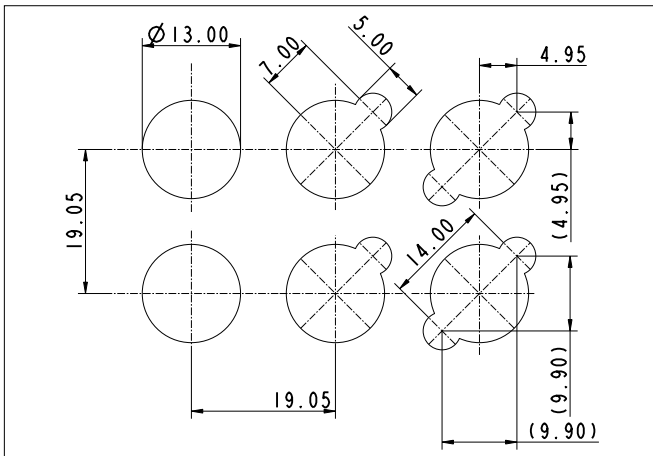
RF 15 N without plunger



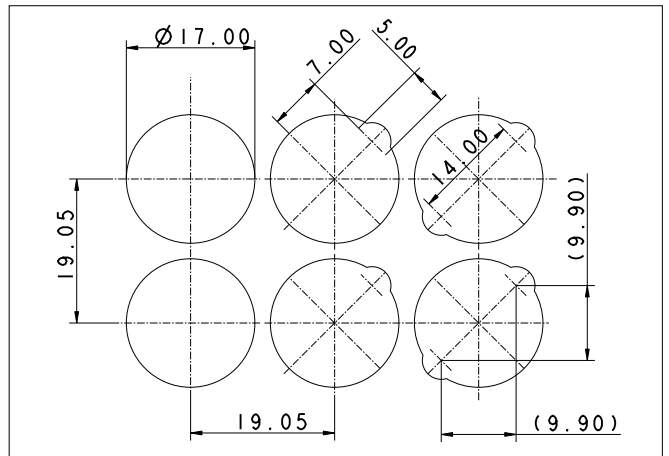
RF 15 N with plunger \varnothing 10 mm, non-illuminated



RF 15 N with plunger \varnothing 10 mm, illuminated

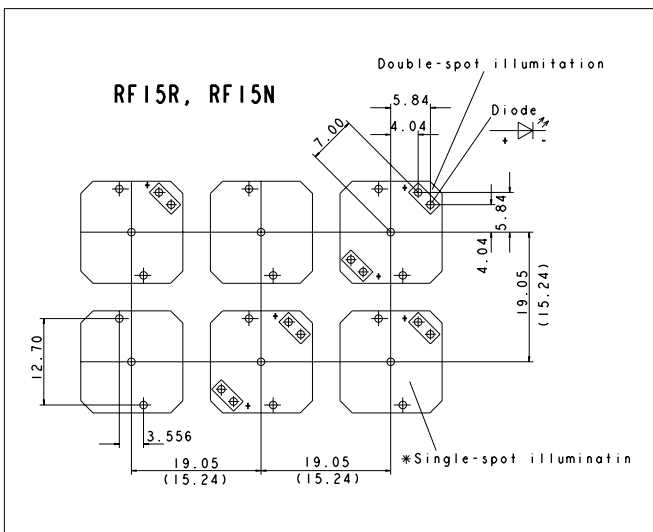


RF 15 N with plunger \varnothing 15 mm, illuminated



4

Hole Pattern RF 15 N



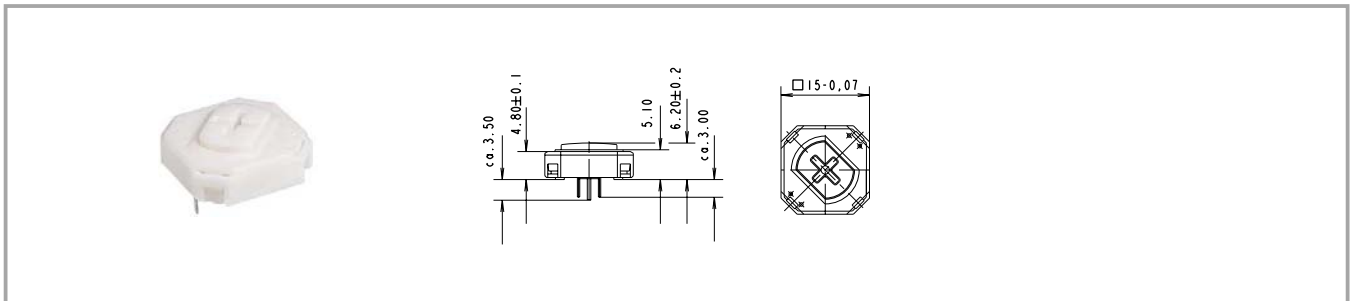
View on component side
All hole diameters 1,1 \pm 0,1 mm
PCB layout Keyswitch 1/400" grid

RF

Accessories RF 15 N short-travel keyswitch

Description	Photo	Order no.	Page
LED yellow, 3mm		1.90.690.103/0000	5 - 20
LED spacer for RF 15 N, Ø 5 mm, spacing length 2.2 mm, light grey, for use with overall height of 12.5 mm		5.30.109.010/0756	
Extension plunger for RF 15 N, Ø 10 mm, overall height 22.5 mm		5.46.011.028/0710	
Extension plunger for RF 15 N, Ø 15 mm, overall height 22.5 mm		5.46.017.028/0710	

RF 15 N short-travel keyswitch, non-illuminated



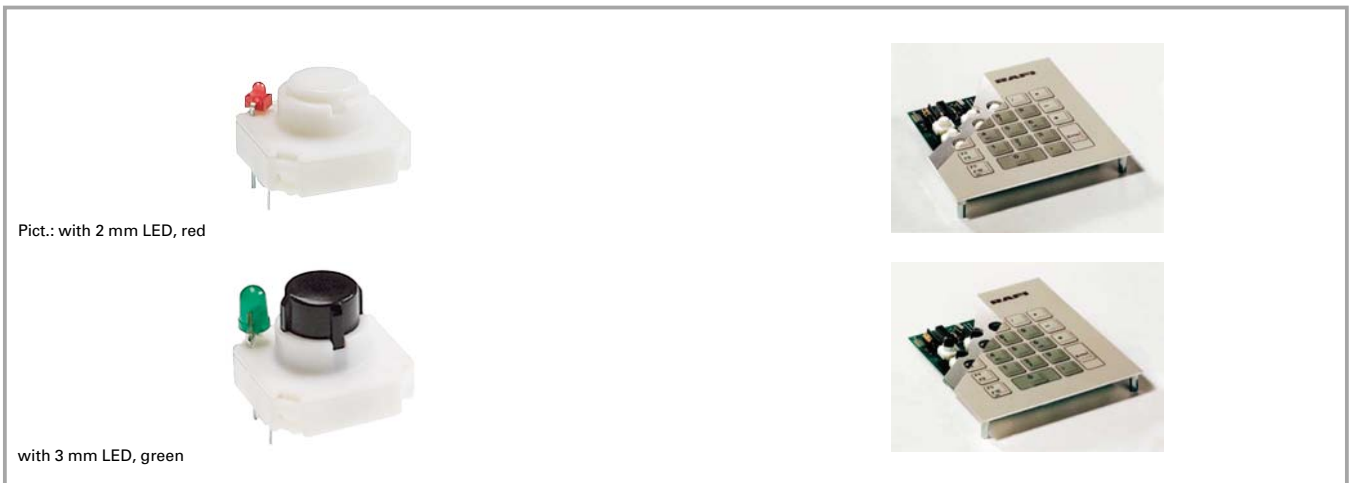
Contact materials	Illumination	Recommended key grid	Overall height	Order no.
Au	external 3 mm LED possible if height < 12 mm	19.05 mm	6.2 mm	3.14.100.601/0000
Ag	external 3 mm LED possible if height < 12 mm	19.05 mm	6.2 mm	3.14.100.606/0000

Technical data see page 4 - 32

For keycaps, refer to RK 90 system design.

Double-spot LED illumination available on request.

RF 15 R short-travel keyswitch



General data

The round actuator of the RF 15 R keyswitch requires round front panel cut-outs. These make it possible to use a narrow keyboard grid of only 15.24 mm with sufficiently large frame webs between the individual keys. We recommend area embossing over the actuators for the overlay.

Technical data

General information

Recommended key grid 15.24 mm

Dimensions

Length 15 mm
Width 15 mm
Overall height 9,7/12,5 mm

Mechanical design

Mounting soldering into PCB
Terminals contacts tin-plated, fix contact Ag plated
Contact system snap-action contact
Contact arrangement 1 NO
Contact materials Au/Ag
Illumination spot illumination
LED colour see order block
LED type see order block

Mechanical characteristics

Operating force max. 2 ... 3 N
Operating travel 0.5 mm
Switching travel 0.5 mm
Robustness min. with through-plated PCB 100 N

Electrical characteristics

Rated voltage min. Au: 0.02 V, Ag: 3 V
Rated voltage max. Au: 42 V, Ag: 50 V
Rated current min. Au: 0,01 mA, Ag: 0,1 mA
Rated current max. Au: 100 mA, Ag: 250 mA
Rated power max. (ohmic load) Au: 2 W, Ag: 12.5 W

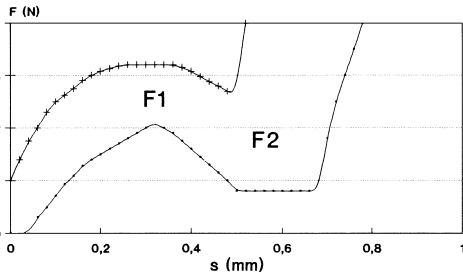
Contact resistance when new max. 100 mΩ
Contact resistance acc. to life max. 3 Ω
Insulation resistance 10⁹ Ω
ESD strength (underneath overlay) 15 kV
Bouncing time max. 5 ms

Other specifications

Ambient temp. operating min. -25 °C
Ambient temp. operating max. +70 °C
Storage temperature min. -40 °C
Storage temperature max. (product) +80 °C
Storage temperature max. (in tube) +50 °C
Resistance to constant environment according to IEC 600 68-2-3 and 2-30
Resistance at variable environment according to IEC 600 68-2-14 and 2-33
Operating life min. 1,000,000
Soldering time max. 2,5 sec.
Soldering temperature max. 250 °C
Flammability of materials UL 94 HB

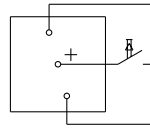
Force/Travel Diagram – Keyswitch RF 15 R

