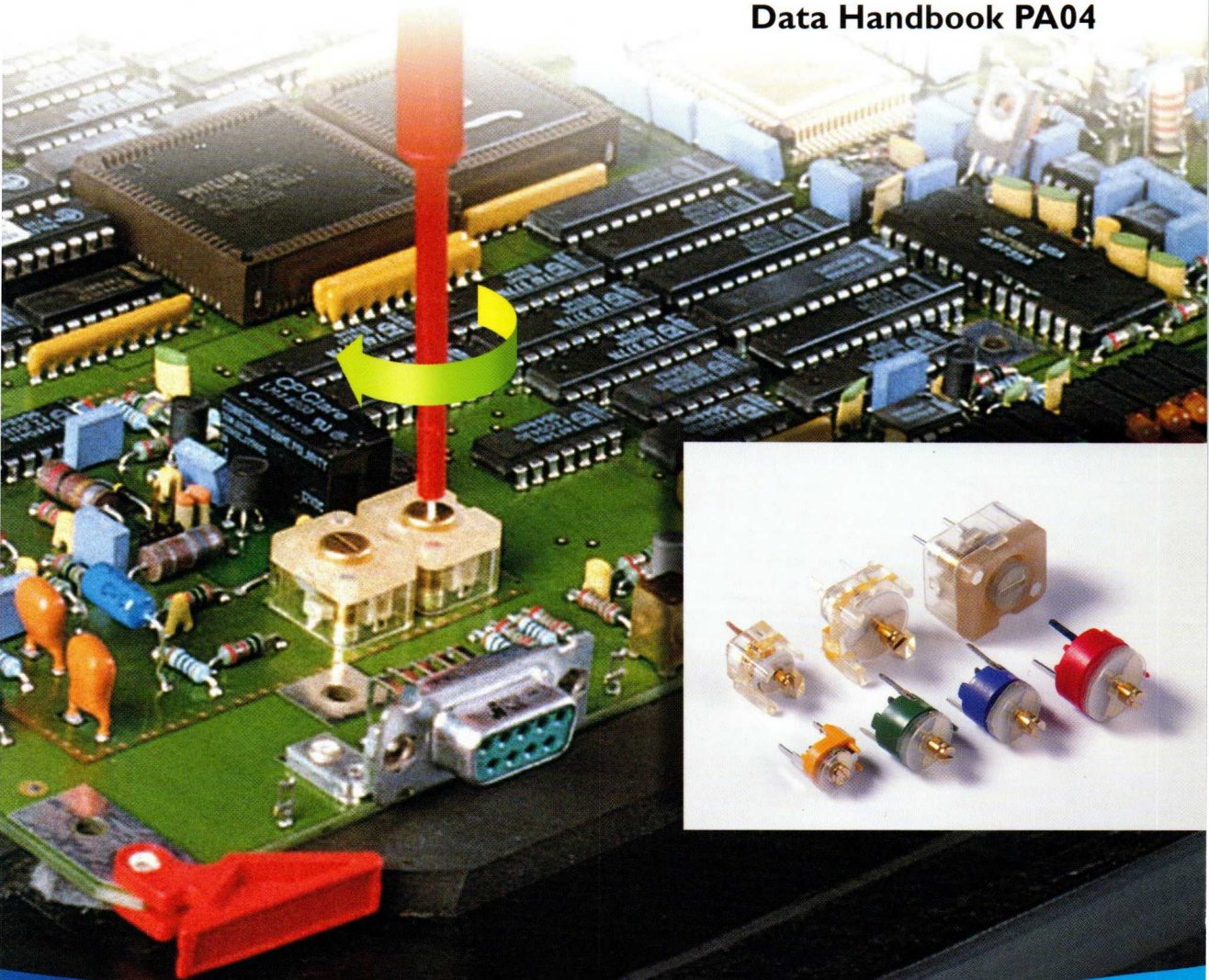


Variable Capacitors

1998/1999

Data Handbook PA04



PHILIPS

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PRODUCT SAFETY

In striving for state-of-the-art perfection, we continuously improve components and processes with respect to environmental demands. Our components offer no hazard to the environment in normal use when operated or stored within the limits specified in the data sheet.

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Variable Capacitors

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DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

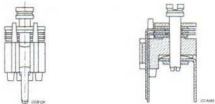
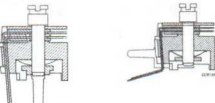
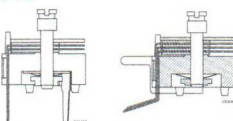
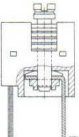
LIFE SUPPORT APPLICATIONS

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Variable Capacitors

Selection guide

FILM DIELECTRIC TRIMMERS

HOUSING DIMENSIONS (mm)	$C_{\min}/C_{\max}$ (pF)	RATED VOLTAGE (V)	TEMP. COEFF. (10 ⁻⁶ /K)	DIELECTRIC/ TEMP. RANGE (°C)	CATALOGUE NUMBER	PAGE
General purpose						
Ø5 	0.35/1.5 to 4/27	150	-450 ±550 to -200 ±550	PP: -40 to +70 PC, PTFE: -40 to +85	2222 808	6
Ø7.5 	1.4/5.5 to 3/50	250	-250 ±800 to -50 ±500	PP: -40 to +70 PE, PC, PTFE, PET: -40 to +85	2222 808	14
Ø10 	2.5/15 to 7/105	150	-200 ±700 to -50 ±400	PP: -40 to +70 PC, PTFE: -40 to +85	2222 808	22
Professional purpose						
6 × 8 × 9 	0.5/2 to 2/18	300	-250 ±350	-40 to +125	2222 809 05...	31
11 × 14 × 9 	2/12 to 7/150	200	0 ±200	-40 to +125	2222 809 07...	38
10 × 11 × 11 	4/38 and 5/57	250	-200 ±250	-40 to +125	2222 809 080..	43
8 × 9 × 10 	1.4/5.5 to 3/18	250	-250 ±350	-40 to +125	2222 809 090..	49

PRODUCT DATA

Film dielectric trimmers

2222 808

Ø5 mm

FEATURES

- Housing diameter 5 mm
- Top and bottom or top adjustment
- Round or hexagonal head
- Vertical version.

APPLICATIONS

- For consumer and industrial equipment.

DESCRIPTION

The vanes of the trimmer are stacked on a sturdy plastic base. The colour of the base indicates the maximum capacitance (see Tables 4, 5 and 6). The dielectric is a film of polypropylene (PP) or polytetrafluorethylene (PTFE) for the standard versions and polycarbonate (PC) for the economic and hexagonal head versions. The dielectric supports the vanes in such a way that good stability is ensured and no microphony can occur.

Flux absorption between the vanes is prevented.

Cleaning with solvents is not advised.

For outline drawings and dimensions see Figs 1 and 2.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with "MIL-STD-105D" and "IEC 60410".

<0.15% major defects

<0.65% minor defects.

Each capacitor is tested for minimum $C_{\max}$ and is also subjected to the full test voltage.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
$C_{\min}/C_{\max}$	0.35/1.5 to 4/27 pF
Rated voltage (DC)	150 V
Test voltage (DC) for 1 minute	300 V
Maximum contact resistance	10 mΩ
Minimum insulation resistance	10000 MΩ
Tan δ at $C_{\max}$, 1 MHz:	
PC	$\leq 70 \times 10^{-4}$
PP, PTFE	$\leq 10 \times 10^{-4}$
Category temperature range:	
PP	-40 to +70 °C
PC, PTFE	-40 to +85 °C
Climatic category (IEC 60068):	
PP	40/070/21
PC, PTFE	40/085/21
Minimum storage temperature	-55 °C
Related specification	IEC 60418-1 and 4

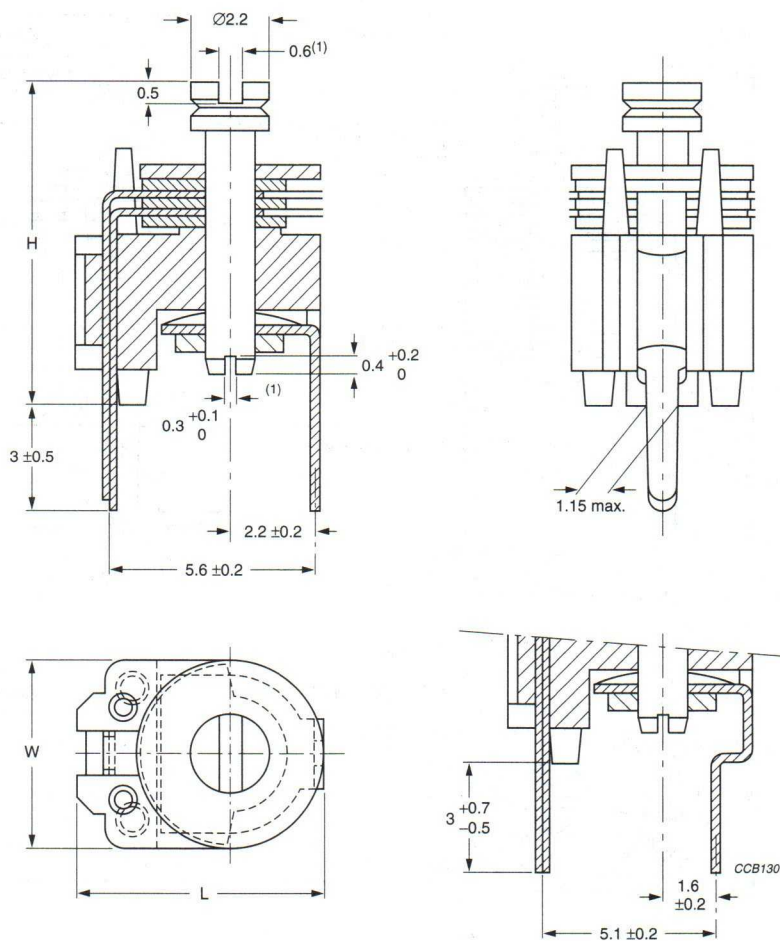
MECHANICAL DATA

DESCRIPTION	VALUE
Effective angle of rotation	180°
Operating torque:	
$C_{\max} < 20$ pF	1 to 15 mNm
$C_{\max} \geq 20$ pF	1 to 25 mNm
Maximum axial thrust	2 N

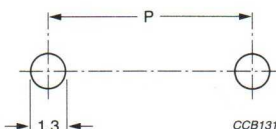
Film dielectric trimmers

2222 808

Ø5 mm



a. Dimensional outlines.



b. Hole pattern.

Dimensions in mm.

For dimensions H, W and L, see Tables 1 and 2.

For dimension P, see Table 3.

