Specifications LED

LED brightness classes

LEDs are subject to production-related variations in brightness over which we have no control with the manufacturers. It is therefore not possible to arrange a delivery in a specific brightness class, and deviations accordingly do not constitute grounds for complaint regarding our products. The majority of the LEDs we use are delivered from our suppliers in selected brightness classes. In this case, the brightness class is shown on a label on the switch's rack packaging. Where the lighting is required to have a uniform brightness – for aesthetic reasons, for example – this can be achieved in the system by means of the circuitry (with a series resistance, for example).

3 mm LED

(valid for 25 °C)	Red LED	Green LED	Yellow LED
Max. forward current IF:	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 UF/IF typ:	2 V/10 mA	2 V/10 mA	2 V/10 mA
Reverse voltage UR/IF 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 IF:	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 UF/IF typ:	2.7 V/10 mA	3.6 V/20 mA	3.5 V/20 mA
Reverse voltage UR/IF typ:	5V/100 µA min.	-	-
Ambient temperature, operating:	- 20 °C . . . + 80 °C	- 20 °C . . . + 80 °C	-30 °C . . . + 100 °C

2 mm LED (full illumination of RF 15/19)

(valid for 25 °C)	Red LED	Green LED	Yellow LED
Max. forward current IF:	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 fV/IF typ:	-	-	250 mlm/20 mA
Wavelength typ:	637 nm	569 nm	590 nm
Forward voltage UF/IF typ:	1.8 V/20 mA	2.1 V/10 mA	1.9 V/20 mA
Reverse voltage UR/IF 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-color LED
Max. forward current IF:	30 mA	30 mA
Current reduction from: T_0 = 50 °C:	-	approx 0.6 mA/°C
Light current fV/IF typ:	-	-
Wavelength typ:	464-485 nm	635/565 nm
Forward voltage UF/IF typ:	3.6 V/20 mA	2 V/10 mA
Reverse voltage UR/IF typ:		-
Ambient temperature, operating:	- 20 °C . . . + 80 °C	- 20 °C . . . + 80 °C

Calculating the series resistor:

$$R_V = \frac{U_B - U_F}{I_F}$$

Rated power of series:

$$P_V = I_F^2 \times R_V$$

Example for 5 Volt:

$$R_V = \frac{5V - 2{,}0\,V}{0{,}02\,A} = 150\ \Omega\ (=\ \text{standard value})$$

RF 15
Tactile switches

→ 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**

Color 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 in PCB
Terminals	THT
Contact system	snap-action contact
Contact arrangement	1 NO
Contact materials	see order block
Illumination	see order block
LED color	see order block
LED type	see order block

→ **Mechanical characteristics**

Operating force max.	$2.9^{\pm 0.6}$ N
Switching travel	$0.5^{+0.2}$ mm
Robustness max.	with through-plated PCB 100 N

→ **Electrical characteristics**

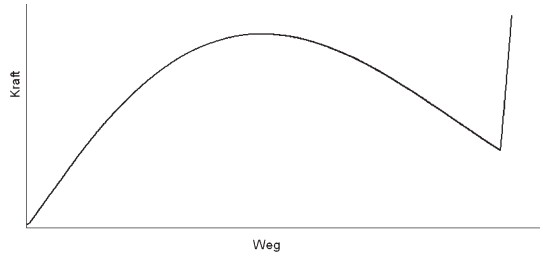
Rated voltage min.	Au: 0.02 V, Ag: 3 V
Rated voltage max.	35 V
Rated current min.	Au: 0.01 mA, Ag: 0.1 mA
Rated current max.	Au: 100 mA, Ag: 250 mA
Rated power max. (ohmic load)	Au: 2 W, Ag: 12.5 W
Contact resistance when new max.	100 mΩ
Insulation resistance	10^9 Ω

→ **Other specifications**

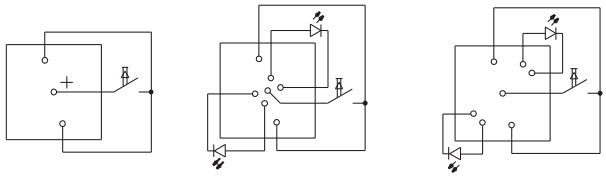
Ambient temp. operating min.	-25 °C
Ambient temp. operating max.	+70 °C
Environmental restistance	acc. to IEC 60068-2-14, -30, -33 and -78
Operating life min. (operations)	1,000,000
Solderability / solder heat resistance	according to DIN EN 60068-2-20
Wave soldering	260 °C max.
Manual soldering	350 °C / 5 sec. max.
ROHS compliant	yes
REACH compliant	yes