Operation characteristic limits RF

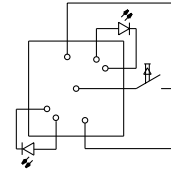


F 1 = Max. operating force
F 2 = Force at contact
F 2 is max. 55% of F 1

Circuit Diagram – Keyswitch RF 15 R

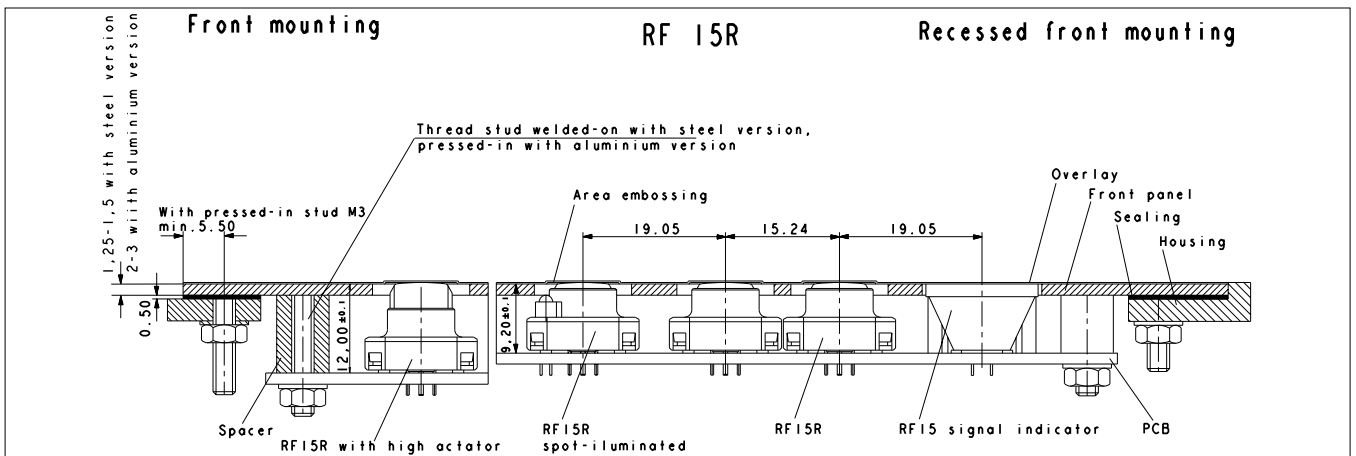


Keyswitch,
non-illuminated

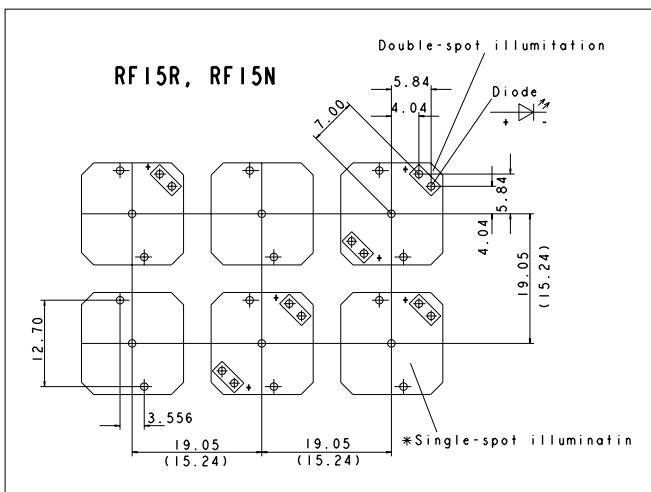


Keyswitch,
spot-illuminated

Dimensional Drawing RF 15 R



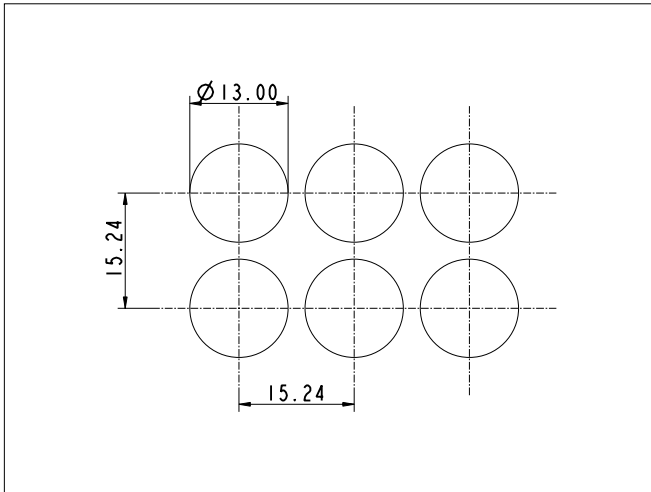
Hole Pattern RF 15 R



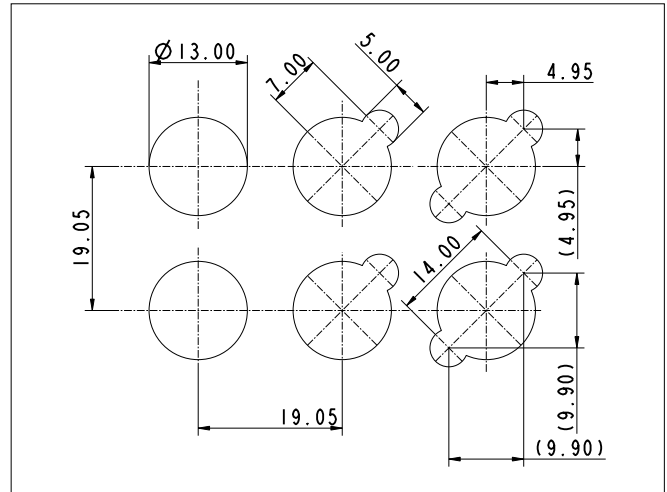
View on component side
All hole diameters 1,1 \pm 0,1 mm
PCB layout Keyswitch 1/400" grid

Hole Pattern – Front Panel RF 15 R

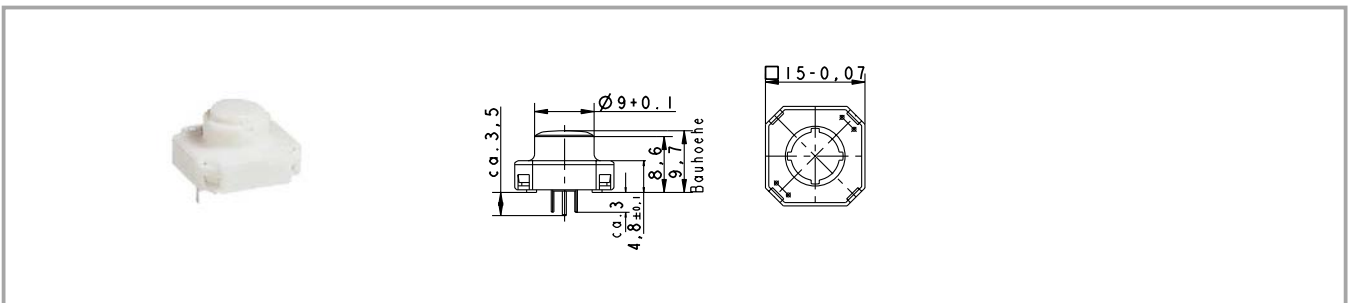
RF 15 R, non-illuminated



RF 15 R, illuminated



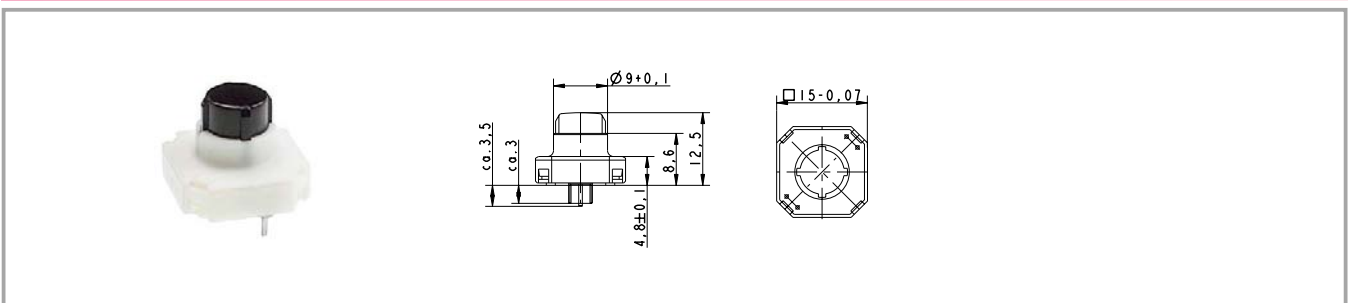
RF 15 R low short-travel keyswitch, non-illuminated



Contact materials	Overall height	Illumination	LED type	LED colour	Order no.
Au	9.7 mm	not illuminated			3.14.100.501/0000
Ag	9.7 mm	not illuminated			3.14.100.506/0000

Technical data see page 4 - 36

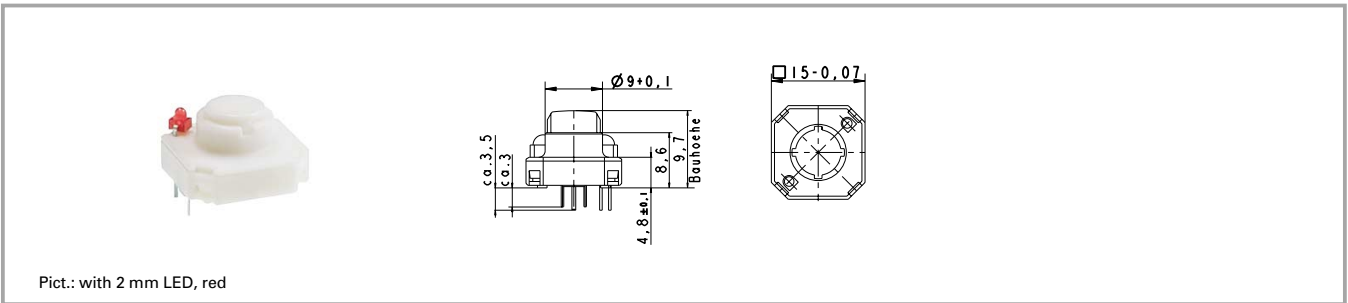
RF 15 R high short-travel keyswitch, non-illuminated



Contact materials	Overall height	Illumination	LED type	LED colour	Order no.
Au	12.5 mm	not illuminated			3.14.100.801/0000
Ag	12.5 mm	not illuminated			3.14.100.806/0000

Technical data see page 4 - 36

RF 15 R low short-travel keyswitch, 1 LED spot-illumination



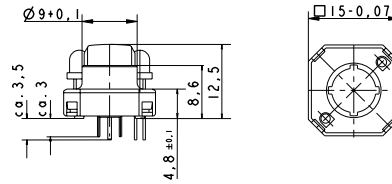
Contact materials	Overall height	Illumination	LED type	LED colour	Order no.
Au	9.7 mm	spot illumination 1 LED	2 mm	red	3.14.100.531/0000
Au	9.7 mm	spot illumination 1 LED	2 mm	green	3.14.100.532/0000
Au	9.7 mm	spot illumination 1 LED	2 mm	yellow	3.14.100.533/0000
Ag	9.7 mm	spot illumination 1 LED	2 mm	red	3.14.100.541/0000
Ag	9.7 mm	spot illumination 1 LED	2 mm	green	3.14.100.542/0000
Ag	9.7 mm	spot illumination 1 LED	2 mm	yellow	3.14.100.543/0000

Technical data see page 4 - 36

Versions with 2 LEDs available on request.

Technical data of LED see separate page at the beginning of this chapter.

RF 15 R high short-travel keyswitch, 1 LED spot-illumination



Pict.: with 3 mm LED, green

Contact materials	Overall height	Illumination	LED type	LED colour	Order no.
Au	12.5 mm	spot illumination 1 LED	3 mm	blue	3.14.100.830/0000
Au	12.5 mm	spot illumination 1 LED	3 mm	red	3.14.100.831/0000
Au	12.5 mm	spot illumination 1 LED	3 mm	green	3.14.100.832/0000
Au	12.5 mm	spot illumination 1 LED	3 mm	yellow	3.14.100.833/0000
Ag	12.5 mm	spot illumination 1 LED	3 mm	blue	3.14.100.840/0000
Ag	12.5 mm	spot illumination 1 LED	3 mm	red	3.14.100.841/0000
Ag	12.5 mm	spot illumination 1 LED	3 mm	green	3.14.100.842/0000
Ag	12.5 mm	spot illumination 1 LED	3 mm	yellow	3.14.100.843/0000

Technical data see page 4 - 36

Versions with 2 LEDs available on request.