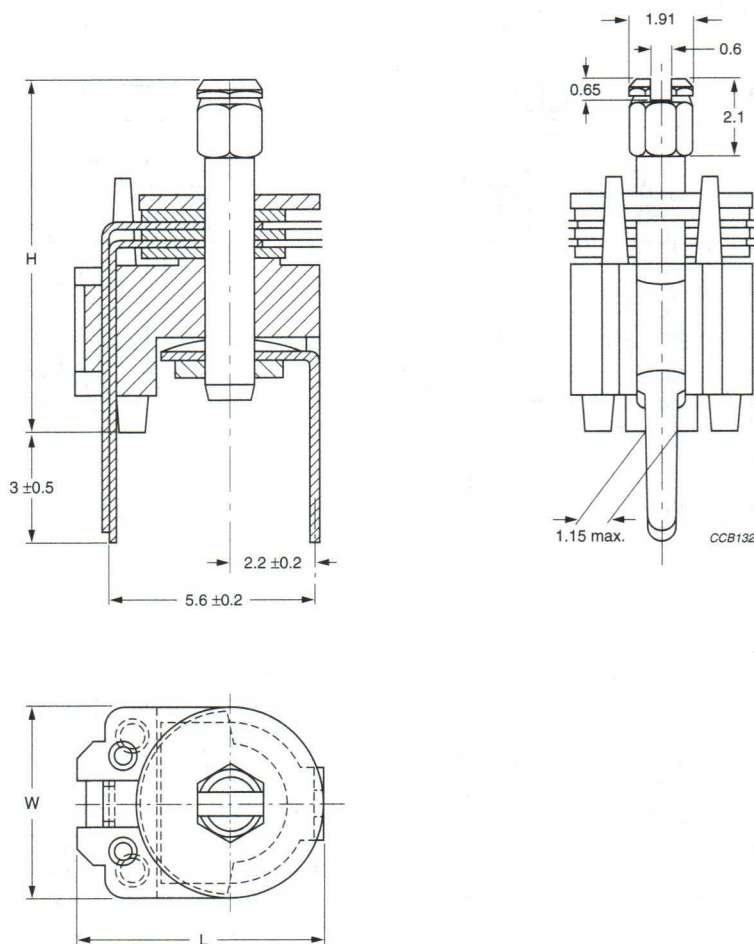
(1) The position of the shaft is not relative to the position of the vanes.

Fig.1 Trimmers 2222 808 series, with round head.

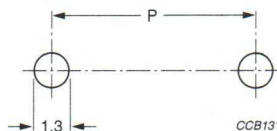
Film dielectric trimmers

2222 808

Ø5 mm



a. Dimensional outlines.



b. Hole pattern.

Dimensions in mm.

For dimensions H, W and L, see Table 2.

For dimension P, see Table 3.

Fig.2 Trimmers 2222 808 series, with hexagonal head.

Film dielectric trimmers

2222 808

Ø5 mm

Table 1 Standard versions; capacitance and relevant physical dimensions; see Fig.1

$C_{\min}/C_{\max}$ (pF)	$H_{\max}$ (mm)	$W_{\max}$ (mm)	$L_{\max}$ (mm)
0.35/1.5	7.0	5.5	7.3
1.5/5	7.0	5.5	7.3
3/10	7.0	5.5	7.3
3/15	8.8	5.5	7.3
4/20	8.8	5.5	7.3
4/27	9.0	6.2	7.8

Table 2 Hexagonal and economic versions; relevant physical dimensions; see Fig.2

TYPE OF HEAD	$H_{\max}$ (mm)	$W_{\max}$ (mm)	$L_{\max}$ (mm)
Hexagonal	9.7	5.5	7.3
Round	7.7	5.5	7.3

MOUNTING

The trimmer has a lead pitch of 5.08 mm or 5.6 mm and can be mounted on printed-circuit boards with a minimum hole diameter of 1.25 mm.

PACKAGING

Bulk packaged in cardboard boxes lined with expanded plastic, 1000 units per box.

Film dielectric trimmers

2222 808

Ø5 mm

ORDERING INFORMATION

Table 3 Selection chart; see Figs 1 and 2

$C_{\min}/C_{\max}$ (pF)	CATALOGUE NUMBER 2222 808		
	TOP AND BOTTOM ADJUSTMENT (P = 5.6 mm)	TOP ADJUSTMENT ONLY (P = 5.6 mm)	TOP ADJUSTMENT ONLY (P = 5.08 mm)
Standard versions: polytetrafluorethylene, round head			
0.35/1.5	22158	—	—
Standard versions: polypropylene, round head			
1.5/5	23508	—	20508
3/10	23109	—	20109
3/15	23159	—	20159
4/20	23209	—	20209
4/27	23279	—	20279
Economic versions: polycarbonate, round head			
1.5/7	—	20126	—
1.6/15	—	20127	—
3/20	—	20123	—
3.5/27	—	20128	—
Economic versions: polycarbonate, hexagonal head			
1.5/7	—	21708	—
1.6/15	—	21159	—
3/20	—	21209	—
3.5/27	—	21279	—

Film dielectric trimmers

2222 808

Ø5 mm

ELECTRICAL DATA

Table 4 Standard versions with round head

GUARANTEED MAX. C_{min} / MIN. C_{max} at 200 kHz (pF)	tan δ at $C_{max} \times 10^{-4}$		TEMP. COEFF. ⁽¹⁾ ($10^{-6}/K$)	MIN. f_{res} at C_{max} (MHz)	COLOUR OF BASE	SMALLEST PACKAGING QUANTITY	CATALOGUE NUMBER
	1 MHz	100 MHz					
0.35/1.5	≤ 10	—	-450 ± 550	—	—	1 000	2222 808 22158
1.5/5	≤ 10	≤ 25	-200 ± 550	700	grey	1 000	2222 808 20508
							2222 808 23508
3/10	≤ 10	≤ 25	-250 ± 550	500	yellow	1 000	2222 808 20109
							2222 808 23109
3/15	≤ 10	≤ 25	-250 ± 550	400	blue	1 000	2222 808 20159
							2222 808 23159
4/20	≤ 10	≤ 25	-250 ± 400	300	green	1 000	2222 808 20209
							2222 808 23209
4/27	≤ 10	≤ 25	-250 ± 400	300	red	1 000	2222 808 20279
							2222 808 23279

Note

1. C : 60% to 80% of C_{max} ; T_{amb} : from +20 °C to +70 °C.

Table 5 Economic versions with round head

REFERENCE C_{min}/C_{max} (pF)	tan δ at $C_{max} \times 10^{-4}$ (1 MHz)	TEMP. COEFF. ($10^{-6}/K$)	COLOUR OF BASE	SMALLEST PACKAGING QUANTITY	CATALOGUE NUMBER
1.5/7	≤ 70	-50 ± 550	grey	1 000	2222 808 20126
1.6/15	≤ 70	-50 ± 550	blue	1 000	2222 808 20127
3/20	≤ 70	-50 ± 550	green	1 000	2222 808 20123
3.5/27	≤ 70	-100 ± 400	red	1 000	2222 808 20128

Table 6 Versions with hexagonal head

REFERENCE C_{min}/C_{max} (pF)	tan δ at $C_{max} \times 10^{-4}$ (1 MHz)	TEMP. COEFF. ($10^{-6}/K$)	COLOUR OF BASE	SMALLEST PACKAGING QUANTITY	CATALOGUE NUMBER
1.5/7	≤ 70	-50 ± 550	grey	1 000	2222 808 21708
1.6/15	≤ 70	-50 ± 550	blue	1 000	2222 808 21159
3/20	≤ 70	-50 ± 550	green	1 000	2222 808 21209
3.5/27	≤ 70	-100 ± 400	red	1 000	2222 808 21279

Film dielectric trimmers

2222 808

Ø5 mm

TESTS AND REQUIREMENTS

Table 7 Test procedures and requirements

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.2		method of mounting	method A	
14		capacitance drift	after TC measurement	$\Delta C/C: \leq 3\%$ for $C_{\max} \leq 10 \text{ pF}$ $\Delta C/C: \leq 2\%$ for $C_{\max} > 10 \text{ pF}$
19		thrust	axial thrust of 2 N	$\Delta C/C: \leq 0.4\%$
21		robustness of terminations:		
21.1	Ua	tensile	1 N	no damage
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle; 0.5 hours at lower and 0.5 hours at upper category temperature	$\Delta C/C: \leq 2.5\%$
23	T	soldering:		
	Ta	solderability	solder bath immersion 3 mm; 235 °C; 2 s	good wetting no mechanical damage
	Tb	resistance to heat	solder bath: 260 °C; 10 s	no mechanical damage
24	Eb	impact bump	4000 ±10 bumps; 40 g; 6 ms	$\Delta C/C: \leq 1\%$; no mechanical damage
25	Fc	vibration	frequency 10 to 55 Hz; amplitude 0.75 mm; 1.5 hours	$\Delta C/C: \leq 1\%$; no mechanical damage
26		climatic sequence:		$\Delta C/C: \leq 4\%$
26.1	B	dry heat	16 hours at upper category temperature	$\tan \delta$ for PP and PTFE foil: $\leq 15 \times 10^{-4}$ $\tan \delta$ for PC foil: $\leq 80 \times 10^{-4}$ $R_{\text{ins}}: \geq 10000 \text{ M}\Omega$ rotor contact R: $\leq 10 \text{ m}\Omega$
26.2	D	damp heat accelerated, first cycle	1 cycle; 24 hours; +40 °C; 95 to 100% RH	voltage proof: 300 V for 1 minute
26.3	Aa	cold	16 hours; -40 °C	visual examination: no mechanical damage
26.5		damp heat accelerated, remaining cycles	1 cycle; 24 hours; +40 °C; 95 to 100% RH	operating torque: 1 to 20 mNm for $C_{\max} < 20 \text{ pF}$; 1 to 30 mNm for $C_{\max} \geq 20 \text{ pF}$

Film dielectric trimmers

2222 808

Ø5 mm

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
27	Ca	damp heat steady state	21 days; +40 °C; 90 to 95% RH	$\Delta C/C: \leq 3\%$ $\tan \delta$ for PP and PTFE foil: $\leq 15 \times 10^{-4}$; $\tan \delta$ for PC foil: $\leq 80 \times 10^{-4}$ $R_{ins}: \geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 10 \text{ m}\Omega$ voltage proof: 300 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 20 mNm for $C_{max} < 20 \text{ pF}$; 1 to 30 mNm for $C_{max} \geq 20 \text{ pF}$
29		mechanical endurance	10 cycles	$\Delta C/C: \leq 3\%$ $\Delta C/C$ after axial thrust: $\leq 0.3\%$; rotor contact R: $\leq 10 \text{ m}\Omega$ voltage proof: 300 V for 1 minute visual examination: no mechanical damage operating torque: 0.5 to 22.5 mNm for $C_{max} < 20 \text{ pF}$; 0.5 to 30 mNm for $C_{max} \geq 20 \text{ pF}$

Film dielectric trimmers

2222 808

Ø7.5 mm

FEATURES

- Housing diameter 7.5 mm
- For a basic grid of 2.54 mm (0.1") or 2.50 mm
- Top and bottom or top adjustment
- Vertical and horizontal versions
- Round or hexagonal head.

APPLICATIONS

- For consumer and industrial equipment.

DESCRIPTION

The vanes of the trimmer are stacked on a sturdy plastic base. The colour of the base indicates the maximum capacitance (see Table 2). The dielectric is a film of polypropylene (PP), polyethylene (PE), polycarbonate (PC), polytetrafluorethylene (PTFE), or polyethyleneterephthalate (PET) which supports the vanes in such a way that good stability is ensured and no microphony can occur.

Flux absorption between the vanes is prevented.

Cleaning with solvents is not advised.

Versions are available with either a vertical spindle (see Fig.1), or a horizontal spindle (see Fig.2). Both versions have top adjustment by means of a screwdriver or trimming key and bottom adjustment by means of a key as shown in Fig.5.