Typical force travel diagram

Actuating characteristics
Force travel diagram



Circuit diagrams RF 15

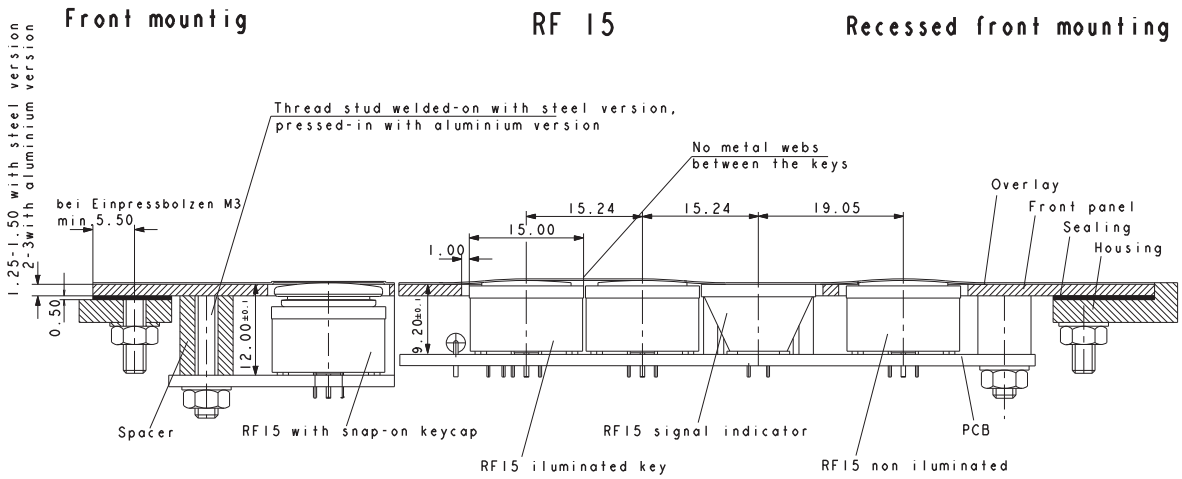


Tactile switch, non-illuminated

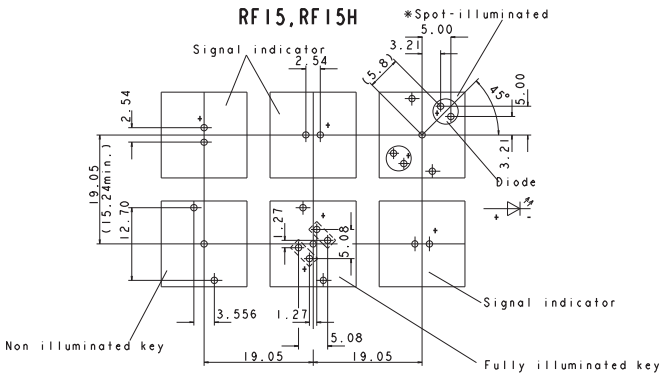
Tactile switch, fully-illuminated

Tactile switch, spot-illuminated

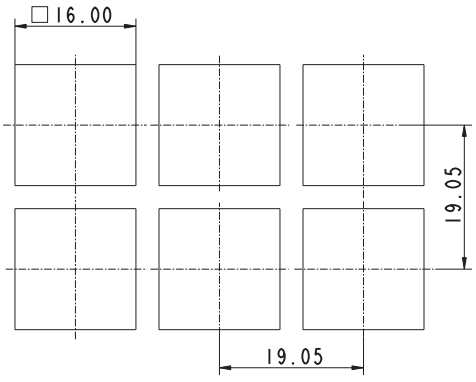
System assembly RF 15



PCB hole patterns RF 15



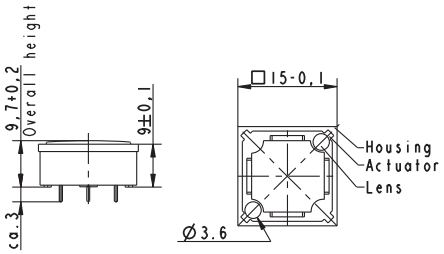
Hole patterns front panel RF 15



View on component side, all hole diameters $1.1^{\pm 0.1}$ mm

RF 15
Tactile switch, non-illuminated

Technical data see page 4 - 58



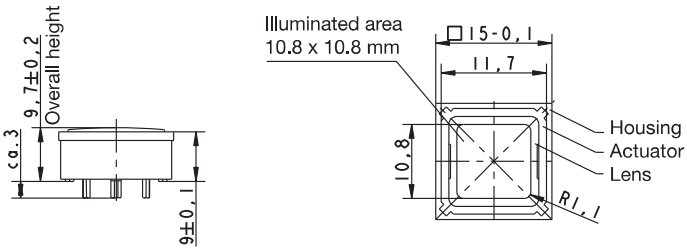
→	Contact materials	Illumination	Color of lens	LED color	LED type	Order no.
	Au	not illuminated	transparent	-	-	3.14.100.001/0000
	Ag	not illuminated	transparent	-	-	3.14.100.006/0000

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
Tactile switch, fully illuminated with 2 LED

Technical data see page 4 - 58



→	Contact materials	Illumination	Color of lens	LED color	LED type	Order no.
	Au	fully illuminated 2 LED	red	red	2 mm	3.14.200.011/0000
	Au	fully illuminated 2 LED	yellow	yellow	2 mm	3.14.200.013/0000
	Au	fully illuminated 2 LED	orange	yellow	2 mm	3.14.200.014/0000
	Au	fully illuminated 2 LED	green	green	2 mm	3.14.200.012/0000
	Au	fully illuminated 2 LED	blue	blue	2 mm	3.14.200.015/0000
	Ag	fully illuminated 2 LED	red	red	2 mm	3.14.200.021/0000
	Ag	fully illuminated 2 LED	yellow	yellow	2 mm	3.14.200.023/0000
	Ag	fully illuminated 2 LED	orange	yellow	2 mm	3.14.200.024/0000

– Table (continued) –
RF 15 - Tactile switch, fully illuminated with 2 LED

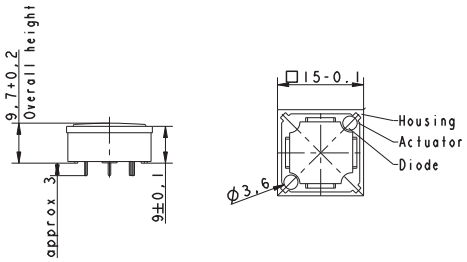
→	Contact materials	Illumination	Color of lens	LED color	LED type	Order no.
	Ag	fully illuminated 2 LED	green	green	2 mm	3.14.200.022/0000
	Ag	fully illuminated 2 LED	blue	blue	2 mm	3.14.200.025/0000

For keycaps, refer to RK 90 system design.