Technical data of LED see separate page at the beginning of the chapter.

RF 15 H short-travel keyswitch



General data

Application notes:

The RF 15 H key has an overall height of 12.5 mm and can be fully illuminated. When designing membrane keyboards, we recommend using a key grid of at least 19.05 mm and a 0.13 mm overlay with area embossing over the keys. You can use the O-ring (accessory) to block the key and use it as an indicator field or blank spaceholder.

Technical data

General information

Colour of lens see order block
Recommended key grid 20 mm

Dimensions

Length 15 mm
Width 15 mm
Overall height 12.5 mm

Mechanical design

Mounting soldering into PCB
Terminals see order block
Contact system snap-action contact
Contact arrangement 1 NO
Contact materials Au/Ag
Illumination not illuminated / fully illuminated
LED colour see order block
LED type see order block

Mechanical characteristics

Operating force max. 2 ... 3 N
Operating travel 0.5 mm
Switching travel 0.5 mm
Robustness min. with through-plated PCB 100 N

Electrical characteristics

Rated voltage min. Au: 0.02 V, Ag: 3 V
Rated voltage max. Au: 42 V, Ag: 50 V
Rated current min. Au: 0,01 mA, Ag: 0,1 mA
Rated current max. Au: 100 mA, Ag: 250 mA

Rated power max. (ohmic load) Au: 2 W, Ag: 12.5 W
Contact resistance when new max. 100 mΩ
Contact resistance acc. to life max. 3 Ω
Insulation resistance 10⁹ Ω
ESD strength (underneath overlay) 15 kV
Bouncing time max. 5 ms

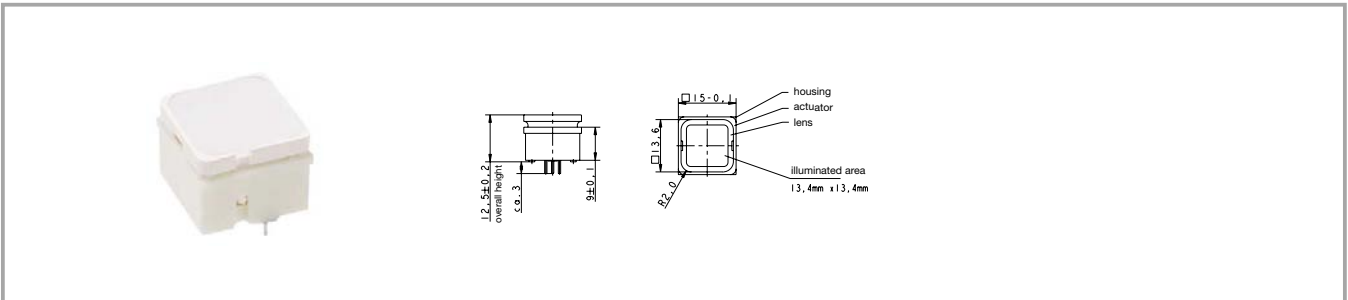
Other specifications

Ambient temp. operating min. -25 °C
Ambient temp. operating max. +70 °C
Storage temperature min. -40 °C
Storage temperature max. (product) +80 °C
Storage temperature max. (in tube) +50 °C
Resistance to constant environment according to IEC 600 68-2-3 and 2-30
Resistance at variable environment according to IEC 600 68-2-14 and 2-33
Operating life min. 1,000,000
Soldering time max. 2,5 sec.
Soldering temperature max. 250 °C
Flammability of materials UL 94 HB

Accessories RF 15 H short-travel keyswitch

Description	Photo	Order no.	Page
O-ring, black, for blocking the operating stroke		5.30.120.009/0100	5 - 27

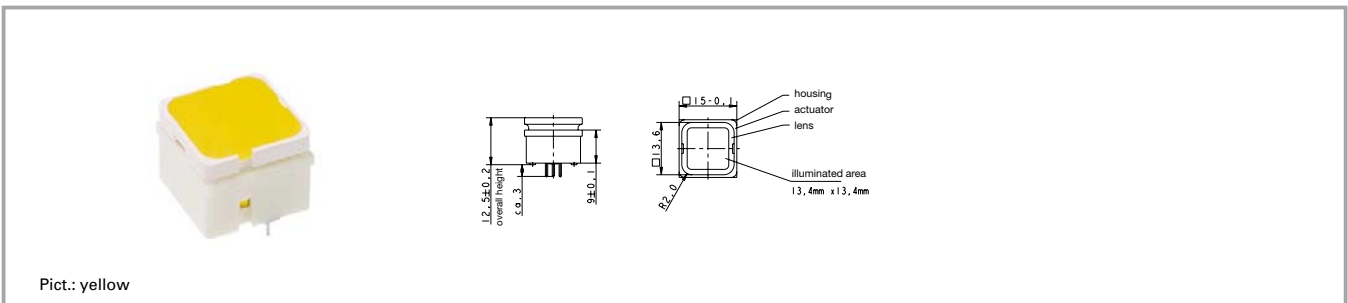
RF 15 H short-travel keyswitch, non-illuminated



Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Au	not illuminated	white			3.14.100.702/0000
Ag	not illuminated	white			3.14.100.707/0000

Technical data see page 4 - 42

RF 15 H short-travel keyswitch, fully illuminated



Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Au	fully illuminated 2 LEDs	red	red	2 mm	3.14.200.731/0000
Au	fully illuminated 2 LEDs	green	green	2 mm	3.14.200.732/0000
Au	fully illuminated 1 LED	green	green super bright	3 mm	3.14.200.736/0000
Au	fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.200.733/0000
Au	fully illuminated 1 LED	white	white	3 mm	3.14.200.735/0000
Au	fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.200.738/0000
Au	fully illuminated 1 LED	blue	blue	3 mm	3.14.200.739/0000
Au	fully illuminated 2 LEDs	white	multi colour	3 mm	3.14.100.734/0000
Ag	fully illuminated 2 LEDs	red	red	2 mm	3.14.200.741/0000
Ag	fully illuminated 2 LEDs	green	green	2 mm	3.14.200.742/0000
Ag	fully illuminated 1 LED	green	green super bright	3 mm	3.14.200.746/0000
Ag	fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.200.743/0000
Ag	fully illuminated 1 LED	white	white	3 mm	3.14.200.745/0000
Ag	fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.200.748/0000
Ag	fully illuminated 1 LED	blue	blue	3 mm	3.14.200.749/0000
Ag	fully illuminated 2 LEDs	white	multi colour	3 mm	3.14.100.744/0000

Technical data see page 4 - 42

When using the keyswitches with multicolour LEDs the illumination colour can be varied from red to green by change of polarity. Due to the frequency of the polarity-changes the colours red, green, yellow as well as all secondary colours from these are possible. Technical data of LED see separate page of the beginning of this chapter.

RF 15 signal indicator



Pict.: green

Technical data

General information

Colour of lens see order block
Recommended key grid 19.05 mm

Dimensions

Length 15 mm
Width 15 mm
Overall height 9.7 mm

Mechanical design

Mounting soldering into PCB
Illumination fully illuminated 1 LED
LED colour see order block
LED type 2 mm

Other specifications

Ambient temp. operating min. -25 °C

Ambient temp. operating max. +70 °C

Storage temperature min. -40 °C

Storage temperature max. (product) +80 °C

Storage temperature max. (in tube) +50 °C

Resistance to constant environment according to IEC 600 68-2-3 and 2-30

Resistance at variable environment according to IEC 600 68-2-14 and 2-33

Soldering time max. 2,5 sec.

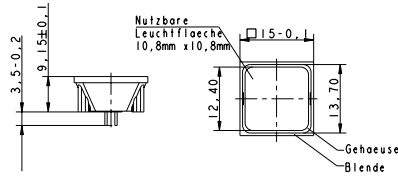
Soldering temperature max. 250 °C

Flammability of materials UL 94 HB

RF 15 signal indicator, fully illuminated, 1 LED



Pict.: green



Overall height	Illumination	Colour of lens	LED colour	LED type	Order no.
9.7 mm	fully illuminated 1 LED	red	red	2 mm	3.14.200.051/0000
9.7 mm	fully illuminated 1 LED	green	green	2 mm	3.14.200.052/0000
9.7 mm	fully illuminated 1 LED	yellow	yellow	2 mm	3.14.200.053/0000
9.7 mm	fully illuminated 1 LED	orange	yellow	2 mm	3.14.200.054/0000
9.7 mm	fully illuminated 1 LED	blue	blue	2 mm	3.14.200.055/0000

Technical data see page 4 - 46

For more information, see LEDs.

Technical data of LED see separate page of the beginning of this chapter.

RF 19 short-travel keyswitch



General data

Application notes:

RF 19 keys offer a large actuation area. When designing low-profile keyboards with a grid of ≥ 23 mm, frame webs remain free between the individual keys.

The overlay can be glued onto these frame webs; we recommend area embossing over the keys for the overlay.

Technical data

General information

Colour of lens see order block
Recommended key grid 23 mm

Dimensions

Length 19.05 mm
Width 19.05 mm
Overall height 9.7 mm

Mechanical design

Mounting soldering into PCB
Terminals contacts tin-plated, fix contact Ag plated snap-action contact

Contact system 1 NO
Contact arrangement Au/Ag
Contact materials spot-/fully illuminated
Illumination see order block
LED colour see order block
LED type

Mechanical characteristics

Operating force max. 2 ... 3 N
Operating travel 0.5 mm
Switching travel 0.5 mm
Robustness min. with through-plated PCB 100 N

Electrical characteristics

Rated voltage min. Au: 0.02 V, Ag: 3 V
Rated voltage max. Au: 42 V, Ag: 50 V
Rated current min. Au: 0,01 mA, Ag: 0,1 mA
Rated current max. Au: 100 mA, Ag: 250 mA

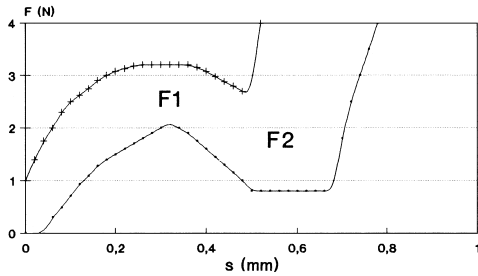
Rated power max. (ohmic load) Au: 2 W, Ag: 12.5 W
Contact resistance when new max. 100 m Ω
Contact resistance acc. to life max. 3 Ω
Insulation resistance 10⁹ Ω
ESD strength (underneath overlay) 15 kV
Bouncing time max. 5 ms

Other specifications

Ambient temp. operating min. -25 °C
Ambient temp. operating max. +70 °C
Storage temperature min. -40 °C
Storage temperature max. (product) +80 °C
Storage temperature max. (in tube) +50 °C
Resistance to constant environment according to IEC 600 68-2-3 and 2-30
Resistance at variable environment according to IEC 600 68-2-14 and 2-33
Operating life min. 1,000,000
Soldering time max. 2,5 sec.
Soldering temperature max. 250 °C
Flammability of materials UL 94 HB