For outline drawings and dimensions see Figs 1 and 2.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
C_{min}/C_{max}	1.4/5.5 to 3/50 pF
Rated voltage (DC)	250 V
Test voltage (DC) for 1 minute	500 V
Maximum contact resistance	10 mΩ
Minimum insulation resistance	10000 MΩ
Category temperature range:	
PP	-40 to +70 °C
PE, PC, PTFE, PET	-40 to +85 °C
Climatic category (IEC 60068):	
PP	40/070/21
PE, PC, PTFE, PET	40/085/21
Minimum storage temperature	-55 °C
Related specification	IEC 60418-1 and 4

MECHANICAL DATA

DESCRIPTION	VALUE
Effective angle of rotation	180°
Operating torque:	
$C_{max} < 33$ pF	1 to 15 mNm
$C_{max} \geq 33$ pF	1 to 25 mNm
Maximum axial thrust	2 N

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with "MIL-STD-105D" and "IEC 60410":

<0.15% major defects

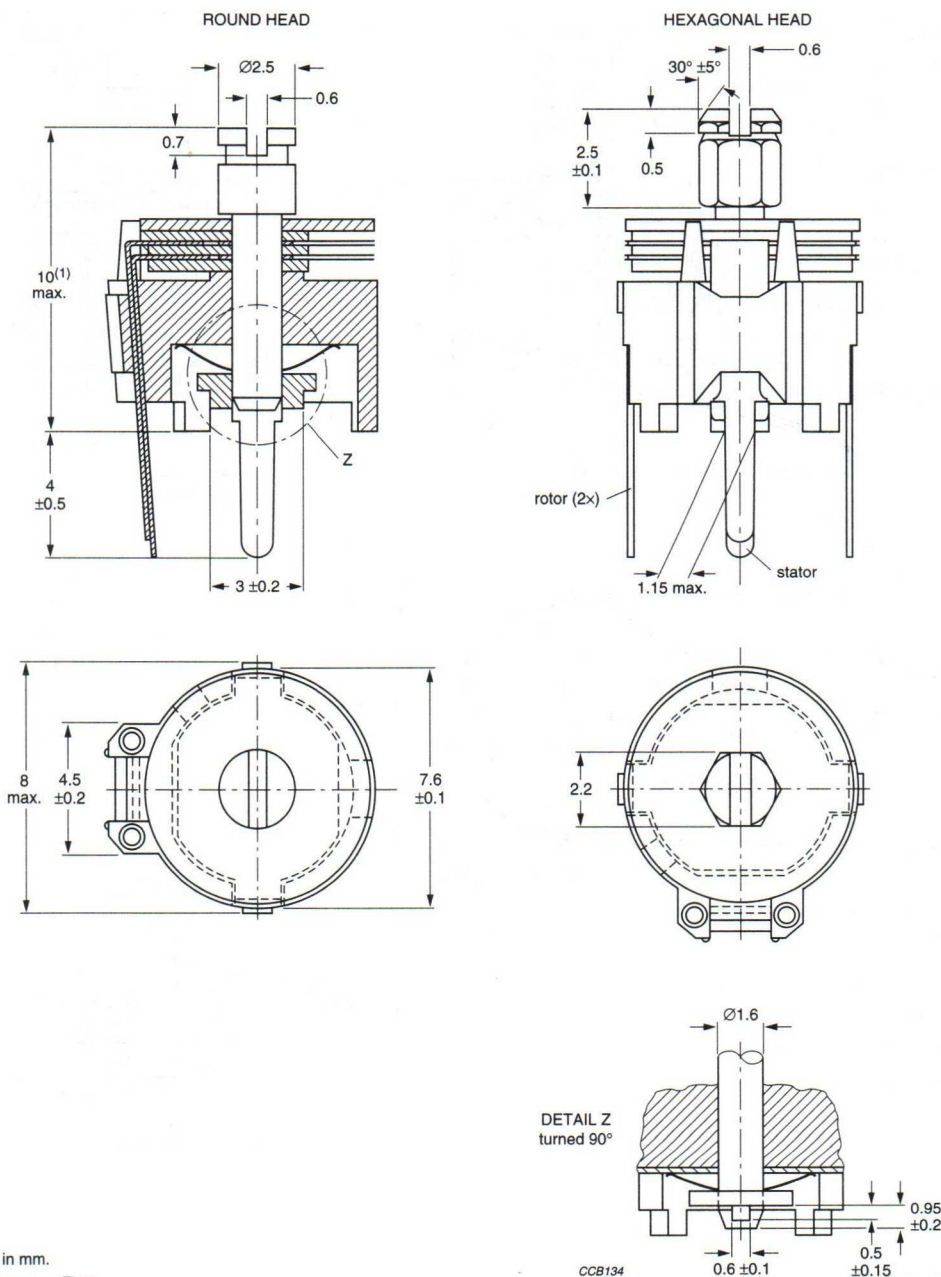
<0.65% minor defects.

Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage.

Film dielectric trimmers

2222 808

Ø7.5 mm



Dimensions in mm.

For hole pattern see Fig.3.

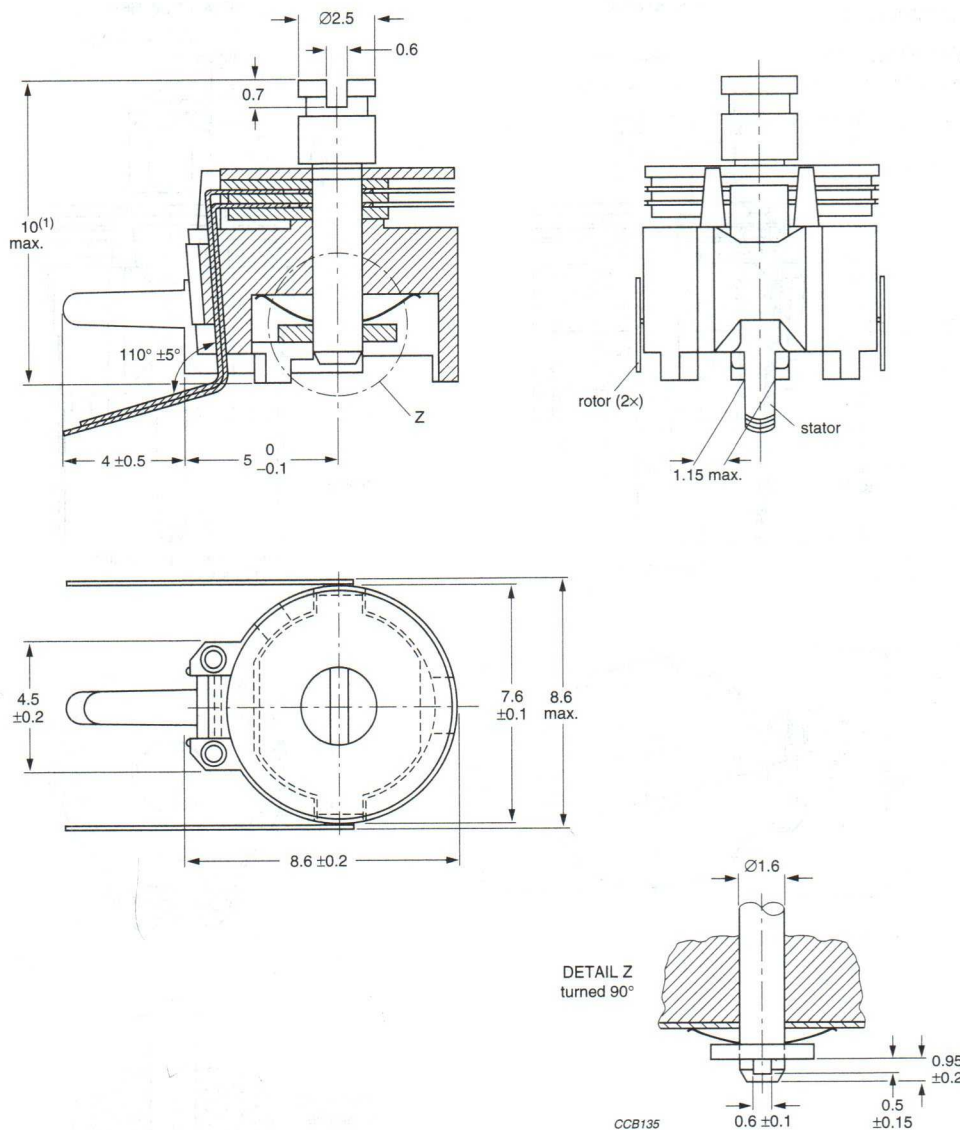
(1) 11 max. for $C_{\max} = 40$ pF and 50 pF.

Fig.1 Trimmers 2222 808 series, vertical version.

Film dielectric trimmers

2222 808

Ø7.5 mm



Dimensions in mm.

For hole pattern see Fig.4.

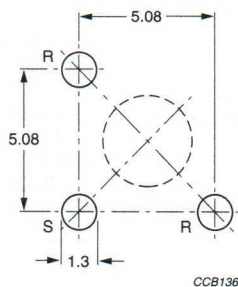
(1) 11 max. for $C_{\text{max}} = 40 \text{ pF}$ and 50 pF .

Fig.2 Trimmers 2222 808 series, horizontal version.

Film dielectric trimmers

2222 808

Ø7.5 mm

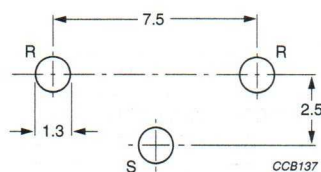


Dimensions in mm.

R = rotor, S = stator.

The large hole is for bottom adjustment and the diameter is determined by user's requirements.

Fig.3 Hole pattern; see Fig.1.



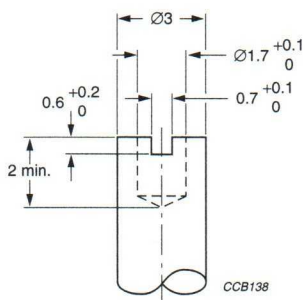
Dimensions in mm.

R = rotor, S = stator.

Fig.4 Hole pattern; see Fig.2.

Adjustment

For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.5.



Dimensions in mm.

Fig.5 Bottom adjustment key.

Film dielectric trimmers

2222 808

Ø7.5 mm

ORDERING INFORMATION

Table 1 Selection chart

$C_{\min}/C_{\max}$ (pF)	CATALOGUE NUMBER 2222 808			
	VERTICAL VERSION			HORIZONTAL VERSION
	ROUND HEAD		HEXAGONAL HEAD	ROUND HEAD
	TOP AND BOTTOM ADJUSTMENT	TOP ADJUSTMENT ONLY	TOP AND BOTTOM ADJUSTMENT	TOP AND BOTTOM ADJUSTMENT
1.4/5.5	11558	00004	—	51558
2/9	00018	—	—	—
2/10	11109	00005	17109	51109
2/10	—	11004	—	—
2/15	11159	—	—	—
2/18	00016	—	—	—
2.5/20	—	11006	—	—
2.5/22	11229	00006	17229	51229
2.5/27	11279	—	—	51279
3/33	11339	—	—	—
3/40	11409	—	17409	51409
3/50	11509	—	17509	51509

MOUNTING

The trimmer can be mounted on printed-circuit boards with a grid of 2.50 mm or 2.54 mm and a minimum hole diameter of 1.25 mm. For hole patterns see Figs 3 and 4.

PACKAGING

Bulk packaged in cardboard boxes lined with expanded plastic. For smallest packaging quantity (SPQ) see Table 2.