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

RF 15
Tactile switch, 1 LED spot-illumination

Technical data see page 4 - 58



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

Double-spot LED illumination available on request

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

RF 15 N
Tactile switches

→ The RF 15N key switch 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 key switches up to an overall height of 10 mm (i.e. without plunger or with small plunger).
Key switches 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 key switch housing. LEDs of key switches 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**	
Color 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 in PCB
Terminals	THT
Contact system	snap-action contact
Contact arrangement	1 NO
Contact materials	see order block
Illumination	external 3 mm LED possible if height more than 12 mm
→ **Mechanical characteristics**	
Operating force max.	$2.9^{\pm 0.6}$ N
Switching travel	$0.5^{+0.2}$ mm
Robustness max.	100 with through-plated PCB N
→ **Electrical characteristics**	
Rated voltage min.	Au: 0.02 V, Ag: 3 V
Rated voltage max.	35 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
Insulation resistance	10^9 Ω
→ **Other specifications**	
Ambient temp. operating min.	-25 °C
Ambient temp. operating max.	+70 °C
Storage temperature max. (in tube)	+50 °C
Environmental restistance	acc. to IEC 60068-2-14, -30, -33 and -78
Operating life min. (operations)	1,000,000
Solderability / solder heat resistance	according to DIN EN 60068-2-20
Wave soldering	260 °C max.
Manual soldering	350 °C / 5 sec. max.
ROHS compliant	yes
REACH compliant	yes

Accessories RF 15 N - Tactile switch

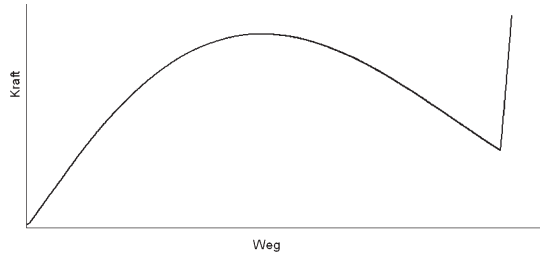
→	Description	Photo	Order no.	Additional accessories see page
	RF 15 N - LED spacer Ø 5 mm, spacing length 2.2 mm, light grey, for use with overall height of 12.5 mm		5.30.109.010/0756	4 - 99
	RF 15 N - Extension plunger, Ø 10 mm, overall height 22.5 mm		5.46.011.028/0710	4 - 95
	RF 15 N - Extension plunger, Ø 15 mm, overall height 22.5 mm		5.46.017.028/0710	4 - 96
	RF 15 N - Extension plunger, Ø 15 mm, overall height 22.5 mm		5.46.017.029/0710	-

PCB KEY SWITCHES

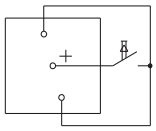
RF 15 N - TACTILE SWITCHES

Typical force travel diagram

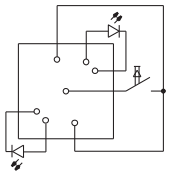
Actuating characteristics
Force travel diagram