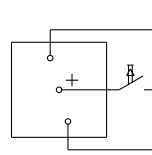
Force/Travel Diagram – Keyswitch RF 19

Operation characteristic limits RF

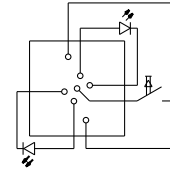


F 1 = Max. operating force
F 2 = Force at contact
F 2 is max. 55% of F 1

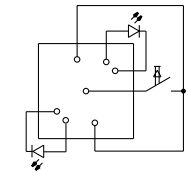
Circuit Diagram – Keyswitch RF 19



Keyswitch, non-illuminated

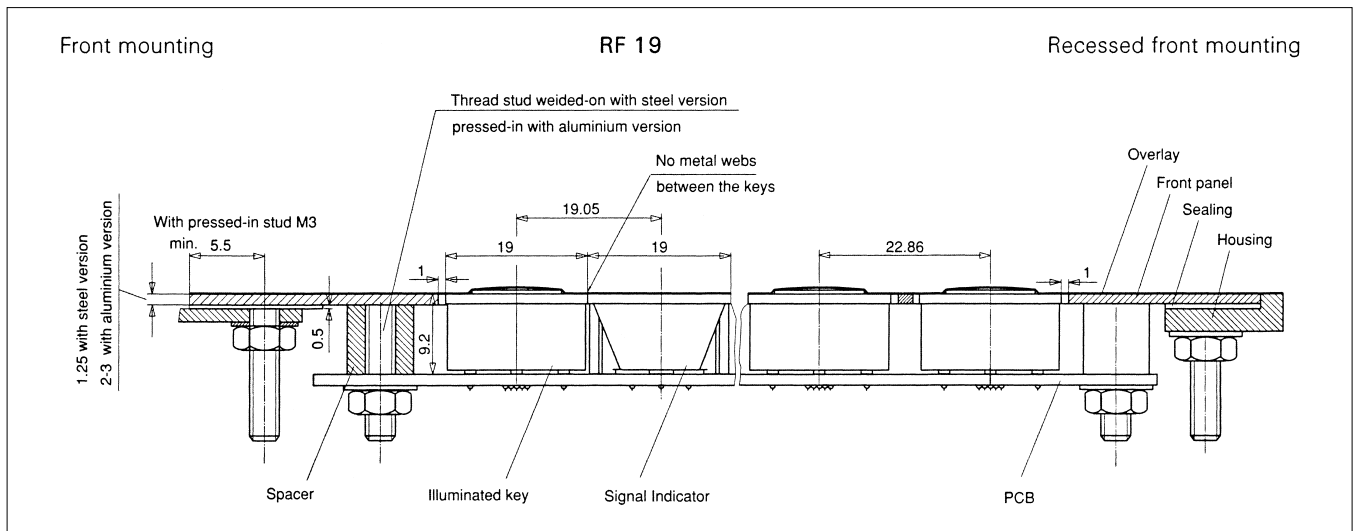


Keyswitch, fully illuminated

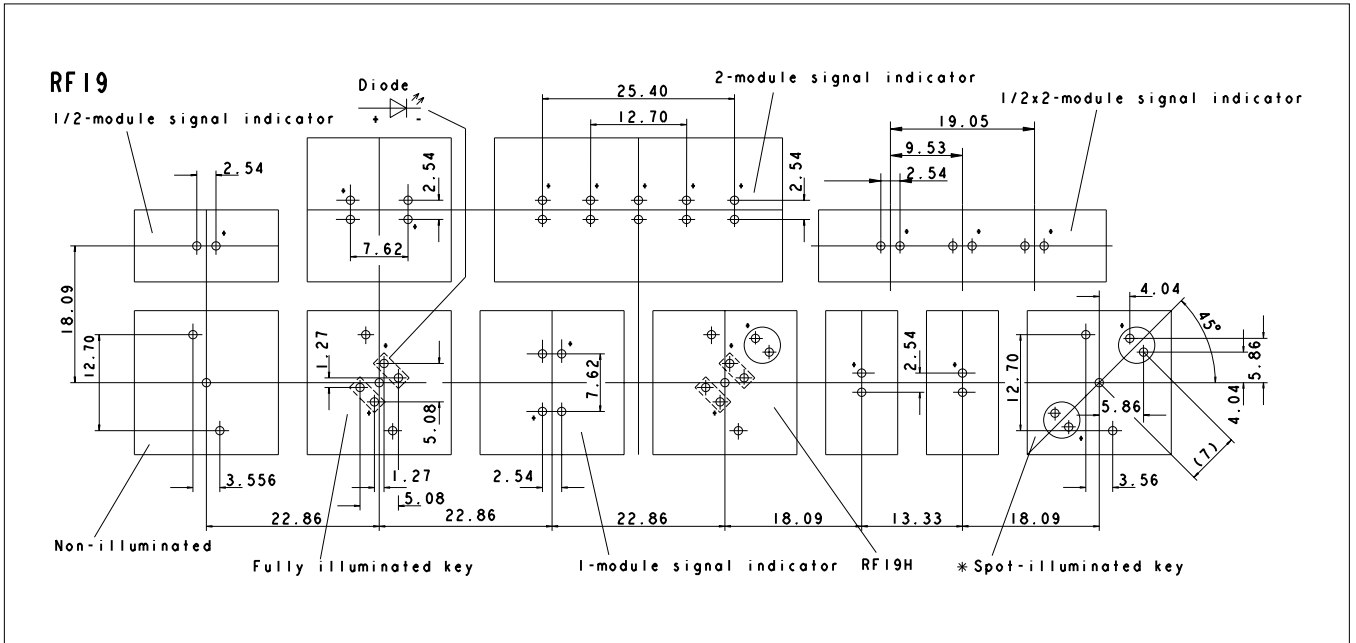


Keyswitch, spot-illuminated

Dimensional Drawing



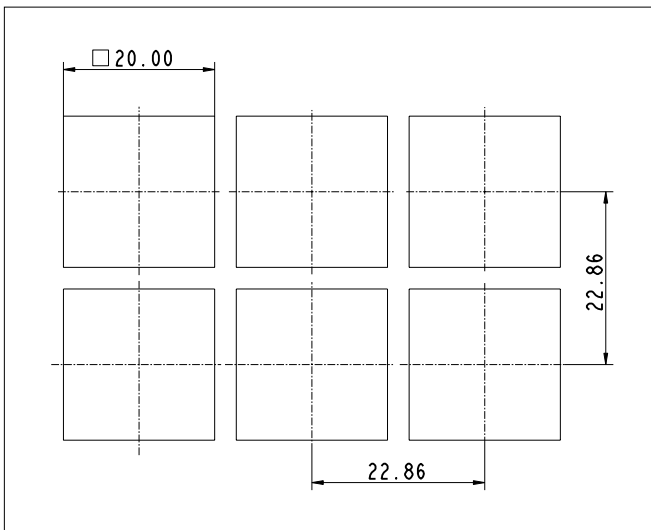
Hole Patterns RF 19



* The LED may be positioned either on the left-hand or right-hand side.
Standard version: LED on left-hand side
View on component side, all hole diameters 1,1 +/- 0,1 mm

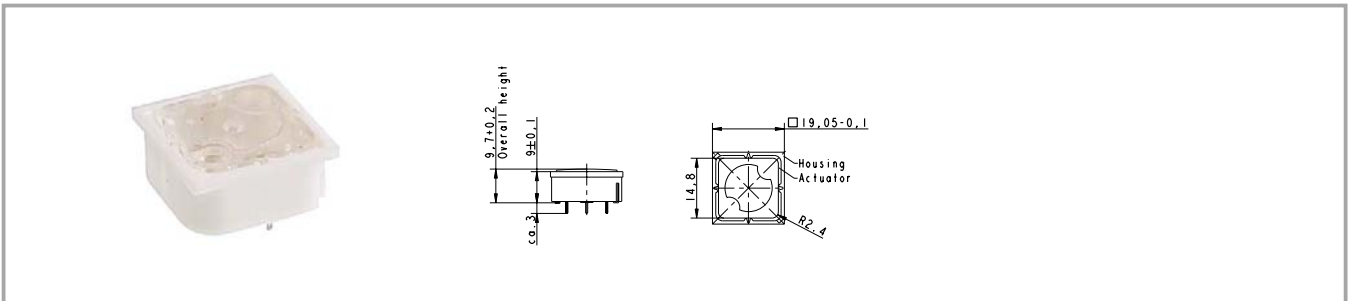
Hole Patterns – Front Panel RF 19

4



RF

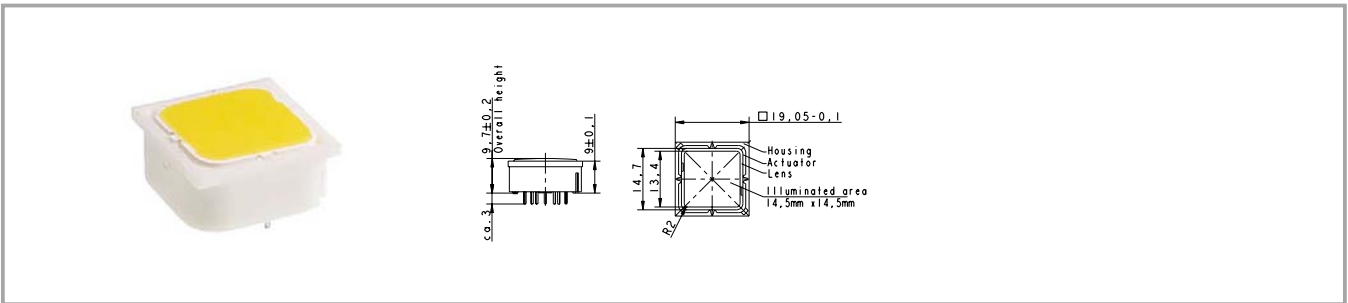
RF 19 short-travel keyswitch, non-illuminated



Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Au	not illuminated	transparent			3.14.001.001/0000
Ag	not illuminated	transparent			3.14.001.006/0000

Technical data see page 4 - 50

RF 19 short-travel keyswitch, fully illuminated with 2 LEDs

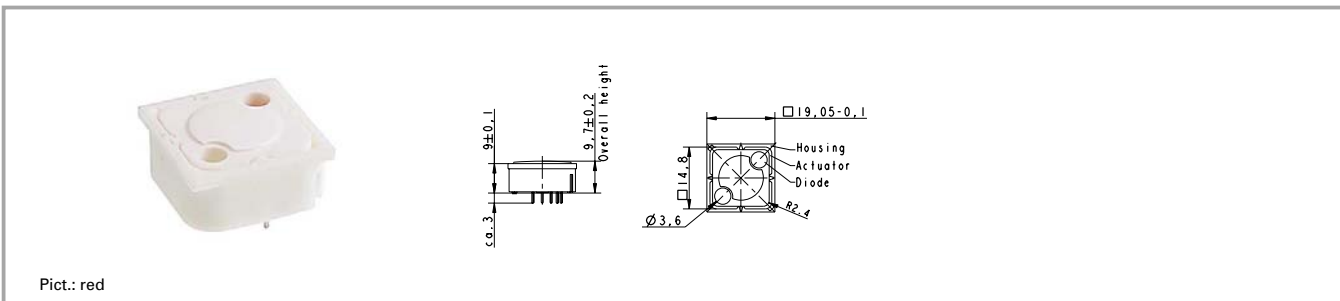


Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Au	fully illuminated 2 LEDs	red	red	2 mm	3.14.002.011/0000
Au	fully illuminated 2 LEDs	green	green	2 mm	3.14.002.012/0000
Au	fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.002.013/0000
Au	fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.002.014/0000
Au	fully illuminated 2 LEDs	blue	blue	2 mm	3.14.002.015/0000
Ag	fully illuminated 2 LEDs	red	red	2 mm	3.14.002.021/0000
Ag	fully illuminated 2 LEDs	green	green	2 mm	3.14.002.022/0000
Ag	fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.002.023/0000
Ag	fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.002.024/0000
Ag	fully illuminated 2 LEDs	blue	blue	2 mm	3.14.002.025/0000

Technical data see page 4 - 50

Technical data of LED see separate page of the beginning of this chapter.