Film dielectric trimmers

2222 808
 Ø7.5 mm

ELECTRICAL DATA

Table 2 Electrical characteristics, smallest packaging quantities and catalogue numbers

GUARANTEED MAX. $C_{min}/$ MIN. C_{max} at 200 kHz (pF)	SPINDLE	SHAPE OF HEAD	FIG.	ADJ. MODE	DIEL.	$\tan \delta$ at $C_{max} \times 10^{-4}$		TEMP. COEFF. ($10^{-6}/K$)	MIN. f_{res} at C_{max} (MHz)	COL. OF BASE	SPQ	CATALOGUE NUMBER
						1 MHz	100 MHz					
1.4/5.5	vertical	round	1	top + bottom	PE	≤ 10	≤ 25	-250 ± 350	850	grey	1400	2222 808 11558
	horizontal	round	2	top + bottom							1400	2222 808 00004
2/9	vertical	round	1	top + bottom	PTFE	≤ 10	≤ 15	-150 ± 800	400	yellow	1200	2222 808 51558
	vertical	round	1	top + bottom	PP	≤ 10	≤ 25	-250 ± 800	480	yellow	1400	2222 808 00018
2/10	vertical	hexag.	1	top							1400	2222 808 11109
	horizontal	round	2	top + bottom	PC	≤ 70	≤ 100	-150 ± 800	250	yellow	1000	2222 808 11004
2/15	vertical	round	1	top		≤ 10	≤ 25	-250 ± 600	450	blue	1400	2222 808 11159
2/18	vertical	round	1	top + bottom	PTFE	≤ 10	≤ 15	-250 ± 350	350	green	1400	2222 808 00016
2.5/20	vertical	round	1	top	PET	≤ 160	—	0 ± 1100	250	green	1000	2222 808 11006
2.5/22	vertical	round	1	top + bottom	PP						1400	2222 808 11229
	vertical	hexag.	1	top		≤ 10	≤ 25	-200 ± 500	350	green	1400	2222 808 00006
2.5/27	horizontal	round	2	top + bottom	PC						1400	2222 808 17229
	vertical	round	1	top + bottom		≤ 70	—	-50 ± 500	350	red	1400	2222 808 11279
3/33	horizontal	round	2	top + bottom	PP	≤ 10	—	-250 ± 350	300	brown	1200	2222 808 51279
	vertical	round	1	top + bottom		≤ 10	—	-250 ± 350	300	brown	1400	2222 808 11339
3/40	vertical	round	1	top + bottom	PC	≤ 70	—	-50 ± 400	300	violet	1400	2222 808 11409
	vertical	hexag.	1	top							1400	2222 808 17409
3/50	horizontal	round	2	top + bottom	PC						1200	2222 808 51409
	vertical	round	1	top + bottom		≤ 70	—	-50 ± 500	250	black	1400	2222 808 11509
	vertical	hexag.	1	top							1400	2222 808 17509
	horizontal	round	2	top + bottom							1200	2222 808 51509

Film dielectric trimmers

2222 808
 $\varnothing 7.5 \text{ mm}$

TESTS AND REQUIREMENTS

Table 3 Test procedures and requirements

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.2		method of mounting	method A	
14		capacitance drift	after TC measurement	$\Delta C/C: \leq 1\%$ for $C_{\max} < 40 \text{ pF}$; $\Delta C/C: \leq 2.5\%$ for $C_{\max} \geq 40 \text{ pF}$
19		thrust	axial thrust of 2 N	$\Delta C/C: \leq 0.3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1 N	no damage
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle; 0.5 hours at lower and 0.5 hours at upper category temperature	$\Delta C/C: \leq 2\%$
23	T	soldering:		
	Ta	solderability	solder bath immersion 3 mm; 235 °C; 2 s	good wetting no mechanical damage
	Tb	resistance to heat	solder bath: 260 °C; 10 s	no mechanical damage
24	Eb	impact bump	4000 $\pm$ 10 bumps; 40 g; 6 ms	$\Delta C/C: \leq 0.6\%$; no mechanical damage
25	Fc	vibration	frequency 10 to 55 Hz; amplitude 0.35 mm; 1.5 hours	$\Delta C/C: \leq 0.6\%$; no mechanical damage
26		climatic sequence:		$\Delta C/C: \leq 4$
26.1	B	dry heat	16 hours at upper category temperature	$\tan \delta: \leq 10 \times 10^{-4}$ for $C_{\max} < 27 \text{ pF}$; $\tan \delta: \leq 70 \times 10^{-4}$ for $C_{\max} \geq 27 \text{ pF}$; $\tan \delta: \leq 80 \times 10^{-4}$ for $C_{\max} \geq 40 \text{ pF}$ $R_{\text{ins}}: \geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 10 \text{ m}\Omega$
26.2	D	damp heat accelerated, first cycle	1 cycle; 24 hours; +40 °C; 95 to 100% RH	voltage proof: 500 V for 1 minute
26.3	Aa	cold	16 hours; -40 °C	visual examination: no mechanical damage
26.5		damp heat accelerated, remaining cycles	1 cycle; 24 hours; +40 °C; 95 to 100% RH	operating torque: 1 to 15 mNm for $C_{\max} < 33 \text{ pF}$; 1 to 25 mNm for $C_{\max} \geq 33 \text{ pF}$

Film dielectric trimmers

2222 808

Ø7.5 mm

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
27	Ca	damp heat steady state	21 days; +40 °C; 90 to 95% RH	$\Delta C/C: \leq 5\%$ $\tan \delta: \leq 30 \times 10^{-4}$ for $C_{\max} < 27 \text{ pF}$; $\tan \delta: \leq 70 \times 10^{-4}$ for $C_{\max} \geq 27 \text{ pF}$; $\tan \delta: \leq 80 \times 10^{-4}$ for $C_{\max} \geq 40 \text{ pF}$ $R_{\text{ins}}: \geq 10000 \text{ M}\Omega$; rotor contact $R: \leq 10 \text{ m}\Omega$ voltage proof: 500 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 15 mNm for $C_{\max} < 33 \text{ pF}$; 1 to 25 mNm for $C_{\max} \geq 33 \text{ pF}$
29		mechanical endurance	10 cycles	$\Delta C/C: \leq 1.5\%$ $\Delta C/C$ after axial thrust: $\leq 0.3\%$; rotor contact $R: \leq 10 \text{ m}\Omega$ voltage proof: 500 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 15 mNm for $C_{\max} < 33 \text{ pF}$; 1 to 25 mNm for $C_{\max} \geq 33 \text{ pF}$

Film dielectric trimmers

2222 808

Ø10 mm

FEATURES

- Housing diameter 10 mm
- For a basic grid of 2.54 mm (0.1") or 2.50 mm
- Top and bottom or top adjustment
- Vertical and horizontal versions
- Round or hexagonal head.

APPLICATIONS

- For consumer and industrial equipment.

DESCRIPTION

The vanes of the trimmer are stacked on a sturdy plastic base. The colour of the base indicates the maximum capacitance (see Table 2). The dielectric is a film of polypropylene (PP), polycarbonate (PC) or polytetrafluoroethylene (PTFE), which supports the vanes in such a way that good stability is ensured and no microphony can occur.

Flux absorption between the vanes is prevented.

Cleaning with solvents is not advised.

Versions are available with either a vertical spindle (see Figs 1 and 2), or a horizontal spindle (see Fig.3). Both versions have top adjustment by means of a screwdriver or trimming key and bottom adjustment by means of a key as shown in Fig.7.

For outline drawings and dimensions see Figs 1, 2 and 3.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
C_{min}/C_{max}	2.5/15 to 7/105 pF
Rated voltage (DC)	150 V
Test voltage (DC) for 1 minute	300 V
Maximum contact resistance	10 mΩ
Minimum insulation resistance	10000 MΩ
Category temperature range:	
PP	-40 to +70 °C
PC, PTFE	-40 to +85 °C
Climatic category (IEC 60068):	
PP	40/070/21
PC, PTFE	40/085/21
Minimum storage temperature	-55 °C
Related specification	IEC 60418-1 and 4

MECHANICAL DATA

DESCRIPTION	VALUE
Effective angle of rotation	180°
Operating torque	2 to 25 mNm
Maximum axial thrust	2 N

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with "MIL-STD-105D" and "IEC 60410":

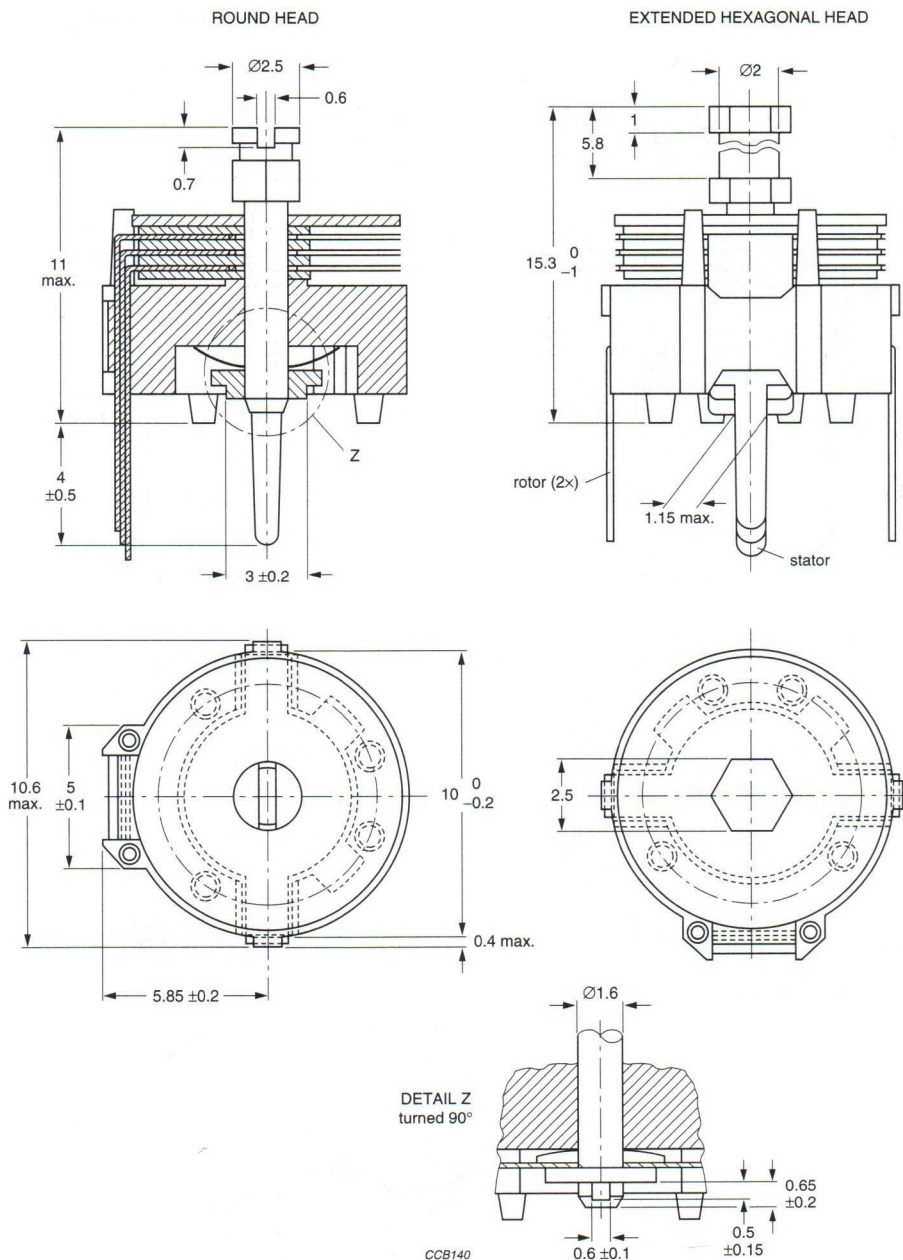
- <0.15% major defects
- <0.65% minor defects.

Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage.

Film dielectric trimmers

2222 808

Ø10 mm



Dimensions in mm.

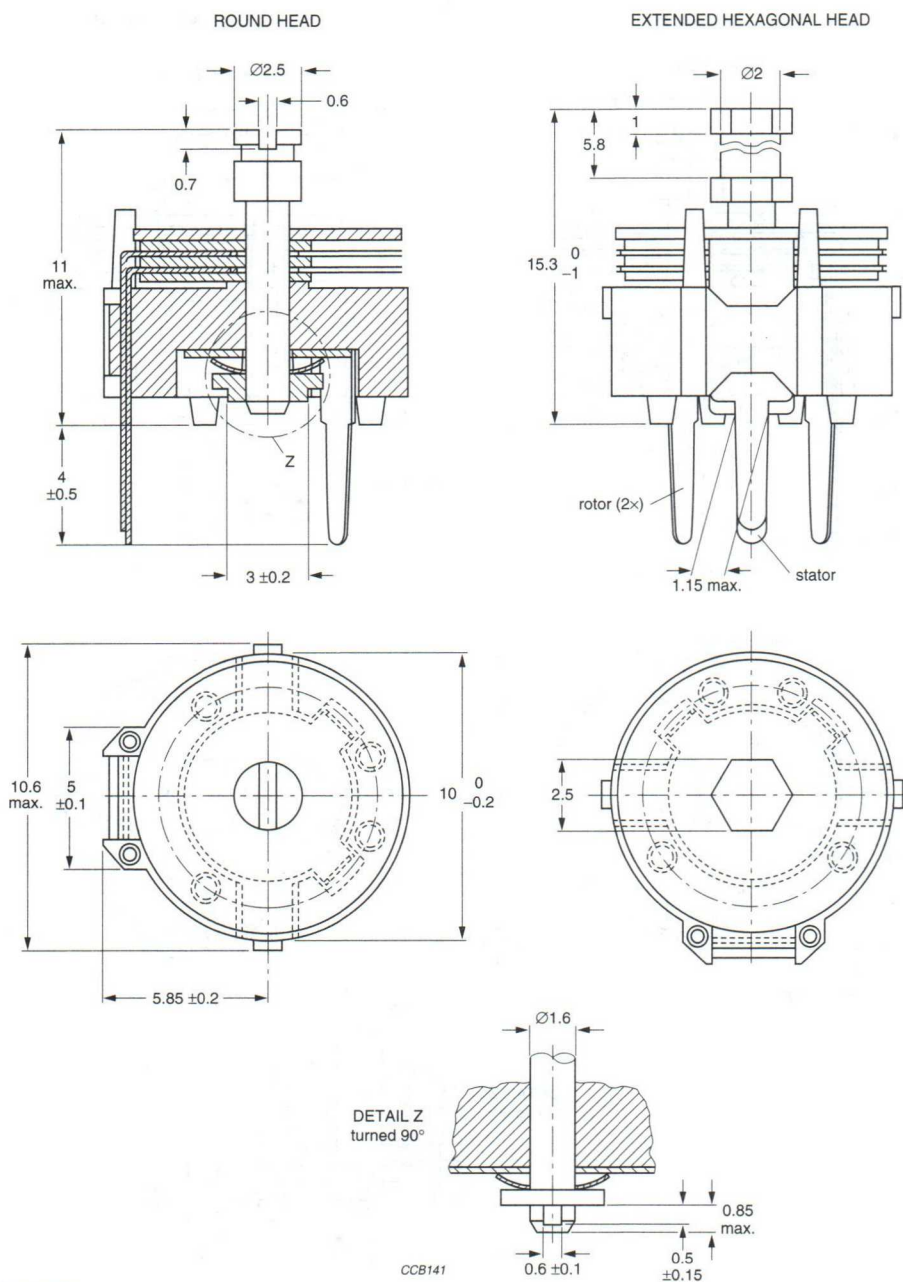
Hole pattern 5 mm × 10 mm; see Fig.4.

Fig.1 Trimmers 2222 808 series, vertical version.

Film dielectric trimmers

2222 808

Ø10 mm



Dimensions in mm.

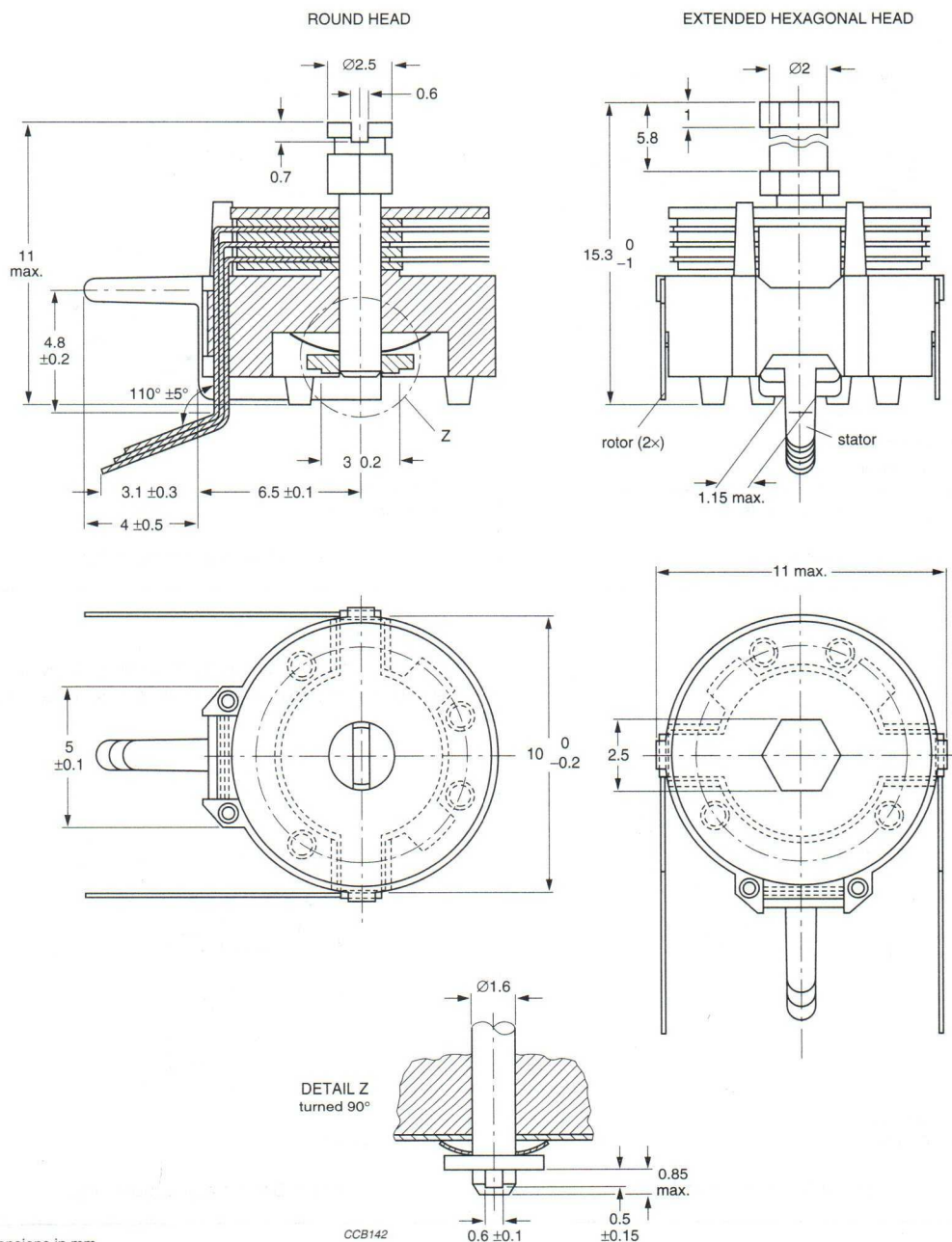
Hole pattern 7.5 mm $\times$ 5 mm; see Fig.5.

Fig.2 Trimmers 2222 808 series, vertical version.

Film dielectric trimmers

2222 808

Ø10 mm



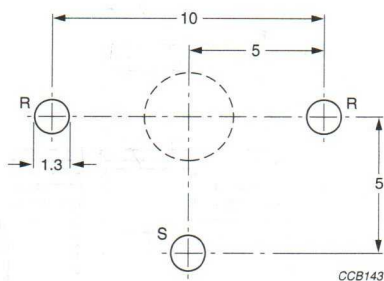
Dimensions in mm.
Hole pattern 5 mm × 10 mm; see Fig.6.

Fig.3 Trimmers 2222 808 series, horizontal version.

Film dielectric trimmers

2222 808

Ø10 mm

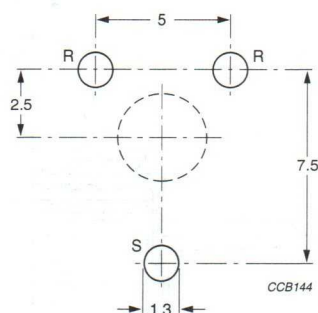


Dimensions in mm.

R = rotor, S = stator.

The large hole is for bottom adjustment and the diameter is determined by user's requirements.

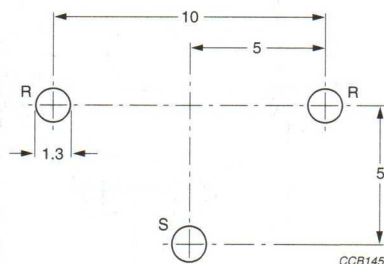
Fig.4 Hole pattern; see Fig.1.



Dimensions in mm.

R = rotor, S = stator.

Fig.5 Hole pattern; see Fig.2.



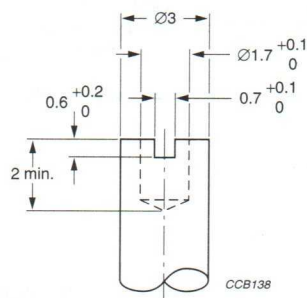
Dimensions in mm.

R = rotor, S = stator.

Fig.6 Hole pattern; see Fig.3.

Adjustment

For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.7.



Dimensions in mm.

Fig.7 Bottom adjustment key.

Film dielectric trimmers

2222 808

Ø10 mm

ORDERING INFORMATION

Table 1 Selection chart

$C_{\min}/C_{\max}$ (pF)	CATALOGUE NUMBER 2222 808						
	HORIZONTAL VERSION		VERTICAL VERSION				
	HOLE PATTERN 5 mm × 10 mm		HOLE PATTERN 5 mm × 10 mm		HOLE PATTERN 7.5 mm × 5 mm		
	ROUND HEAD	HEX HEAD	ROUND HEAD	HEX. HEAD	ROUND HEAD	HEX. HEAD	ROUND HEAD
	TOP AND BOTTOM ADJUSTMENT		TOP AND BOTTOM ADJUSTMENT				TOP ADJUSTMENT
2.5/15	61159	—	31159	—	32159	—	—
3/22.5	61229	—	31229	—	32229	—	—
5.5/40	61409	—	31409	—	32409	—	—
5.5/50	—	—	01029	—	01006	—	—
5.5/65	61659	64659	31659	34659	32659	—	01001
6/80	61809	64809	31809	34809	32809	35809	—
7/105	61101	64101	31101	—	32101	—	—
6/120	—	—	31121	—	—	—	—

MOUNTING

The trimmer can be mounted on printed-circuit boards with a grid of 2.50 mm or 2.54 mm and a minimum hole diameter of 1.25 mm. For hole patterns see Figs 4, 5 and 6.