Circuit diagrams RF 15 N

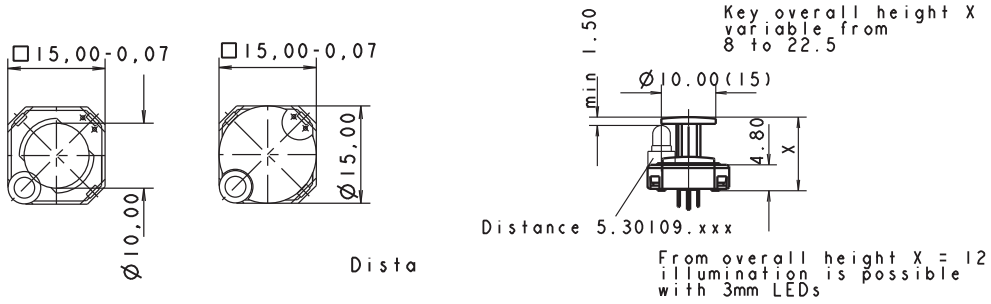


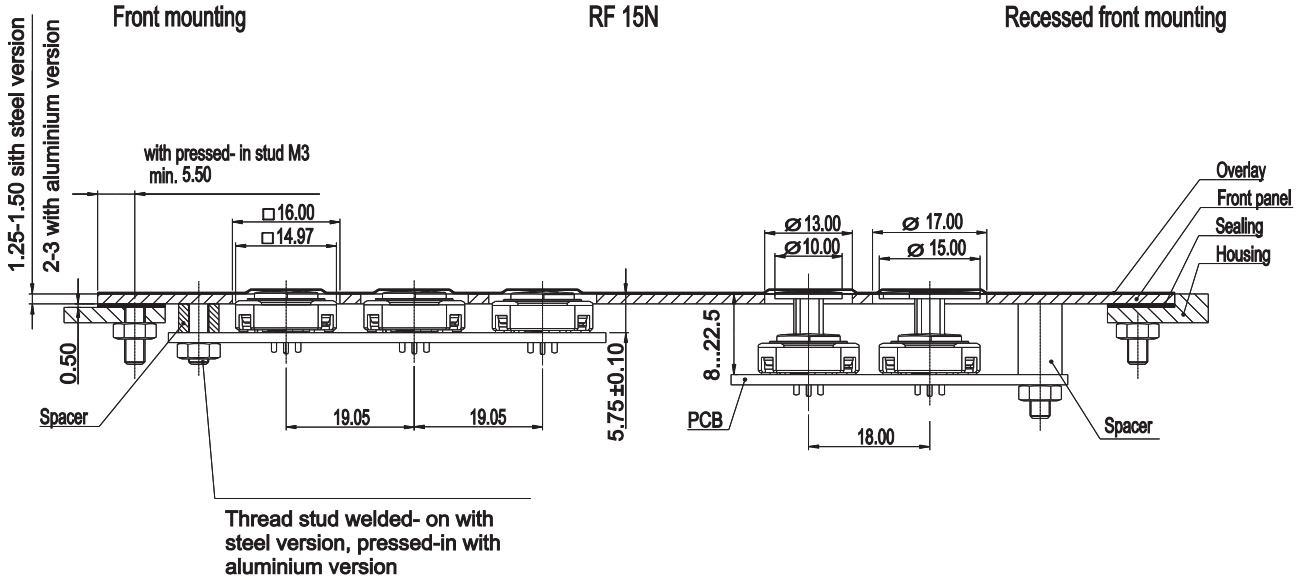
Tactile switch, non-illuminated



Tactile switch, spot-illuminated

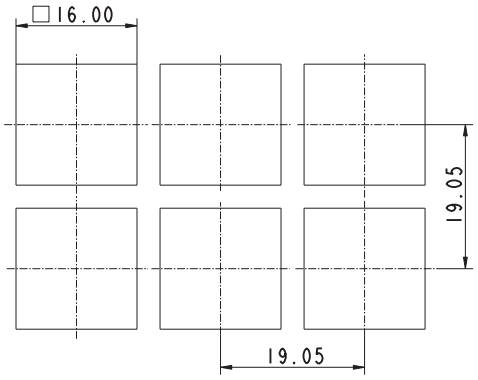
Dimensional drawing RF 15 N



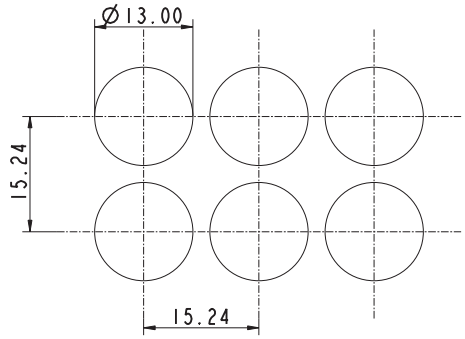


Hole patterns front panel RF 15 N

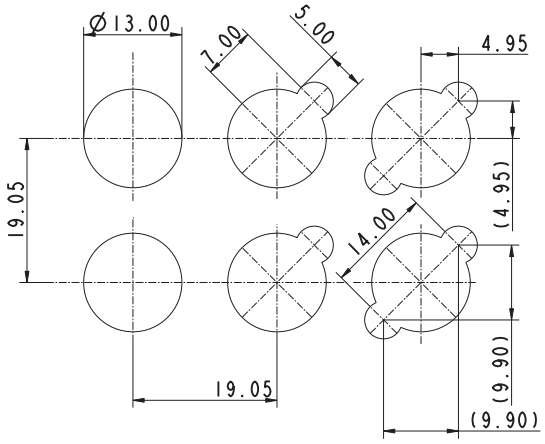
RF 15 N without plunger



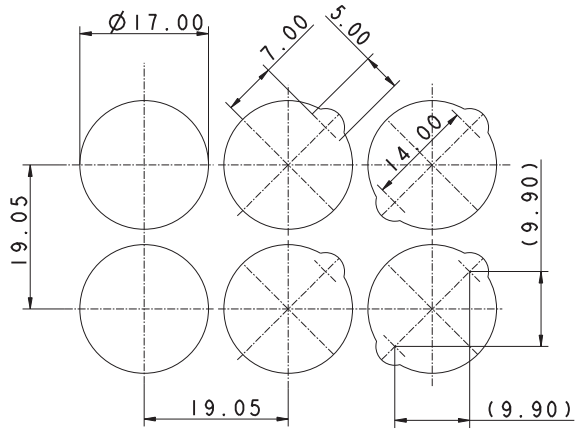
RF 15 N with plunger ø 10 mm, not illuminated



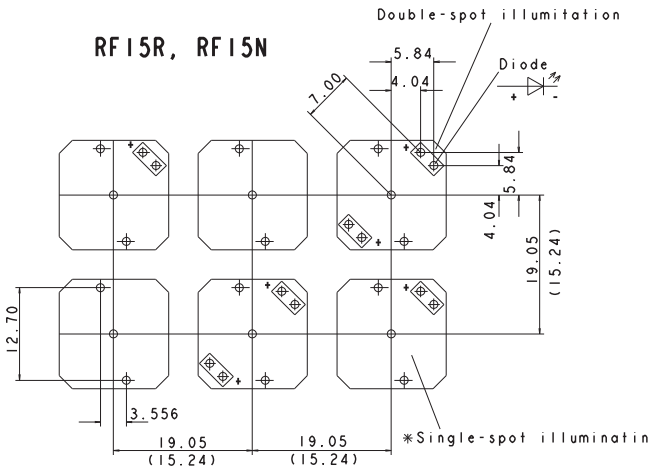
RF 15 N with plunger ø 10 mm, illuminated



RF 15 N with plunger ø 15 mm, illuminated



PCB hole patterns RF 15 N



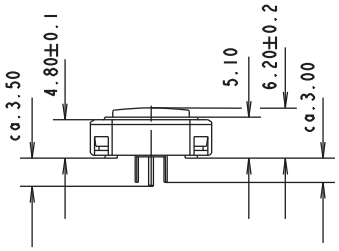
View on component side,
all hole diameters $1.1^{\pm 0.1}$ mm
PCB layout switch 1/400" grid

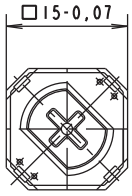
4

RF

RF 15 N
Tactile switch, non-illuminated

Technical data see page 4 - 62





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

For keycaps, refer to RK 90 system design.
Double-spot LED illumination available on request.