RF 19 short-travel keyswitch, 1 LED spot-illumination



Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Au	spot illumination 1 LED	opaque white	blue	3 mm	3.14.001.030/0000
Au	spot illumination 1 LED	transparent	red	3 mm	3.14.001.031/0000
Au	spot illumination 1 LED	transparent	green	3 mm	3.14.001.032/0000
Au	spot illumination 1 LED	transparent	yellow	3 mm	3.14.001.033/0000
Ag	spot illumination 1 LED	opaque white	blue	3 mm	3.14.001.040/0000
Ag	spot illumination 1 LED	transparent	red	3 mm	3.14.001.041/0000
Ag	spot illumination 1 LED	transparent	green	3 mm	3.14.001.042/0000
Ag	spot illumination 1 LED	transparent	yellow	3 mm	3.14.001.043/0000

Technical data see page 4 - 50

Versions with 2 LEDs available on request.

Technical data of LED see separate page of the beginning of this chapter.

RF 19 short-travel keyswitch, 1 NC + 1 NO



Technical data

General information

Recommended key grid 23 mm

Dimensions

Length 19.05 mm
Width 19.05 mm
Overall height 9.7 mm

Mechanical design

Mounting soldering into PCB
Terminals contacts tin-plated, fix contact Ag plated bridge contact
Contact system 1 NC + 1 NO
Contact arrangement Au/Ag
Contact materials none
Illumination

Mechanical characteristics

Operating force max. 2 ... 3 N
Operating travel 0.5 mm
Switching travel 0.5 mm
Robustness min. with through-plated PCB 100 N

Electrical characteristics

Rated voltage min. Au: 0,02 V, Ag: 3 V V
Rated voltage max. Au: 42 V, Ag: 50 V V
Rated current min. Au: 0,01 mA, Ag: 0,1 mA mA
Rated current max. Au: 100 mA, Ag: 250 mA mA
Rated power max. (ohmic load) Au: 2 W, Ag: 12.5 W

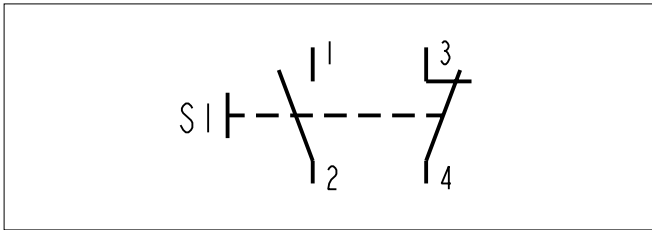
For keycaps, refer to RK 90.

Contact resistance when new max. 100 mΩ
Contact resistance acc. to life max. 3 Ω
Insulation resistance 2 x 10⁶ Ω
ESD strength (underneath overlay) 15 kV
Bouncing time max. 5 ms

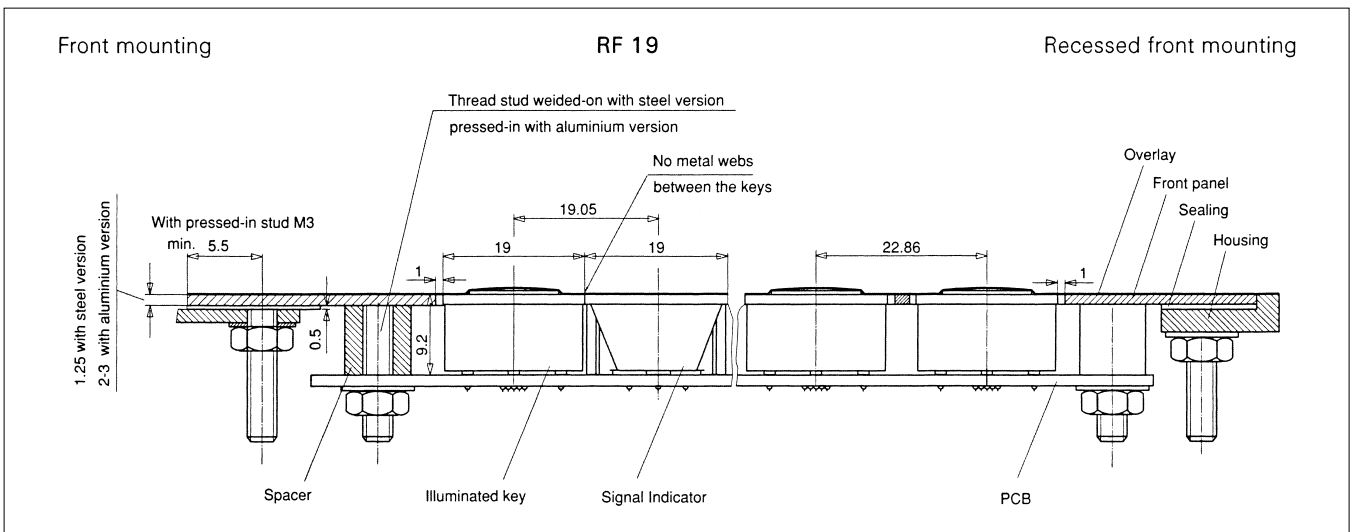
Other specifications

Ambient temp. operating min. -25 °C
Ambient temp. operating max. +70 °C
Storage temperature min. -40 °C
Storage temperature max. (product) +80 °C
Storage temperature max. (in tube) +50 °C
Resistance to constant environment according to IEC 600 68-2-3 and 2-30
Resistance at variable environment according to IEC 600 68-2-14 and 2-33
Operating life min. 100000
Soldering time max. 5 sec.
Soldering temperature max. 265 °C
Flammability of materials UL 94 HB

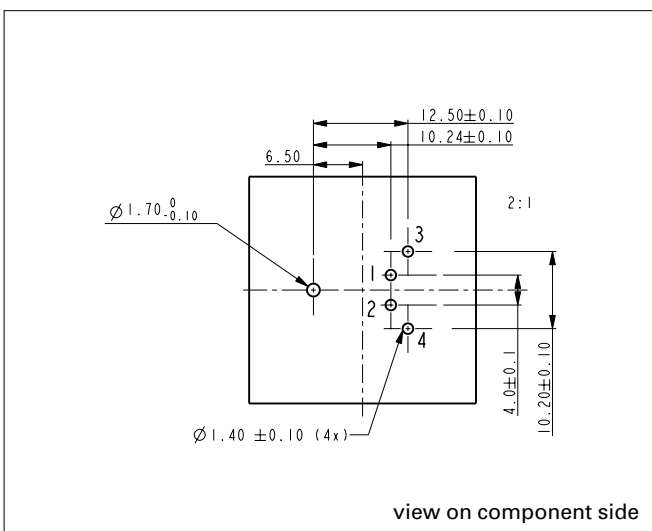
Circuit Diagram



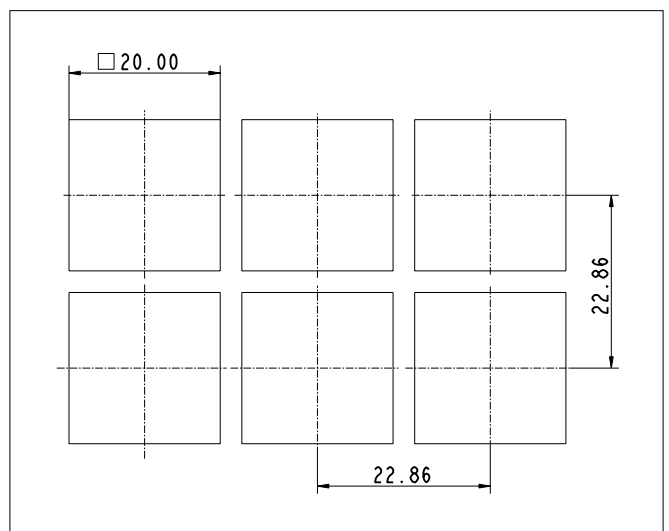
Dimensional Drawing



Hole Pattern



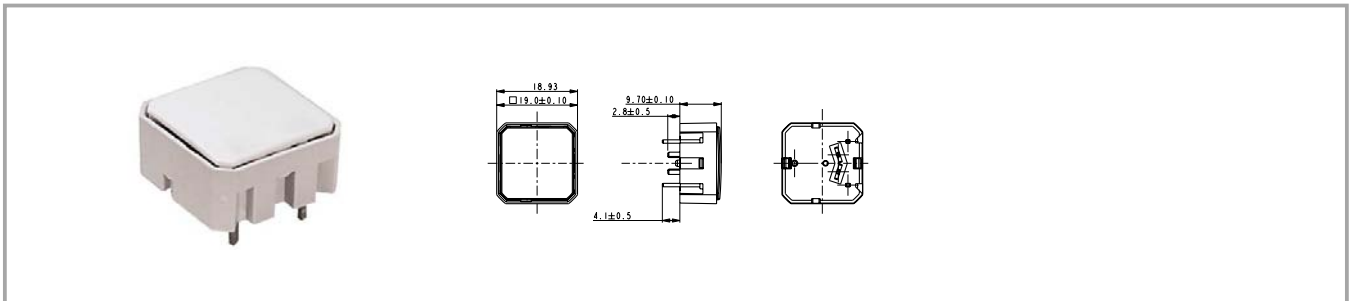
Hole Pattern – Front Panel



4

RF

RF 19 short-travel keyswitch, non-illuminated



Contact materials	Contact arrangement	Illumination	Colour of lens	Order no.
Au	1 NC + 1 NO	not illuminated	opaque white	1.16.000.991/0000
Ag	1 NC + 1 NO	not illuminated	opaque white	1.16.000.990/0000

Technical data see page 4 - 56

RF 19 H short-travel keyswitch



General data

Application notes:

The RF 19H key has an overall height of 12.5 mm and can be fully illuminated. When designing membrane keyboards, we recommend using a key grid of at least 23 mm and a 0.13 mm overlay with area embossing over the keys. You can use the O-ring (accessory) to block the key and use it as an indicator field or blank spaceholder.