PACKAGING

Bulk packaged in cardboard boxes lined with expanded plastic. For smallest packaging quantities (SPQ) see Table 2.

Film dielectric trimmers

2222 808

Ø10 mm

ELECTRICAL DATA

Table 2 Electrical characteristics and catalogue numbers

GUARANTEED MAX. C _{min} / MIN. C _{max} at 200 kHz (pF)	SPINDLE	SHAPE OF HEAD	FIG.	ADJ. MODE	DIEL.	tan δ at C _{max} × 10 ⁻⁴		TEMP. COEFF. (10 ⁻⁶ /K)	MIN. f _{res} at C _{max} (MHz)	COL. OF BASE	SPQ	CATALOGUE NUMBER
						1 MHz	100 MHz					
2.5/15	vertical	round	1	top + bottom	PP	≤10	≤25	-200 ±700	420	blue	800	2222 808 31159
	2		800			2222 808 32159						
	3		700			2222 808 61159						
3/22.5	vertical	round	1	top + bottom	PP	≤10	≤25	-200 ±700	200	green	800	2222 808 31229
	2		800			2222 808 32229						
	3		700			2222 808 61229						
5.5/40	vertical	round	1	top + bottom	PP	≤10	≤25	-200 ±400	200	grey	800	2222 808 31409
	2		800			2222 808 32409						
	3		700			2222 808 61409						
5.5/50	vertical	round	1	top + bottom	PTFE	≤10	≤25	-200 ±400	170	yellow	800	2222 808 01029
	2	800	2222 808 01006									
5.5/65	vertical	round	2	top	PP	≤10	≤25	-200 ±500	170	yellow	800	2222 808 01001
		round	1	800							2222 808 31659	
		round	2	800							2222 808 32659	
	horizontal	hexag.	1	700							2222 808 34659	
		round	3	700							2222 808 61659	
		hexag.	3	600							2222 808 64659	
6/80	vertical	round	1	top + bottom	PC	≤70	-	-50 ±400	170	red	800	2222 808 31809
		hexag.	1								700	2222 808 34809
		round	2								800	2222 808 32809
	horizontal	hexag.	2								700	2222 808 35809
		round	3								700	2222 808 61809
		hexag.	3								600	2222 808 64809
7/105	vertical	round	1	top + bottom	PC	≤70	-	-50 ±400	170	violet	800	2222 808 31101
		round	2								800	2222 808 32101
	horizontal	round	3								700	2222 808 61101
		hexag.	3								600	2222 808 64101
6/120	vertical	round	2	top + bottom	PC	≤70	-	-50 ±400	170	violet	800	2222 808 31121

Film dielectric trimmers

2222 808

Ø10 mm

TESTS AND REQUIREMENTS

Table 3 Test procedures and requirements

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.2		method of mounting	method A	
14		capacitance drift	after TC measurement	$\Delta C/C: \leq 4.5\%$ for $C_{\max} < 40$ pF; $\Delta C/C: \leq 2.5\%$ for $C_{\max} \geq 40$ pF
19		thrust	axial thrust of 2 N	$\Delta C/C: \leq 0.3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1 N	no damage
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle; 0.5 hours at lower and 0.5 hours at upper category temperature	$\Delta C/C: \leq 1.5\%$
23	T	soldering:		
	Ta	solderability	solder bath immersion 3 mm; 235 °C; 2 s	good wetting no mechanical damage
	Tb	resistance to heat	solder bath: 260 °C; 10 s	no mechanical damage
24	Eb	impact bump	4000 $\pm$ 10 bumps; 40 g; 6 ms	$\Delta C/C: \leq 0.4\%$; no mechanical damage
25	Fc	vibration	frequency 10 to 55 Hz; amplitude 0.35 mm; 1.5 hours	$\Delta C/C: \leq 0.8\%$; no mechanical damage
26		climatic sequence:		
26.1	B	dry heat	16 hours at upper category temperature	$\Delta C/C: \leq 3\%$ for $C_{\max} < 80$ pF; $\Delta C/C: \leq 6\%$ for $C_{\max} \geq 80$ pF $\tan \delta: \leq 15 \times 10^{-4}$ for $C_{\max} < 80$ pF; $\tan \delta: \leq 80 \times 10^{-4}$ for $C_{\max} \geq 80$ pF $R_{\text{ins}}: \geq 10000$ M Ω ; rotor contact R: ≤ 10 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle; 24 hours; +40 °C; 95 to 100% RH	voltage proof: 300 V for 1 minute
26.3	Aa	cold	16 hours; -40 °C	visual examination: no mechanical damage
26.5		damp heat accelerated, remaining cycles	1 cycle; 24 hours; +40 °C; 95 to 100% RH	operating torque: 2 to 35 mNm

Film dielectric trimmers

2222 808

Ø10 mm

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
27	Ca	damp heat steady state	21 days; +40 °C; 90 to 95% RH	$\Delta C/C$: $\leq 3\%$ for $C_{\max} < 100 \text{ pF}$; $\leq 3.5\%$ for $C_{\max} \geq 100 \text{ pF}$ $\tan \delta$: $\leq 20 \times 10^{-4}$ for $C_{\max} < 80 \text{ pF}$; $\tan \delta$: $\leq 80 \times 10^{-4}$ for $C_{\max} \geq 80 \text{ pF}$ R_{ins} : $\geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 10 \text{ m}\Omega$ voltage proof: 300 V for 1 minute visual examination: no mechanical damage operating torque: 2 to 35 mNm
29		mechanical endurance	10 cycles	$\Delta C/C$: $\leq 1\%$ $\Delta C/C$ after axial thrust: $\leq 0.4\%$; rotor contact R: $\leq 10 \text{ m}\Omega$ voltage proof: 300 V for 1 minute visual examination: no mechanical damage operating torque: 1.5 to 37 mNm

Film dielectric trimmers

2222 809 05...

FEATURES

- High temperature type
- Housing dimensions:
6 mm × 8 mm × 9 mm
- For a basic grid of 2.54 mm
- Top and bottom adjustment
- Round or hexagonal head
- Vertical version.

APPLICATIONS

- For fine adjustment in professional applications.

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and plated brass stator with PTFE film as the dielectric. The stator plate tags are heat sealed to the housing.

The rotor contact surfaces are plated to ensure a long life and a stable contact even under severe climatic conditions. A coloured dot indicates the maximum capacitance.

Cleaning with solvents is not advised.

Versions are available with either a round head or hexagonal head. Both versions have top adjustment by means of a screwdriver or trimming key and bottom adjustment by means of a key as shown in Fig.4.

For outline drawings and dimensions see Figs 1 and 2.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
$C_{\min}/C_{\max}$	0.5/2 to 2/18 pF
Rated voltage (DC)	300 V
Test voltage (DC) for 1 minute	600 V
Maximum contact resistance	5 mΩ
Minimum insulation resistance between stator and rotor	10000 MΩ
Category temperature range	-40 to +125 °C
Climatic category (IEC 60068)	40/125/21
Related specification	IEC 60418-1 and 4
Minimum storage temperature	-55 °C

MECHANICAL DATA

DESCRIPTION	VALUE
Effective angle of rotation	180°
Operating torque:	
$C_{\max} \leq 3.5$ pF	1 to 15 mNm
$C_{\max} > 3.5$ pF	1 to 20 mNm
Maximum axial thrust	2 N

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with "MIL-STD-105D" and "IEC 60410".

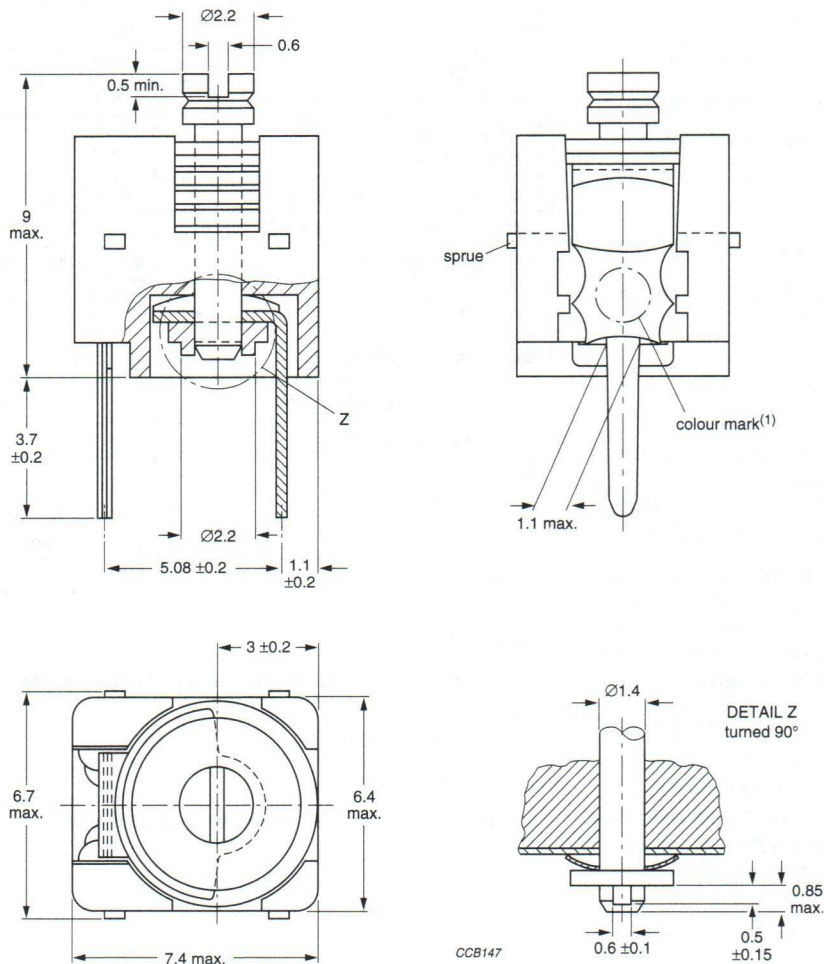
<0.15% major defects

<0.65% minor defects.

Each capacitor is tested for minimum $C_{\max}$ and is also subjected to the full test voltage.

Film dielectric trimmers

2222 809 05...



Dimensions in mm.

For hole pattern see Fig.3.

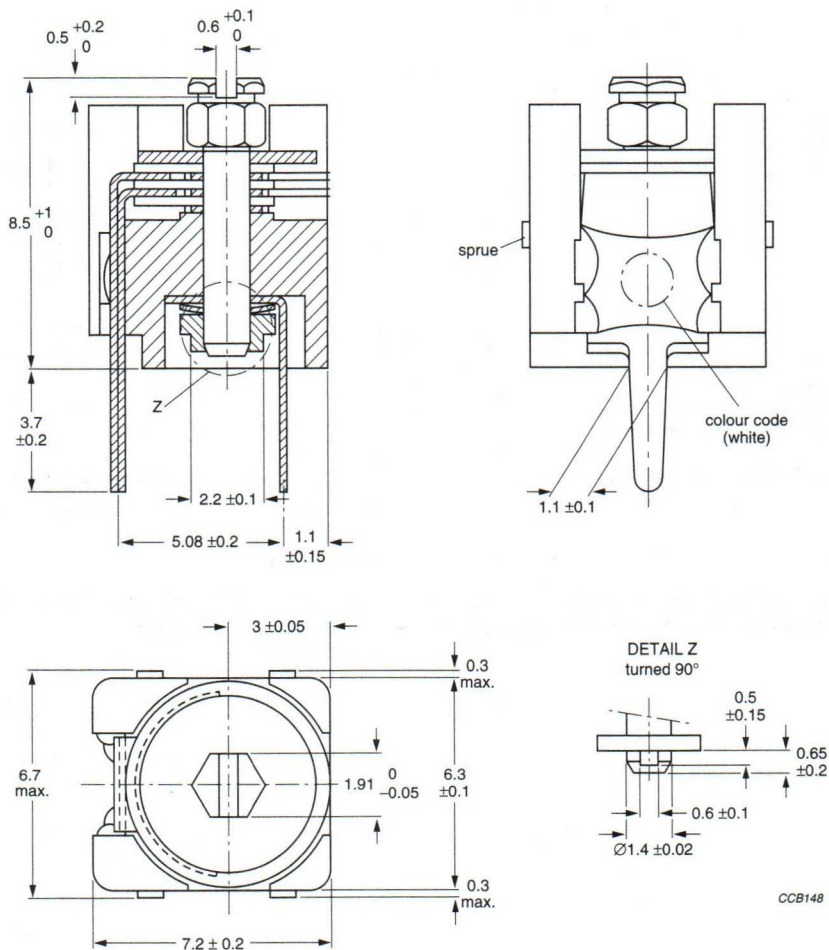
Version with flux guard available; see Table 1.