RF 15 R
Tactile switches

→ The round actuator of the RF 15 R key switch 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

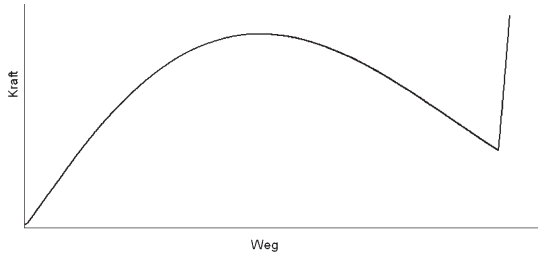
→ General information	
Recommended key grid	15.24 mm
→ Dimensions	
Length	15 mm
Width	15 mm
Overall height	see order block
→ Mechanical design	
Mounting	soldering in PCB
Terminals	THT
Contact system	snap-action contact
Contact arrangement	1 NO
Contact materials	see order block
Illumination	see order block
LED color	see order block
LED type	see order block
→ Mechanical characteristics	
Operating force max.	$2.9^{\pm 0.6}$ N
Switching travel	$0.5^{+0.2}$ mm
Robustness max.	with through-plated PCB 100 N
→ Electrical characteristics	
Rated voltage min.	Au: 0.02 V, Ag: 3 V
Rated voltage max.	35 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
Insulation resistance	10^9 Ω
→ Other specifications	
Ambient temp. operating min.	-25 °C
Ambient temp. operating max.	+70 °C
Environmental restistance	acc. to IEC 60068-2-14, -30, -33 and -78
Operating life min. (operations)	1,000,000
Solderability / solder heat resistance	according to DIN EN 60068-2-20
Wave soldering	260 °C max.
Manual soldering	350 °C / 5 sec. max.
ROHS compliant	yes
REACH compliant	yes

PCB KEY SWITCHES

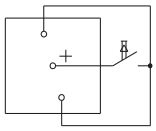
RF 15 R LOW - TACTILE SWITCHES

Typical force travel diagram

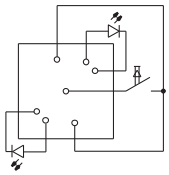
Actuating characteristics
Force travel diagram



Circuit diagrams RF 15 R

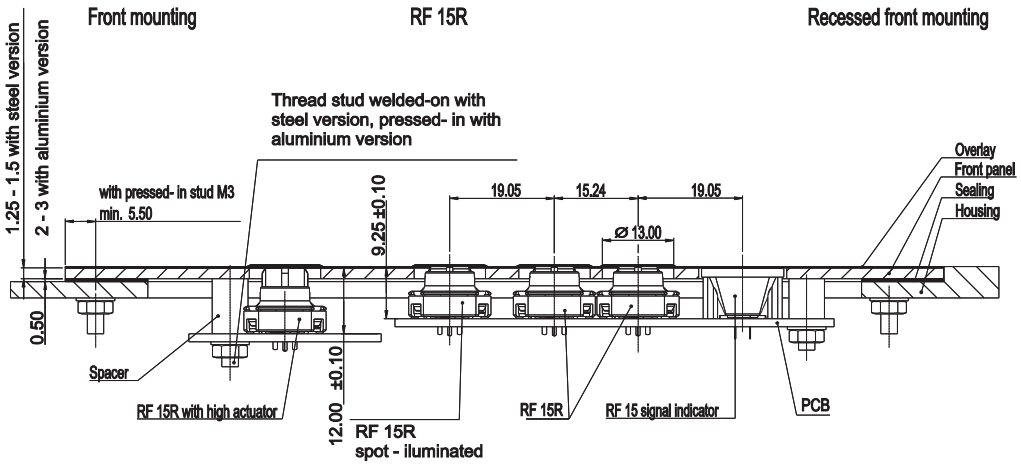


Tactile switch,
non-illuminated

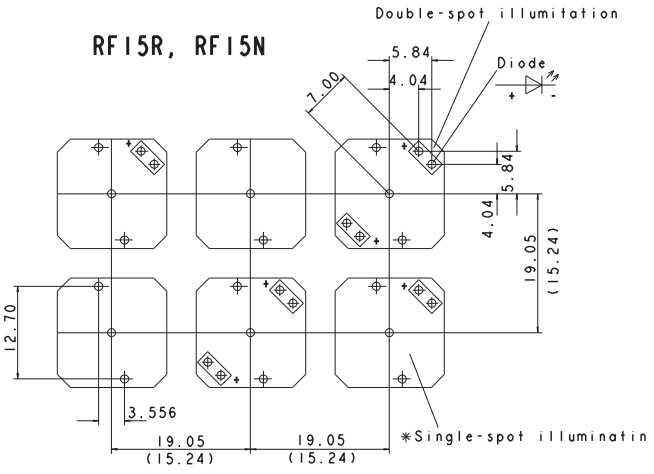


Tactile switch,
spot-illuminated

Dimensional drawing RF 15 R



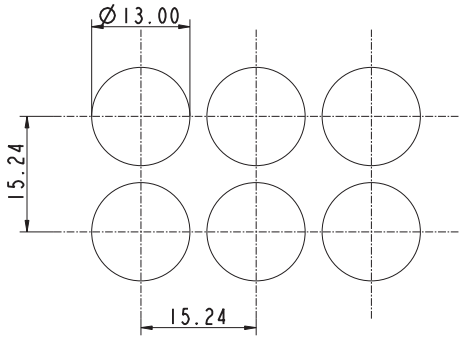
PCB hole patterns RF 15 R



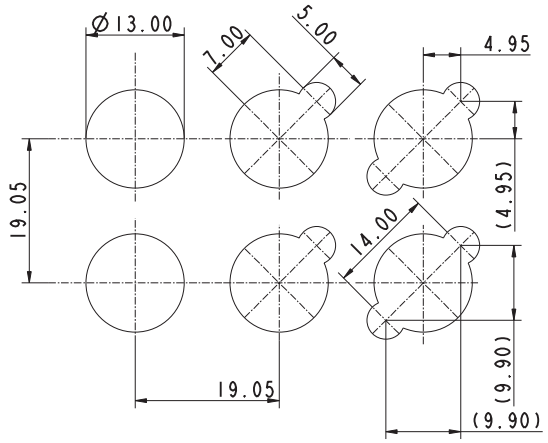
View on component side,
all hole diameters $1.1^{\pm 0.1}$ mm
PCB layout switch 1/400" grid