Technical data

General information

Colour of lens see order block
Recommended key grid 24 mm

Dimensions

Length 19.05 mm
Width 19.05 mm
Overall height 12.5 mm

Mechanical design

Mounting soldering into PCB
Terminals contacts tin-plated, fix contact Ag plated snap-action contact

Contact system 1 NO
Contact arrangement Au/Ag
Contact materials spot-/fully illuminated
Illumination see order block
LED colour see order block
LED type see order block

Mechanical characteristics

Operating force max. 2 ... 3 N
Operating travel 0.5 mm
Switching travel 0.5 mm
Robustness min. with through-plated PCB 100 N

Electrical characteristics

Rated voltage min. Au: 0.02 V, Ag: 3 V
Rated voltage max. Au: 42 V, Ag: 50 V
Rated current min. Au: 0,01 mA, Ag: 0,1 mA
Rated current max. Au: 100 mA, Ag: 250 mA

Rated power max. (ohmic load) Au: 2 W, Ag: 12.5 W
Contact resistance when new max. 100 mΩ
Contact resistance acc. to life max. 3 Ω
Insulation resistance 10⁹ Ω
ESD strength (underneath overlay) 15 kV
Bouncing time max. 5 ms

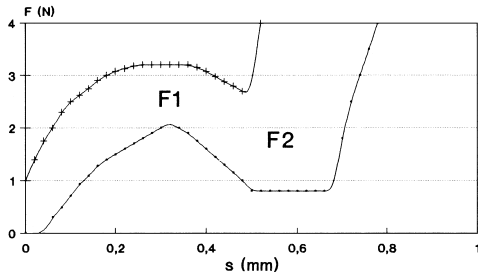
Other specifications

Ambient temp. operating min. -25 °C
Ambient temp. operating max. +70 °C
Storage temperature min. -40 °C
Storage temperature max. (product) +80 °C
Storage temperature max. (in tube) +50 °C
Resistance to constant environment according to IEC 600 68-2-3 and 2-30
Resistance at variable environment according to IEC 600 68-2-14 and 2-33
Operating life min. 1,000,000
Soldering time max. 2,5 sec.
Soldering temperature max. 250 °C
Flammability of materials UL 94 HB

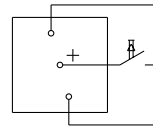
Force/Travel Diagram – Keyswitch RF 19 H

Circuit Diagram – Keyswitch RF 19 H

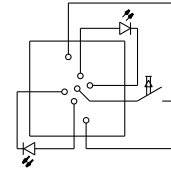
Operation characteristic limits RF



F 1 = Max. operating force
F 2 = Force at contact
F 2 is max. 55% of F 1

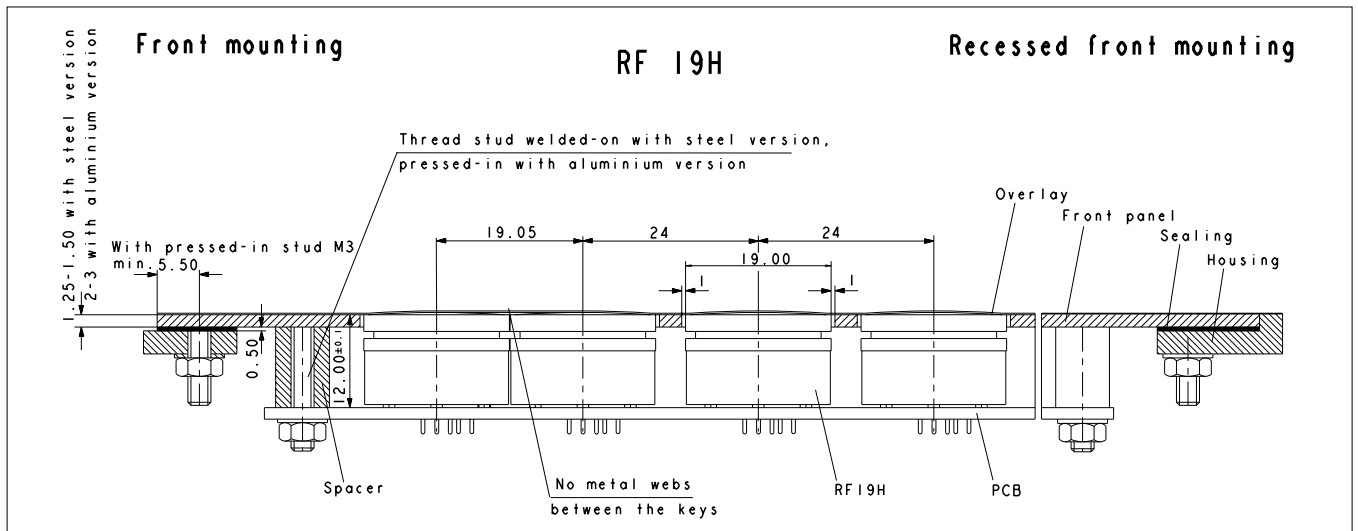


Keyswitch,
non illuminated

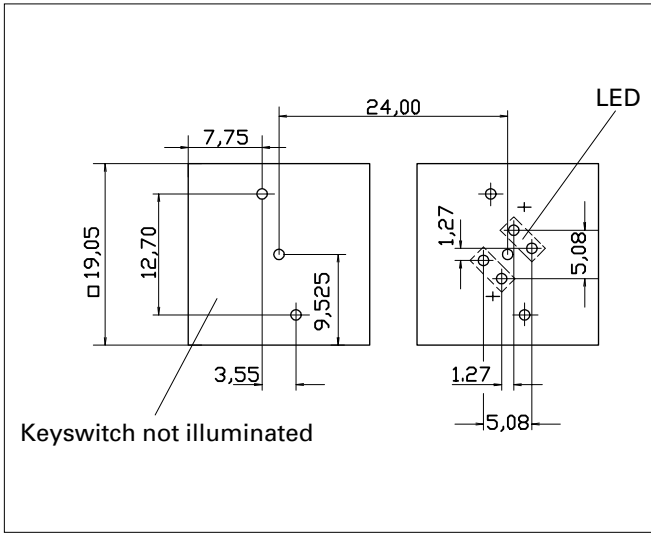


Keyswitch,
fully illuminated

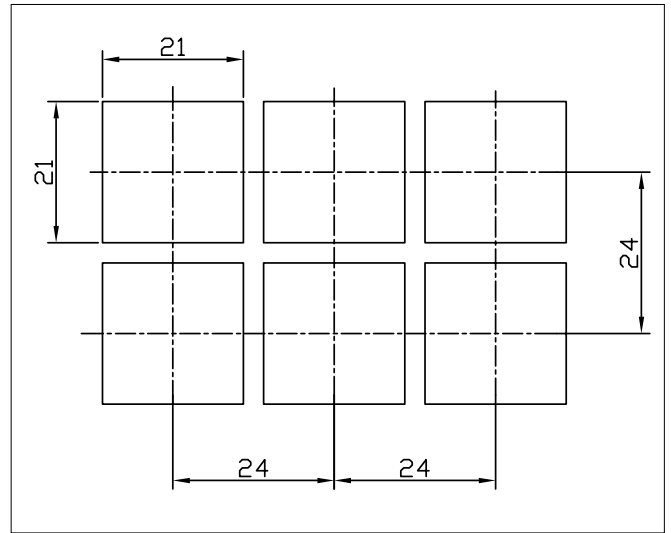
Dimensional Drawing



Hole Pattern RF 19 H



Hole Pattern – Front Panel RF 19 H



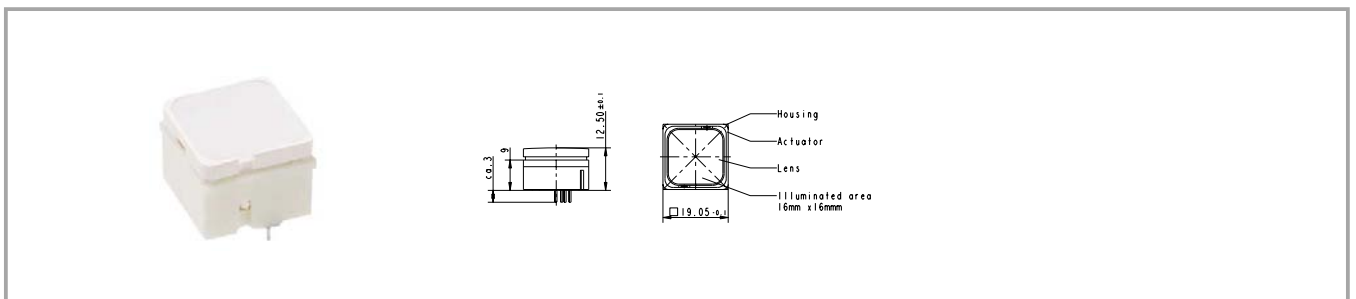
* The LED may be positioned either on the left-hand or right-hand side.
 Standard version: LED on left-hand side
 View on component side, all hole diameters 1,1 +/- 0,1 mm

4

Accessories RF 19 H short-travel keyswitch

Description	Photo	Order no.	Page
O-ring, black, 17.0 x 1.5, for blocking RF 19H keys		5.30.125.003/0100	5 - 27

RF 19 H keyswitch, non-illuminated

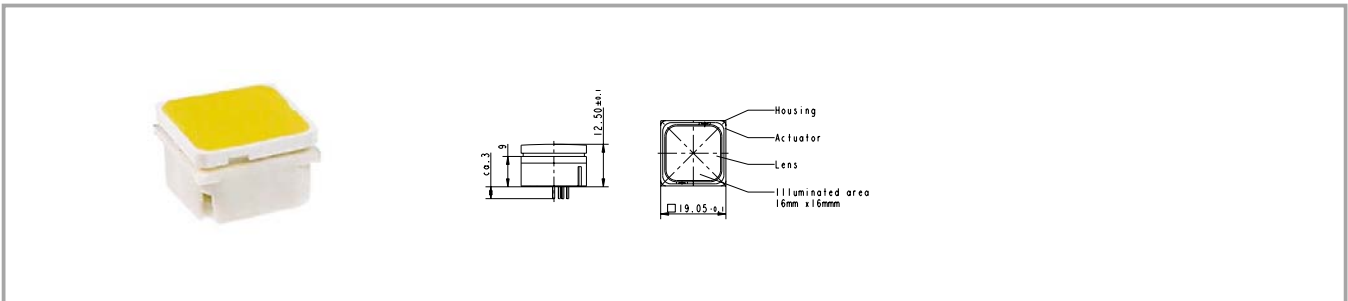


RF

Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Au	not illuminated	white			3.14.001.501/0000
Ag	not illuminated	white			3.14.001.506/0000

Technical data see page 4 - 60

RF 19 H short-travel keyswitch, fully illuminated

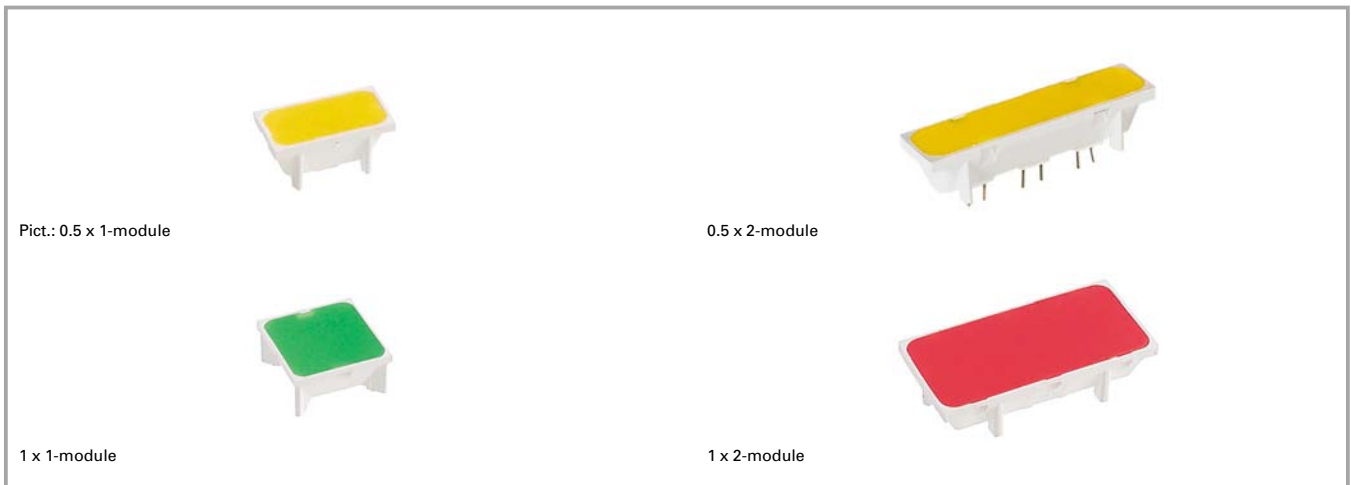


Contact materials	Illumination	Colour of lens	LED colour	LED type	Order no.
Au	fully illuminated 2 LEDs	red	red	2 mm	3.14.002.613/0000
Au	fully illuminated 2 LEDs	green	green	2 mm	3.14.002.632/0000
Au	fully illuminated 1 LED	green	green super bright	3 mm	3.14.002.633/0000
Au	fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.002.653/0000
Au	fully illuminated 1 LED	white	white	3 mm	3.14.002.684/0000
Au	fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.002.673/0000
Au	fully illuminated 2 LEDs	white	multi colour	3 mm	3.14.001.672/0000
Au	fully illuminated 1 LED	blue	blue	3 mm	3.14.002.683/0000
Ag	fully illuminated 2 LEDs	red	red	2 mm	3.14.002.623/0000
Ag	fully illuminated 2 LEDs	green	green	2 mm	3.14.002.642/0000
Ag	fully illuminated 1 LED	green	green super bright	3 mm	3.14.002.643/0000
Ag	fully illuminated 1 LED	blue	blue super bright	3 mm	3.14.002.688/0000
Ag	fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.002.663/0000
Ag	fully illuminated 1 LED	white	white	3 mm	3.14.002.689/0000
Ag	fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.002.678/0000
Ag	fully illuminated 2 LEDs	white	multi colour	3 mm	3.14.001.682/0000