(1) For colour of dot see Table 2.

Fig.1 Trimmers 2222 809 05... series, with round heads.

Film dielectric trimmers

2222 809 05...

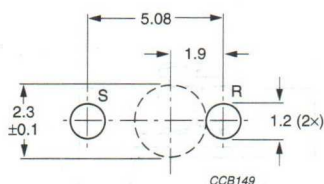


Dimensions in mm.
For hole pattern see Fig.3.

Fig.2 Trimmers 2222 809 05... series, with hexagonal heads.

Film dielectric trimmers

2222 809 05...



Dimensions in mm.

R = rotor, S = stator.

The large hole is for bottom adjustment and the diameter is determined by user's requirements.

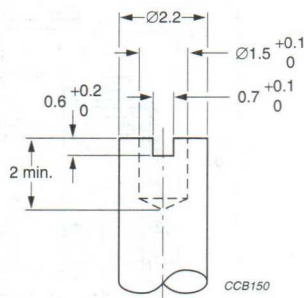
Fig.3 Hole pattern; see Figs 1 and 2.

MOUNTING

The trimmer can be mounted on printed-circuit boards with a minimum hole diameter of 2.54 mm. For hole pattern see Fig.3.

Adjustment

For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.4.



Dimensions in mm.

Fig.4 Bottom adjustment key.

PACKAGING

Blister packs of 70 units each. For smallest packaging quantities (SPQ) see Table 2.

Film dielectric trimmers

2222 809 05...

ORDERING INFORMATION

Table 1 Selection chart

$C_{\min}/C_{\max}$ (pF)	CATALOGUE NUMBER 2222 809 05...		
	TOP AND BOTTOM ADJUSTMENT		
	ROUND HEAD	ROUND HEAD AND FLUX GUARD	HEXAGONAL HEAD
0.5/2	011	—	021
1.2/3.5	215	001	225
1.8/10	216	—	226
2/18	217	—	227

ELECTRICAL DATA

Table 2 Electrical characteristics and catalogue numbers

GUARANTEED MAX. $C_{\min}$ / MIN. $C_{\max}$ at 200 kHz (pF)	SHAPE OF HEAD	FIG.	tan δ at $C_{\max} \times 10^{-4}$		TEMP. COEFF. ⁽¹⁾ ($10^{-6}/K$)	MIN. f_{res} at $C_{\max}$ (MHz)	COL. OF DOT	SPQ	CATALOGUE NUMBER
			1 MHz	100 MHz					
0.5/2	round	1	≤ 10	≤ 20	-250 ± 350	1200	none	700	2222 809 05011
	hexag.	2						700	2222 809 05021
1.2/3.5	round	1	≤ 10	≤ 20	-250 ± 350	850	orange	700	2222 809 05001
	round	1						700	2222 809 05215
	hexag.	2						700	2222 809 05225
1.8/10	round	1	≤ 10	≤ 20	-250 ± 350	580	white	700	2222 809 05216
	hexag.	2						700	2222 809 05226
2/18	round	1	≤ 10	≤ 25	-250 ± 350	360	red	700	2222 809 05217
	hexag.	2						700	2222 808 05227

Note

1. C : 60% to 80% of $C_{\max}$; T_{amb} : from $+20\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$.

Film dielectric trimmers

2222 809 05...

TESTS AND REQUIREMENTS

Table 3 Test procedures and requirements

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.2		method of mounting	method A	
14		capacitance drift	after TC measurement	$\Delta C/C$: $\leq 2.5\%$; 4% for 2 pF
19		thrust	axial thrust of 2 N	$\Delta C/C$: $\leq 0.3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1 N	no damage
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle; 0.5 hours at lower and 0.5 hours at upper category temperature	$\Delta C/C$: $\leq 2.5\%$
23	T	soldering:		
	Ta	solderability	solder bath immersion 3 mm; 235 °C; 2 s	good wetting no mechanical damage
	Tb	resistance to heat	solder bath: 260 °C; 10 s	no mechanical damage
24	Eb	impact bump	4000 $\pm$ 10 bumps; 40 g; 6 ms	$\Delta C/C$: $\leq 0.6\%$; no mechanical damage
25	Fc	vibration	frequency 10 to 55 Hz; amplitude 0.35 mm; 1.5 hours	$\Delta C/C$: $\leq 0.2\%$; no mechanical damage
26		climatic sequence:		$\Delta C/C$: $\leq 2.5\%$
26.1	B	dry heat	16 hours at upper category temperature	$\tan \delta$: $\leq 10 \times 10^{-4}$ for $C_{\max} < 18$ pF; $\tan \delta$: $\leq 40 \times 10^{-4}$ for $C_{\max} \geq 18$ pF R_{ins} : ≥ 10000 M Ω ; rotor contact R: ≤ 5 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle; 24 hours; +40 °C; 95 to 100% RH	voltage proof: 600 V for 1 minute
26.3	Aa	cold	16 hours; -40 °C	visual examination: no mechanical damage
26.5		damp heat accelerated, remaining cycles	1 cycle; 24 hours; +40 °C; 95 to 100% RH	operating torque: 1 to 20 mNm

Film dielectric trimmers

2222 809 05...

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
27	Ca	damp heat steady state	21 days; +40 °C; 90 to 95% RH	$\Delta C/C: \leq 2.5\%$ $\tan \delta: \leq 10 \times 10^{-4}$ for $C_{\max} < 18 \text{ pF}$; $\tan \delta: \leq 25 \times 10^{-4}$ for $C_{\max} \geq 18 \text{ pF}$ $R_{\text{ins}}: \geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 5 \text{ m}\Omega$ voltage proof: 600 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 20 mNm
29		mechanical endurance	25 cycles	$\Delta C/C: \leq 0.3\%$; $\leq 2.5\%$ for 2 pF $\Delta C/C$ after axial thrust: $\leq 0.3\%$; rotor contact R: $\leq 5 \text{ m}\Omega$ voltage proof: 600 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 20 mNm

Film dielectric trimmers

2222 809 07...

FEATURES

- High temperature type
- Housing dimensions:
11 mm × 14 mm × 9 mm
- For a basic grid of 2.54 mm
- Top adjustment
- Vertical version.

APPLICATIONS

- For fine adjustment in professional applications.

DESCRIPTION

The trimmers consist of a glass reinforced polysulphone frame with a polysulphone dust cover, brass rotor and stator with PTFE or polycarbonate film as the dielectric. The stator plates are stacked on pins and separated by rings, so that it is possible to produce a single stator or a differential type.

The rotor contact surfaces are plated to ensure a long life and a stable contact even under severe climatic conditions.

For outline drawing and dimensions see Fig.1a.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
C_{min}/C_{max} :	
single stator type	2.5/20 to 7/100 pF
differential type	2/12 to 7/150 pF
Rated voltage (DC)	200 V
Test voltage (DC) for 1 minute	400 V
Maximum contact resistance	5 mΩ
Minimum insulation resistance between stator and rotor	10000 MΩ
Category temperature range	-40 to +125 °C
Climatic category (IEC 60068)	40/125/21
Related specification	IEC 60418-1 and 4
Minimum storage temperature	-55 °C

MECHANICAL DATA

DESCRIPTION	VALUE
Effective angle of rotation	180°
Operating torque	1.5 to 25 mNm
Maximum axial thrust	2 N

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with "MIL-STD-105D" and "IEC 60410".

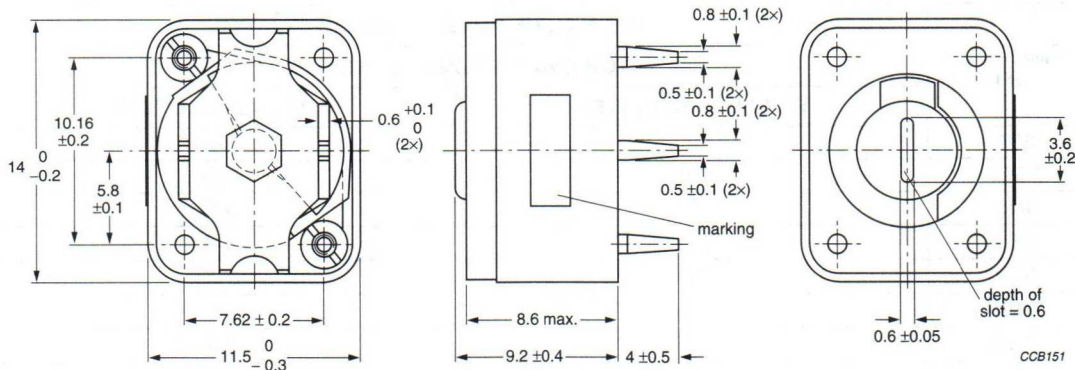
<0.15% major defects

<0.65% minor defects.

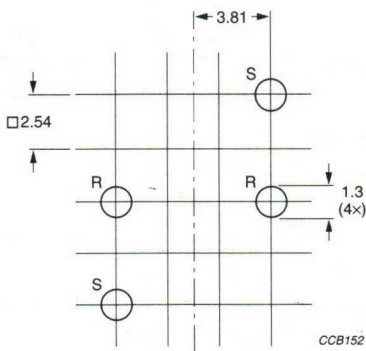
Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage.

Film dielectric trimmers

2222 809 07...



a. Dimensional outlines.



b. Hole pattern.

Dimensions in mm.
R = rotor, S = stator.

Fig.1 Trimmers 2222 809 07... series.

Adjustment

The trimmers can be adjusted with a screwdriver or trimming key. Capacitance increase is obtained with clockwise rotation.

MARKING

The trimmers are marked with the capacitance value in pF, followed by the letter 'E' (single-stator type) or the letter 'D' (differential type).

MOUNTING

The trimmer can be mounted on printed-circuit boards with a grid of 2.54 mm and a minimum hole diameter of 1.25 mm. For hole pattern see Fig.1b.

PACKAGING

Blister packs of 70 units each. For smallest packaging quantities (SPQ) see Table 2.

Film dielectric trimmers

2222 809 07...