Hole patterns front panel RF 15 R

RF 15 R, not illuminated

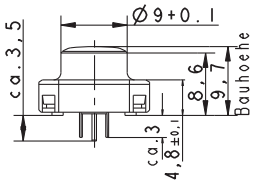


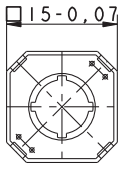
RF 15 R, illuminated



RF 15 R
Low tactile switch, non-illuminated

Technical data see page 4 - 67

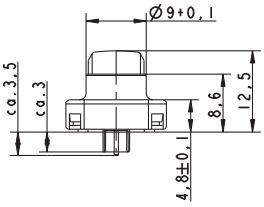


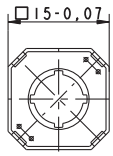


→ Contact materials	Overall height	Illumination	LED type	LED color	Order no.
Au	9.7 mm	not illuminated	-	-	3.14.100.501/0000
Ag	9.7 mm	not illuminated	-	-	3.14.100.506/0000

RF 15 R
High tactile switch, non-illuminated

Technical data see page 4 - 67

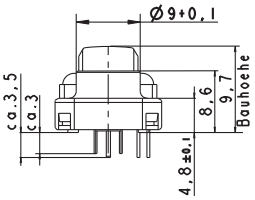


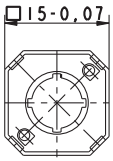


→ Contact materials	Overall height	Illumination	LED type	LED color	Order no.
Au	12.5 mm	not illuminated	-	-	3.14.100.801/0000
Ag	12.5 mm	not illuminated	-	-	3.14.100.806/0000

RF 15 R
Low tactile switch, 1 LED spot-illumination

Technical data see page 4 - 67





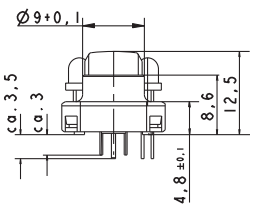
→	Contact materials	Overall height	Illumination	LED type	LED color	Order no.
	Au	9.7 mm	spot illumination 1 LED	2 mm	red	3.14.100.531/0000
	Au	9.7 mm	spot illumination 1 LED	2 mm	yellow	3.14.100.533/0000
	Au	9.7 mm	spot illumination 1 LED	2 mm	green	3.14.100.532/0000
	Ag	9.7 mm	spot illumination 1 LED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

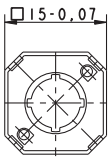
Versions with 2 LEDs available on request.

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

RF 15 R
High tactile switch, 1 LED spot-illumination

Technical data see page 4 - 67





→	Contact materials	Overall height	Illumination	LED type	LED color	Order no.
	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	yellow	3.14.100.833/0000
	Au	12.5 mm	spot illumination 1 LED	3 mm	green	3.14.100.832/0000

– Table (continued) –
RF 15 R - High tactile switch, 1 LED spot-illumination

→ Contact materials	Overall height	Illumination	LED type	LED color	Order no.
Au	12.5 mm	spot illumination 1 LED	3 mm	blue	3.14.100.830/0000

Versions with 2 LEDs available on request.

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

RF 15 H
Tactile switches

→ **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 20 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

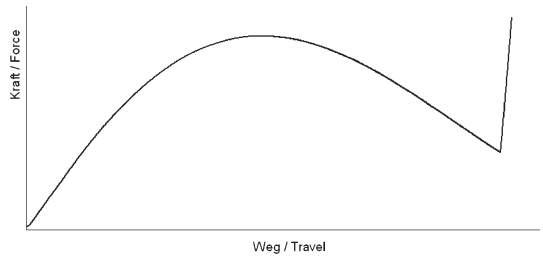
→ **General information**	
Color of lens	see order block
Recommended key grid	20 mm
→ **Dimensions**	
Length	15 mm
Width	15 mm
Overall height	12.5 mm
→ **Mechanical design**	
Mounting	soldering in PCB
Terminals	THT
Contact system	snap-action contact
Contact arrangement	1 NO
Contact materials	see order block
Illumination	see order block
LED color	see order block
LED type	see order block
→ **Mechanical characteristics**	
Operating force max.	$2.9^{\pm 0.6}$ N
Switching travel	$0.5^{+0.2}$ mm
Robustness max.	with through-plated PCB 100 N
→ **Electrical characteristics**	
Rated voltage min.	Au: 0.02 V, Ag: 3 V
Rated voltage max.	35 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
Insulation resistance	10^9 Ω
→ **Other specifications**	
Ambient temp. operating min.	-25 °C
Ambient temp. operating max.	+70 °C
Environmental restistance	acc. to IEC 60068-2-14, -30, -33 and -78
Operating life min. (operations)	1,000,000
Solderability / solder heat resistance	according to DIN EN 60068-2-20
Wave soldering	260 °C max.
Manual soldering	350 °C / 5 sec. max.
ROHS compliant	yes
REACH compliant	yes

Accessories RF 15 H - Tactile switch

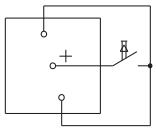
→	Description	Photo	Order no.	Additional accessories see page
	O-ring, black, 16.0 x 1, for blocking RF 19H keys		5.30.125.007/0100	5 - 31

Typical force travel diagram RF 15 H

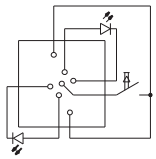
Actuating characteristics
Force travel diagram