Technical data see page 4 - 60

When using the keyswitches with multicolour LEDs the illumination colour can be varied from red to green by change of polarity. Due to the frequency of the polarity-changes the colours red, green, yellow as well as all secondary colours from these are possible. Technical data of LED see separate page of the beginning of this chapter.

RF 19 signal indicator



Technical data

General information

Colour of lens see order block
Recommended key grid 23/x mm

Dimensions

Length see order block
Width see order block
Overall height 9.15 mm

Mechanical design

Mounting soldering into PCB
Illumination see order block
LED colour see order block
LED type see order block

Other specifications

Ambient temp. operating min. -25 °C

Ambient temp. operating max.

+70 °C

Storage temperature min.

-40 °C

Storage temperature max. (product)

+80 °C

Storage temperature max. (in tube)

+50 °C

Resistance to constant environment

according to IEC 600 68-2-3 and 2-30

Resistance at variable environment

according to IEC 600 68-2-14 and 2-33

Soldering time max.

2,5 sec.

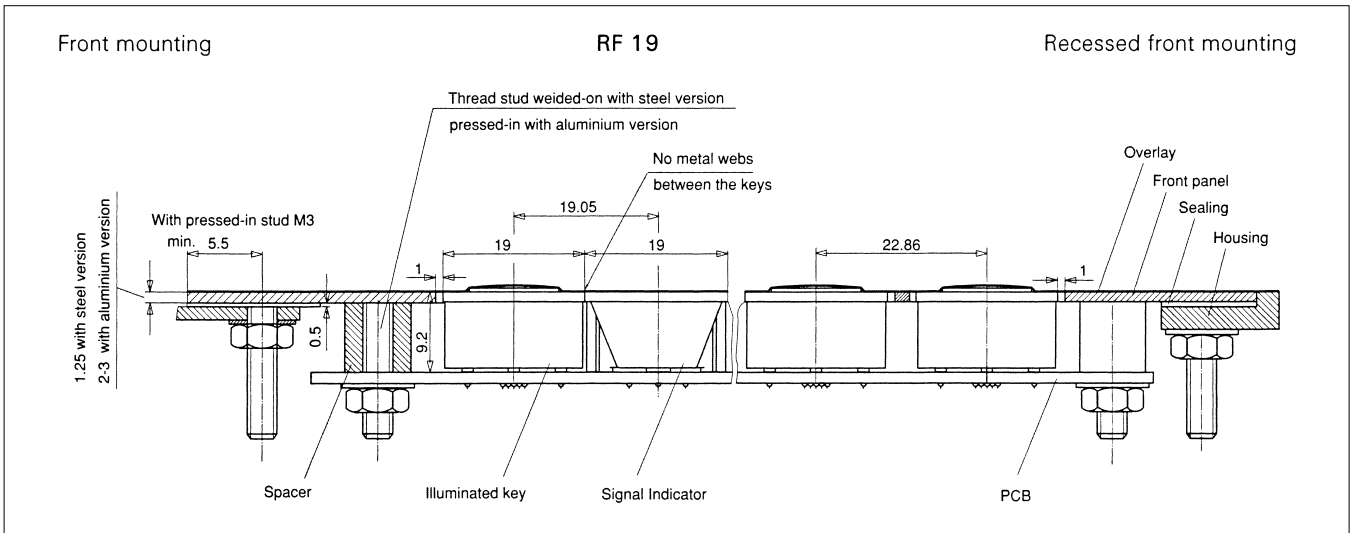
Soldering temperature max.

250 °C

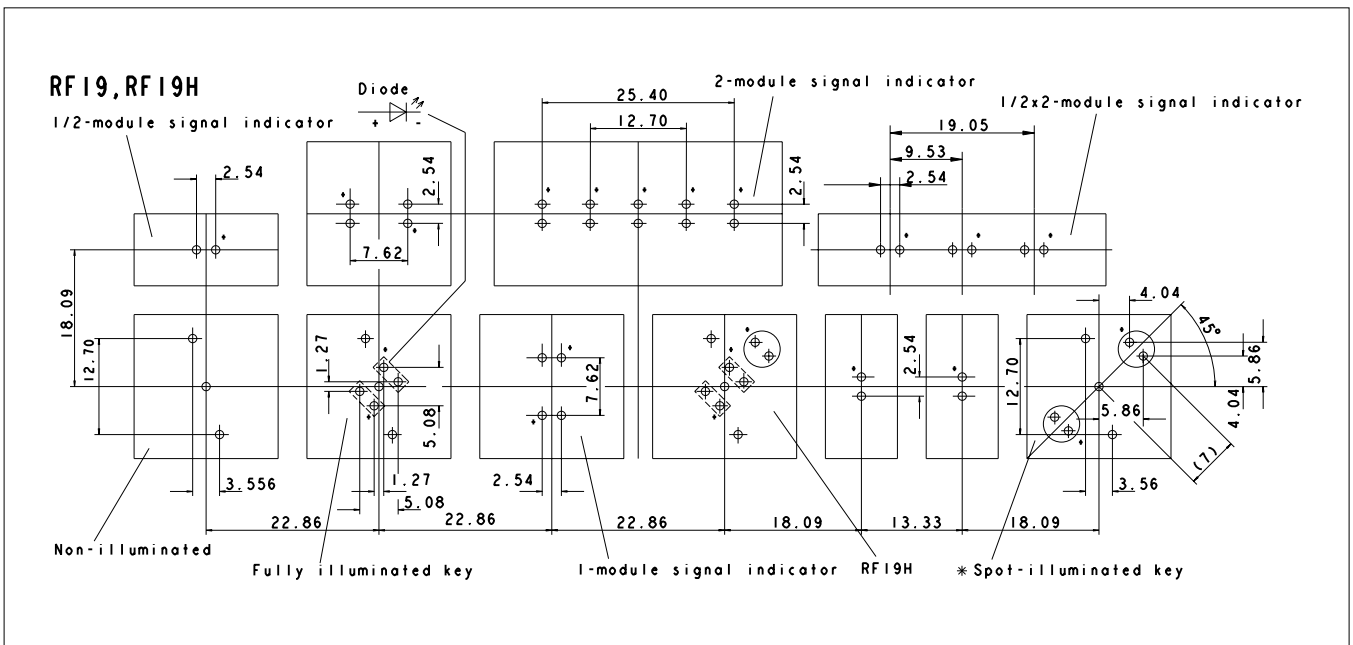
Flammability of materials

UL 94 HB

Dimensional Drawing Signal Indicator RF 19



Hole Patterns RF 19



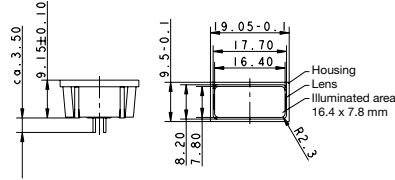
* The LED may be positioned either on the left-hand or right-hand side.
Standard version: LED on left-hand side
View on component side, all hole diameters 1,1 +/- 0,1 mm

Front panel cut-out = outer keyswitch size + 1 mm

4

RF

RF 19 signal indicator, 1/2 x 1-module



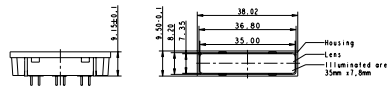
Pict.: 0,5 x 1-module, yellow

illumination	Colour of lens	LED colour	LED type	Order no.
fully illuminated 1 LED	red	red	2 mm	3.14.002.061/0000
fully illuminated 1 LED	green	green	2 mm	3.14.002.062/0000
fully illuminated 1 LED	yellow	yellow	2 mm	3.14.002.063/0000
fully illuminated 1 LED	orange	yellow	2 mm	3.14.002.064/0000

Technical data see page 4 - 64

For more information, see LEDs.

RF 19 signal indicator, 1/2 x 2-module



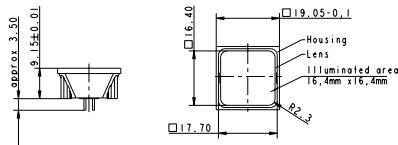
Pict.: 0,5 x 2-module, yellow

illumination	Colour of lens	LED colour	LED type	Order no.
fully illuminated 3 LEDs	red	red	2 mm	3.14.002.908/0000
fully illuminated 3 LEDs	green	green	2 mm	3.14.002.909/0000
fully illuminated 3 LEDs	yellow	yellow	2 mm	3.14.002.910/0000
fully illuminated 3 LEDs	orange	yellow	2 mm	3.14.002.911/0000

Technical data see page 4 - 64

For more information, see LEDs.

RF 19 signal indicator, 1 x 1-module



Pict.: 1 x 1-module, green

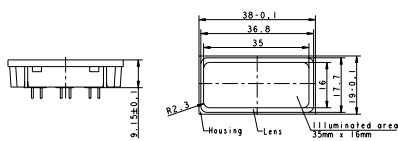
illumination	Colour of lens	LED colour	LED type	Order no.
fully illuminated 2 LEDs	red	red	2 mm	3.14.002.051/0000
fully illuminated 2 LEDs	green	green	2 mm	3.14.002.052/0000
fully illuminated 2 LEDs	yellow	yellow	2 mm	3.14.002.053/0000
fully illuminated 2 LEDs	orange	yellow	2 mm	3.14.002.054/0000
fully illuminated 2 LEDs	blue	blue	2 mm	3.14.001.659/0000

Technical data see page 4 - 64

For more information, see LEDs.

Suitable for RK 90 system design, illuminated for 2-module keycap.

RF 19 signal indicator, 1 x 2-module



Pict.: 1 x 2-module, red

illumination	Colour of lens	LED colour	LED type	Order no.
fully illuminated 5 LEDs	red	red	2 mm	3.14.002.071/0000
fully illuminated 5 LEDs	green	green	2 mm	3.14.002.072/0000
fully illuminated 5 LEDs	yellow	yellow	2 mm	3.14.002.073/0000
fully illuminated 5 LEDs	orange	yellow	2 mm	3.14.002.074/0000

Technical data see page 4 - 64

For more information, see LEDs.