Curcuit diagram RF 15 H

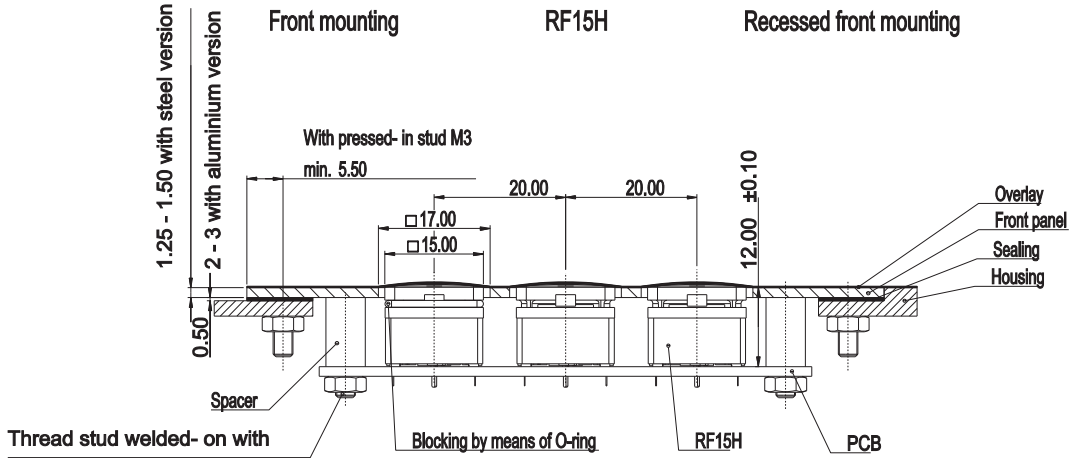


Tactile switch,
non-illuminated

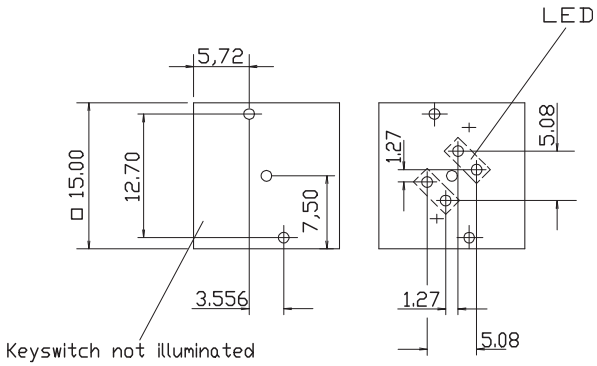


Tactile switch,
fully-illuminated

Dimensional drawing RF 15 H

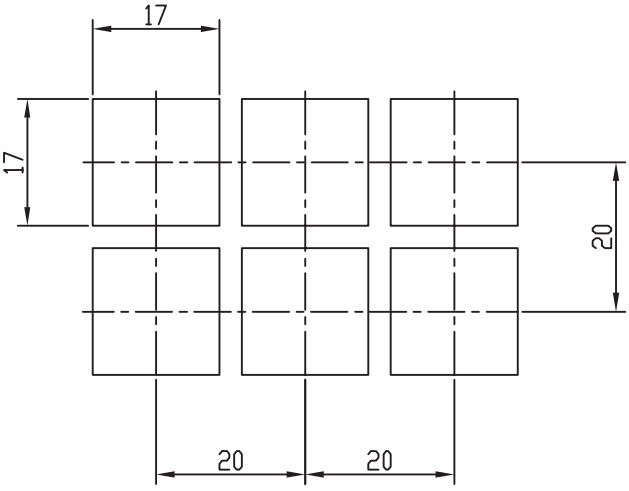


Hole Pattern



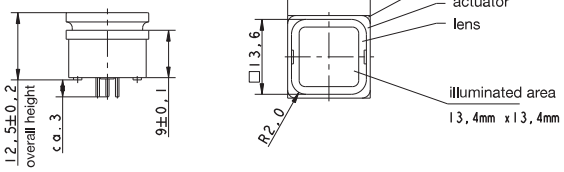
View on component side.

Hole Pattern – Front Panel



RF 15 H
Tactile switch, non-illuminated

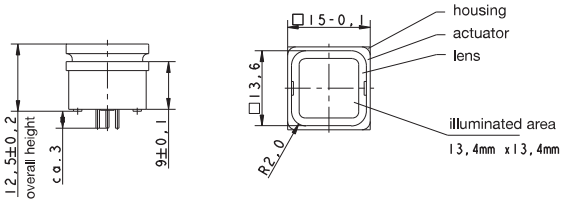
Technical data see page 4 - 73



→	Contact materials	Illumination	Color of lens	LED color	LED type	Order no.
	Au	not illuminated	white	-	-	3.14.100.702/0000
	Ag	not illuminated	white	-	-	3.14.100.707/0000

RF 15 H
Tactile switch, fully illuminated

Technical data see page 4 - 73



→	Contact materials	Illumination	Color of lens	LED color	LED type	Order no.
	Au	fully illuminated 2 LED	red	red	2 mm	3.14.200.731/0000
	Au	fully illuminated 2 LED	yellow	yellow	2 mm	3.14.200.733/0000
	Au	fully illuminated 2 LED	orange	yellow	2 mm	3.14.200.738/0000
	Au	fully illuminated 1 LED	green	green super bright	3 mm	3.14.200.736/0000
	Au	fully illuminated 2 LED	green	green	2 mm	3.14.200.732/0000
	Au	fully illuminated 1 LED	blue	blue	3 mm	3.14.200.739/0000
	Au	fully illuminated 1 LED	white	white	3 mm	3.14.200.735/0000
	Ag	fully illuminated 2 LED	red	red	2 mm	3.14.200.741/0000
	Ag	fully illuminated 2 LED	yellow	yellow	2 mm	3.14.200.743/0000
	Ag	fully illuminated 2 LED	orange	yellow	2 mm	3.14.200.748/0000
	Ag	fully illuminated 1 LED	green	green super bright	3 mm	3.14.200.746/0000

– Table (continued) –
RF 15 H - Tactile switch, fully illuminated

→ Contact materials	Illumination	Color of lens	LED color	LED type	Order no.
Ag	fully illuminated 2 LED	green	green	2 mm	3.14.200.742/0000
Ag	fully illuminated 1 LED	blue	blue	3 mm	3.14.200.749/0000
Ag	fully illuminated 1 LED	white	white	3 mm	3.14.200.745/0000

When using the key switches with multicolor LEDs the illumination color can be varied from red to green by change of polarity. Due to the frequency of the polarity-changes the colors red, green, yellow as well as all secondary colors from these are possible.

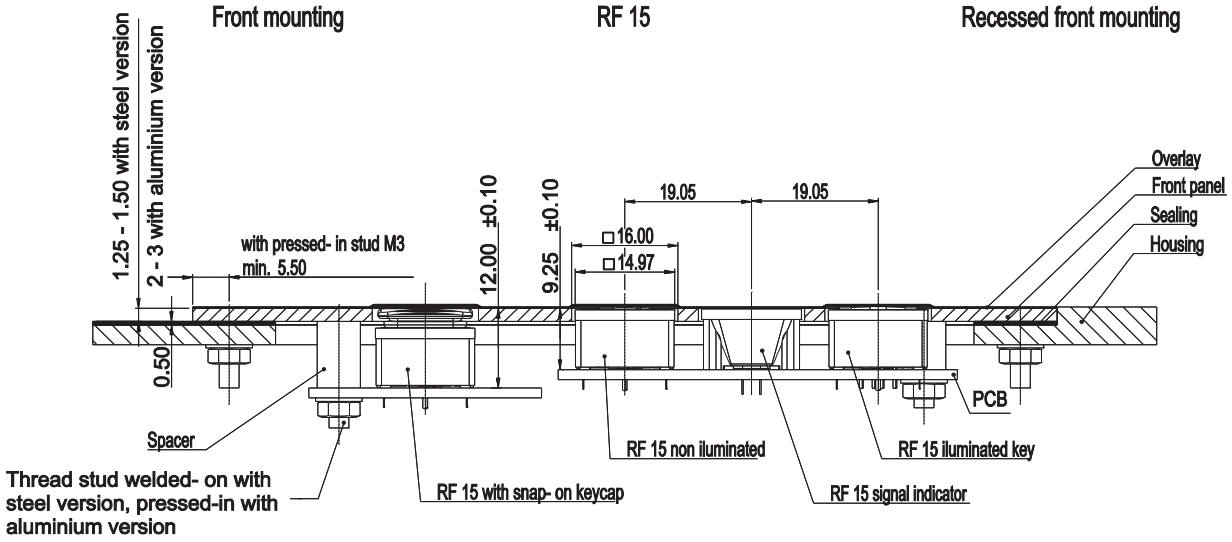
Technical data of LED see separate page at the beginning of this chapter.

RF 15
Signal indicators

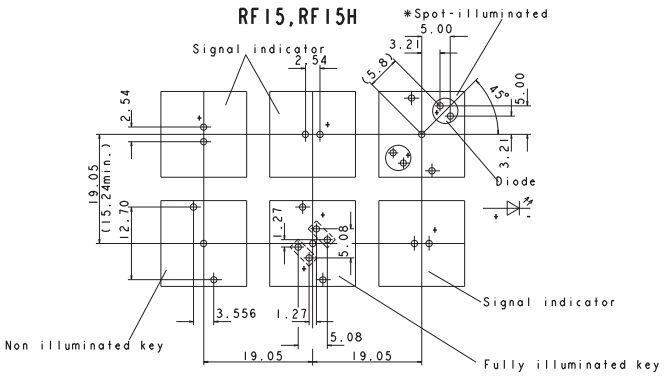
Technical Data

→ General information	
Color of lens	see order block
Recommended key grid	19.05 mm
→ Dimensions	
Length	15 mm
Width	15 mm
Overall height	9.15 mm
→ Mechanical design	
Mounting	THT soldering in PCB
Illumination	fully illuminated 1 LED
LED color	see order block
LED type	2 mm
→ Other specifications	
Ambient temp. operating min.	-25 °C
Ambient temp. operating max.	+70 °C
Environmental restistance	acc. to IEC 60068-2-14, -30, -33 and -78
Solderability / solder heat resistance	according to DIN EN 60068-2-20
Wave soldering	260 °C max.
Manual soldering	350 °C / 5 sec. max.
ROHS compliant	yes
REACH compliant	yes

System assembly RF 15 signal indicator

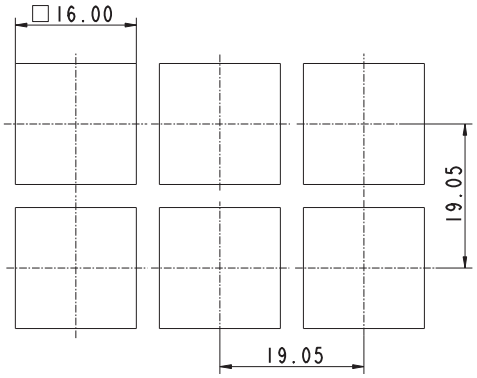


PCB hole patterns RF 15



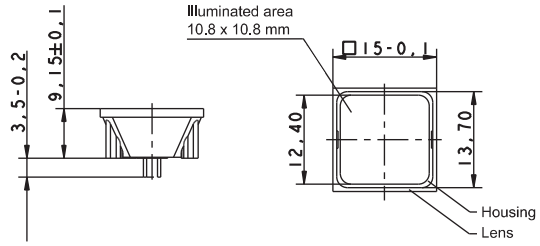
View on component side, all hole diameters $1.1^{\pm 0.1}$ mm

Hole patterns front panel RF 15



RF 15
Signal indicator, fully illuminated, 1 LED

Technical data see page 4 - 78



→ Overall height	Illumination	Color of lens	LED color	LED type	Order no.
9.15 mm	fully illuminated 1 LED	red	red	2 mm	3.14.200.051/0000
9.15 mm	fully illuminated 1 LED	yellow	yellow	2 mm	3.14.200.053/0000
9.15 mm	fully illuminated 1 LED	orange	yellow	2 mm	3.14.200.054/0000
9.15 mm	fully illuminated 1 LED	green	green	2 mm	3.14.200.052/0000
9.15 mm	fully illuminated 1 LED	blue	blue	2 mm	3.14.200.055/0000

Technical data of LED see separate page at the beginning of chapter 4 PCB Key switches.