RF special accessories



Pict.: light grey

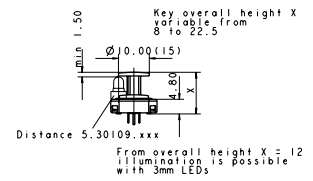
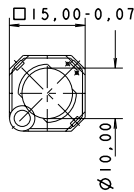


round and triangular versions

Extension plunger for RF 15 N, round head



Pict.: light grey



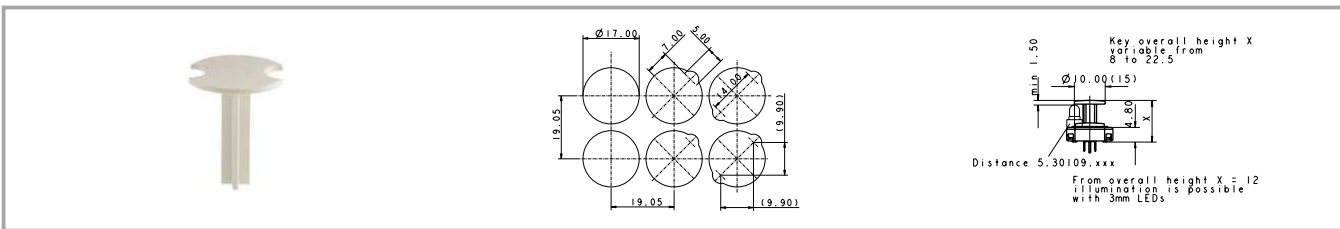
Length	Width	Overall height	Diameter	Colour	Order no.
		9 mm	10 mm		5.46.011.036/0710
		9.7 mm	10 mm		5.46.011.030/0710
		12.5 mm	10 mm		5.46.011.037/0710
		13 mm	10 mm		5.46.011.038/0710
		22.5 mm	10 mm		5.46.011.028/0710

Length of plunger = Overall height - 4.25 mm.

4

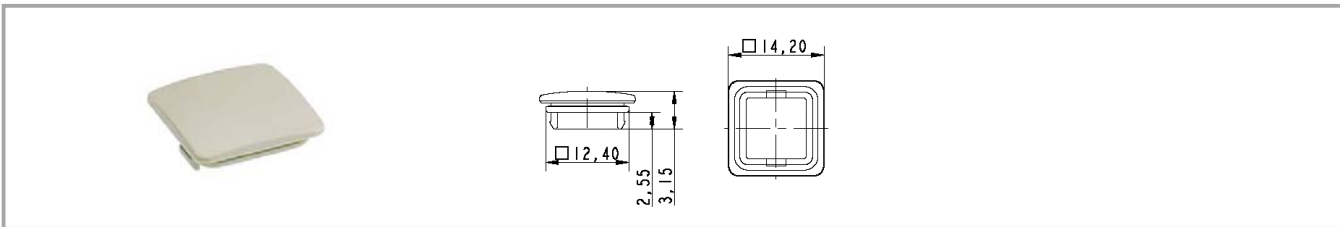
RF

Extension plunger for RF 15 N, round head, with recess for LED



Length	Width	Overall height	Diameter	Colour	Order no.
		9 mm	15 mm		5.46.017.036/0710
		9.7 mm	15 mm		5.46.017.030/0710
		12.5 mm	15 mm		5.46.017.037/0710
		13 mm	15 mm		5.46.017.038/0710
		22.5 mm	15 mm		5.46.017.028/0710

Keycap for RF 15, snap-on, for overall height 12.5 mm

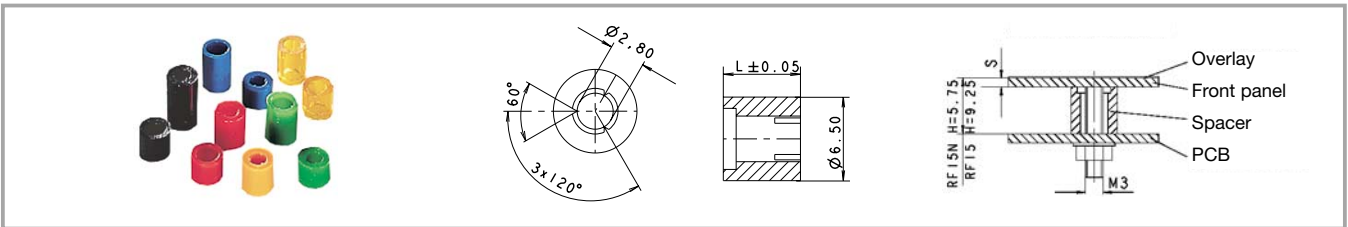


Length	Width	Overall height	Diameter	Colour	Order no.
14.2 mm	14.2 mm	12.5 mm		beige	5.46.654.059/0227

4

RF

Spacers, round

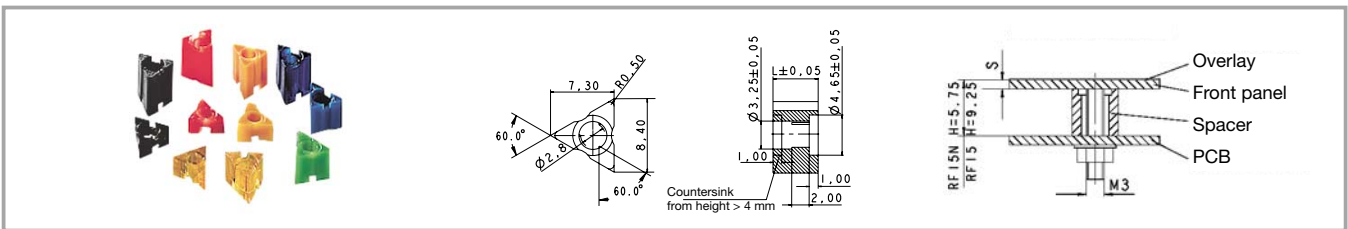


Length	Width	Overall height	Diameter	Colour	Order no.
3.50 mm				blue transparent	5.30.759.023/0000
4 mm				green	5.30.759.025/0000
4.25 mm				blue	5.30.759.026/0000
4.50 mm				red	5.30.759.027/0000
4.75 mm				blue transparent	5.30.759.028/0000
5 mm				black	5.30.759.029/0000
5.25 mm				yellow orange transparent	5.30.759.030/0000
5.50 mm				yellow	5.30.759.031/0000
5.75 mm				green	5.30.759.032/0000
6 mm				blue	5.30.759.033/0000
6.2 mm				blue	5.30.759.251/0000
6.25 mm				red	5.30.759.034/0000
6.50 mm				blue transparent	5.30.759.035/0000
6.75 mm				black	5.30.759.036/0000
7 mm				yellow orange transparent	5.30.759.037/0000
7.25 mm				yellow	5.30.759.038/0000
7.50 mm				green	5.30.759.039/0000
7.75 mm				blue	5.30.759.040/0000
8 mm				red	5.30.759.041/0000
8.25 mm				blue transparent	5.30.759.042/0000
9.00 mm				green	5.30.759.046/0000
10.00 mm				black	5.30.759.043/0104

4

RF

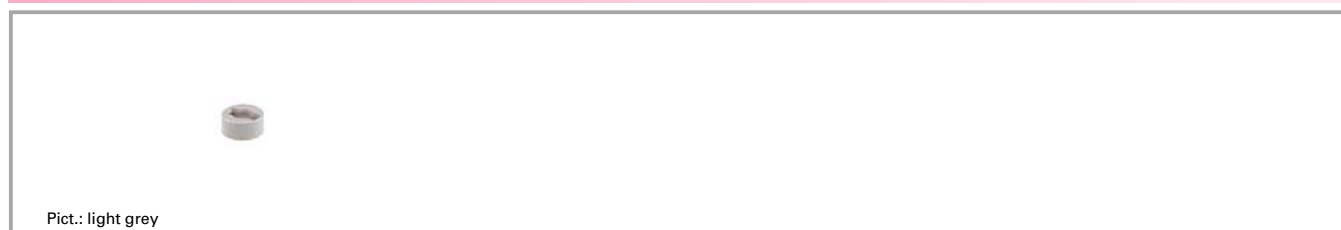
Spacers, triangular



Length	Width	Overall height	Diameter	Colour	Order no.
2.50 mm				blue	5.30.759.094/0000
2.75 mm				red	5.30.759.095/0000
3 mm				blue transparent	5.30.759.096/0000
3.25 mm				black	5.30.759.097/0000
3.50 mm				yellow orange transparent	5.30.759.098/0000
3.75 mm				yellow	5.30.759.099/0000
4 mm				green	5.30.759.100/0000
4.25 mm				blue	5.30.759.101/0000
4.50 mm				red	5.30.759.102/0000
4.75 mm				blue transparent	5.30.759.103/0000
5 mm				black	5.30.759.104/0000
5.25 mm				yellow orange transparent	5.30.759.105/0000
5.50 mm				yellow	5.30.759.106/0000
5.75 mm				green	5.30.759.107/0000
6 mm				blue	5.30.759.108/0000
6.2 mm				blue	5.30.759.253/0000
6.25 mm				red	5.30.759.109/0000
6.50 mm				blue transparent	5.30.759.110/0000
6.75 mm				black	5.30.759.111/0000
7 mm				yellow orange transparent	5.30.759.112/0000
7.25 mm				yellow	5.30.759.113/0000
7.50 mm				green	5.30.759.114/0000
7.75 mm				blue	5.30.759.115/0000

Length	Width	Overall height	Diameter	Colour	Order no.
8 mm				red	5.30.759.116/0000
8.25 mm				blue transparent	5.30.759.117/0000
9 mm				blue	5.30.759.254/0000
10.00 mm				black	5.30.759.124/0000
10.25 mm				yellow orange transparent	5.30.759.125/0000

LED spacer for RF 15 N



Length Characteristic 1	Width Characteristic 2	Overall height	Diameter	Colour	Order no.
2.2 mm		12.5 mm	5 mm	light grey	5.30.109.010/0756
12 mm		22.5 mm	5 mm	black	5.30.109.019/0105

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [Tactile Switches](#) category:

Click to view products by [Rafi](#) manufacturer:

Other Similar products are found below :

[KMR633NG LFG](#) [5GTH9202242](#) [6426-201-11343](#) [MJ1226](#) [MJTP1109B](#) [MJTP1138EAUTR](#) [MJTP1230BL](#) [MJTPSHW](#) [GS6.90F300QP](#) [1-1977223-0](#) [1-1977120-4](#) [ADTSA62NV](#) [ADTSA62RV](#) [ADTSA63KV](#) [ADTSA644NV](#) [ADTSM24NVTR](#) [ADTSMW66NV](#) [ADTSMW67RV](#) [ATM533VTR](#) [1571300-3](#) [B3F-3123](#) [B3F-6055A](#) [B3F-B32-01-KIT](#) [1977177-8](#) [1977266-1](#) [2-1977223-4](#) [2-1977223-7](#) [ADTS644KV](#) [ADTSA61RV](#) [ADTSA62KV](#) [ADTSA63NV](#) [ADTSA63RV](#) [ADTSA65NV](#) [ADTSM21NSVTR](#) [ADTSM25RVTR](#) [ADTSM31RVTR](#) [ADTSM32NVTR](#) [ADTSM61YVTR](#) [ADTSM63SVTR](#) [ADTSM644KVTR](#) [ADTSMW64RV](#) [ADTSMW69NV](#) [FSMRA4JHA04](#) [GS4.70F300QP](#) [D38999/20JJ37SA](#) [TL1105B](#) [TL1105J](#) [ATH447K2Q](#) [ATM534VTR](#) [MJ1215](#)