ORDERING INFORMATION

Table 1 Selection chart

$C_{\min}/C_{\max}$ (pF)	CATALOGUE NUMBER 2222 809 07...	
	TOP AND BOTTOM ADJUSTMENT	
	SINGLE STATOR TYPE	DIFFERENTIAL TYPE
2/12	—	018
2.5/20	004	006
4/40	008	009
5/60	011	012
6/80	013	014
7/100	015	016
7/150	—	107

ELECTRICAL DATA

Table 2 Electrical characteristics and catalogue numbers

GUARANTEED MAX. $C_{\min}/$ MIN. $C_{\max}$ at 200 kHz (pF)	TYPE	DIEL.	tan δ at $C_{\max} \times 10^{-4}$		TEMP. COEFF. ⁽³⁾ ($10^{-6}/K$)	SPQ	CATALOGUE NUMBER
			1 MHz	100 MHz			
2/12	differential	PTFE ⁽¹⁾	≤ 10	≤ 17	0 ± 200	350	2222 809 07018
2.5/20	single stator	PTFE	≤ 10	≤ 17	0 ± 200	350	2222 809 07004
	differential					350	2222 809 07006
4/40	single stator	PTFE	≤ 10	≤ 17	0 ± 200	350	2222 809 07008
	differential					350	2222 809 07009
5/60	single stator	PTFE	≤ 10	≤ 25	0 ± 200	350	2222 809 07011
	differential					350	2222 809 07012
6/80	single stator	PTFE	≤ 10	≤ 25	0 ± 200	350	2222 809 07013
	differential					350	2222 809 07014
7/100	single stator	PTFE	≤ 10	≤ 25	0 ± 200	350	2222 809 07015
	differential					350	2222 809 07016
7/150	differential	PC ⁽²⁾	≤ 50	—	0 ± 200	350	2222 809 07107

Notes

1. PTFE = polytetrafluorethylene.
2. PC = polycarbonate.
3. C: 60% to 80% of $C_{\max}$; T_{amb} : from +20 °C to +125 °C.

Film dielectric trimmers

2222 809 07...

TESTS AND REQUIREMENTS

Table 3 Test procedures and requirements

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.2		method of mounting	method A	
14		capacitance drift	after TC measurement	$\Delta C/C: \leq 1\%$
19		thrust	axial thrust of 2 N	$\Delta C/C: \leq 0.3\%$
21 21.1 21.2	Ua Ub	robustness of terminations: tensile bending	1 N	no damage bending not allowed
22	Na	rapid change of temperature	1 cycle; 0.5 hours at lower and 0.5 hours at upper category temperature	$\Delta C/C: \leq 1\%$
23	T Ta Tb	soldering: solderability resistance to heat	solder bath immersion 3 mm; 235 °C; 2 s solder bath: 260 °C; 10 s	good wetting no mechanical damage no mechanical damage
24	Eb	impact bump	4000 $\pm$ 10 bumps; 40 g; 6 ms	$\Delta C/C: \leq 0.2\%$; no mechanical damage
25	Fc	vibration	frequency 10 to 55 Hz; amplitude 0.35 mm; 1.5 hours	$\Delta C/C: \leq 0.25\%$; no mechanical damage
26 26.1 26.2 26.3 26.5	B D Aa	climatic sequence: dry heat damp heat accelerated, first cycle cold damp heat accelerated, remaining cycles	16 hours at upper category temperature 1 cycle; 24 hours; +40 °C; 95 to 100% RH 16 hours; -40 °C 1 cycle; 24 hours; +40 °C; 95 to 100% RH	$\Delta C/C: \leq 3\%$ tan $\delta: \leq 10 \times 10^{-4}$ $R_{ins}: \geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 10 \text{ m}\Omega$ voltage proof: 400 V for 1 minute visual examination: no mechanical damage operating torque: 1.5 to 35 mNm

Film dielectric trimmers

2222 809 07...

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
27	Ca	damp heat steady state	21 days; +40 °C; 90 to 95% RH	$\Delta C/C$: $\leq 3\%$ $\tan \delta$: $\leq 10 \times 10^{-4}$ R_{ins} : $\geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 10 \text{ m}\Omega$ voltage proof: 400 V for 1 minute visual examination: no mechanical damage operating torque: 1.5 to 35 mNm
29		mechanical endurance	25 cycles	$\Delta C/C$: $\leq 0.3\%$ $\Delta C/C$ after axial thrust: $\leq 0.3\%$; rotor contact R: $\leq 10 \text{ m}\Omega$ voltage proof: 400 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 50 mNm

Film dielectric trimmers

2222 809 080..

FEATURES

- High temperature type
- Housing dimensions:
10 mm × 11 mm × 11 mm
- For a basic grid of 2.54 mm
- Vertical version with a round head
- Top and bottom adjustment.

APPLICATIONS

- For fine adjustment in professional applications.

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and plated brass stator with PTFE film as the dielectric. The stator plate tags are heat sealed to the housing.

The rotor contact surfaces are plated to ensure a long life and a stable contact even under severe climatic conditions. A coloured dot indicates the maximum capacitance.

Flux absorption between the vanes is prevented.

Cleaning with solvents is not advised.

For outline drawing and dimensions see Fig.1.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
$C_{\min}/C_{\max}$	4/38 to 5/57 pF
Rated voltage (DC)	250 V
Test voltage (DC) for 1 minute	500 V
Maximum contact resistance	5 mΩ
Minimum insulation resistance	10000 MΩ
Category temperature range	-40 to +125 °C
Climatic category (IEC 60068)	40/125/21
Related specification	IEC 60418-1 and 4
Minimum storage temperature	-55 °C

MECHANICAL DATA

DESCRIPTION	VALUE
Effective angle of rotation	180°
Operating torque	2 to 25 mNm
Maximum axial thrust	2 N

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with "MIL-STD-105D" and "IEC 60410".

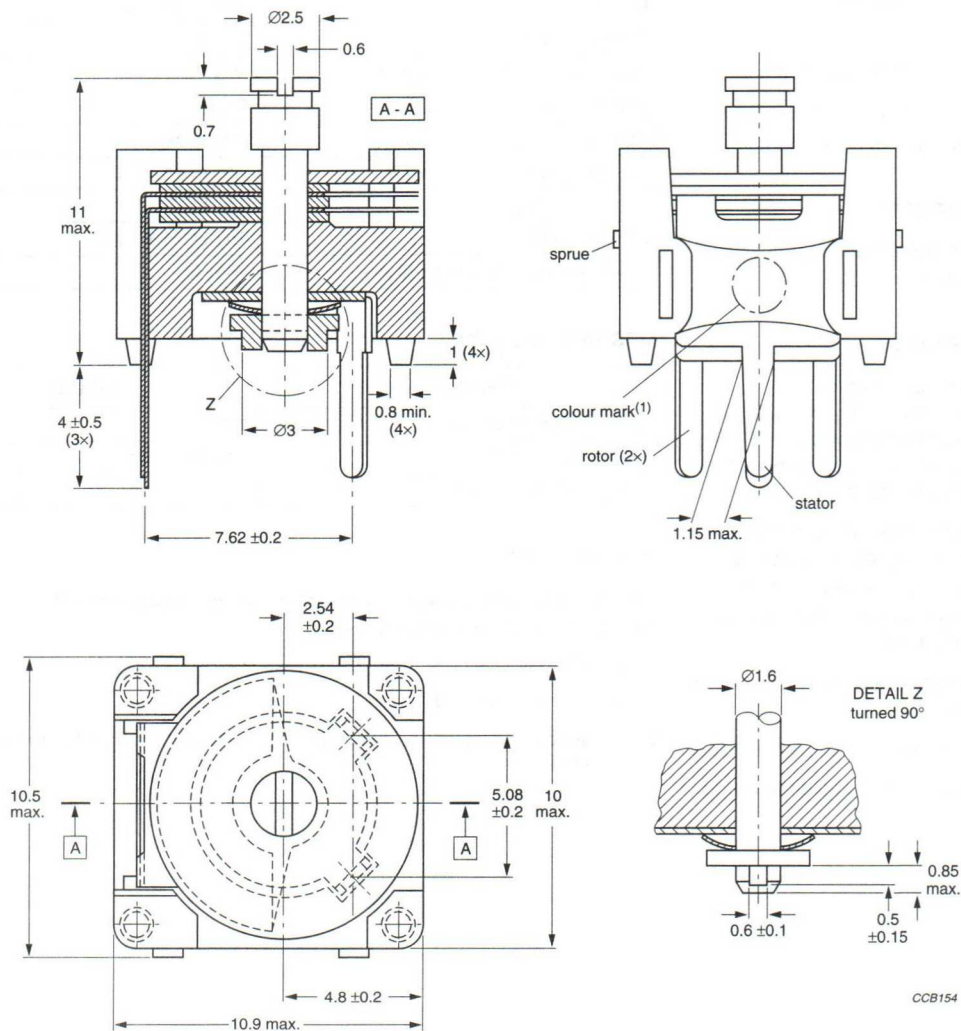
<0.15% major defects

<0.65% minor defects.

Each capacitor is tested for minimum $C_{\max}$ and is also subjected to the full test voltage.

Film dielectric trimmers

2222 809 080..



CCB154

Dimensions in mm.

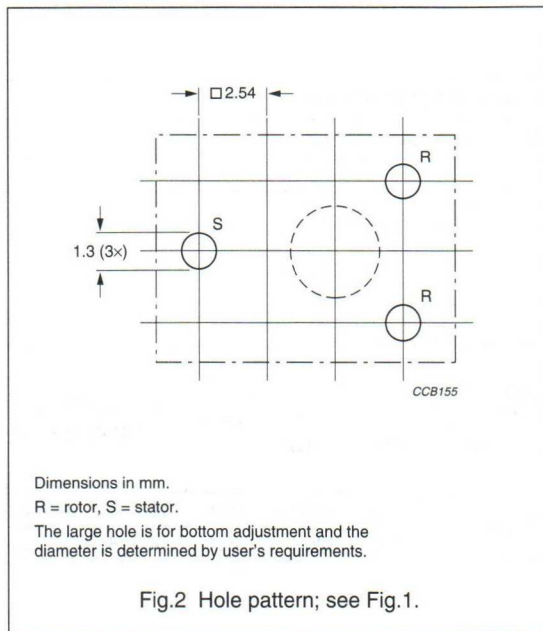
For hole pattern see Fig.2.

(1) For colour of dot see Table 2.

Fig.1 Trimmers 2222 809 080.. series, with round heads.

Film dielectric trimmers

2222 809 080..

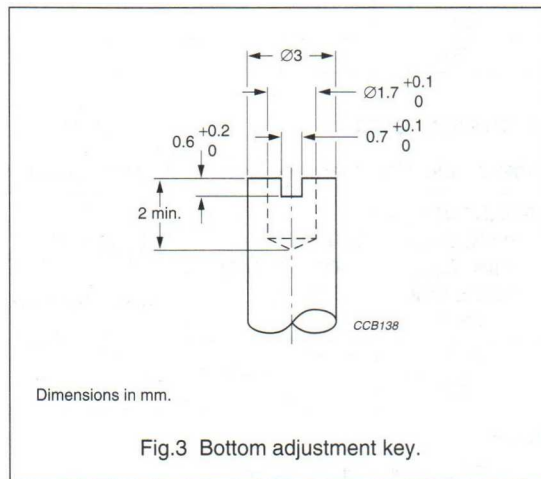


MOUNTING

The trimmer can be mounted on printed-circuit boards with a grid of 2.54 mm and a minimum hole diameter of 1.25 mm. For hole pattern see Fig.2.

Adjustment

For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.3.



PACKAGING

Blister packs of 70 units each. For smallest packaging quantities (SPQ) see Table 2.

Film dielectric trimmers

2222 809 080..

ORDERING INFORMATION

Table 1 Selection chart

$C_{\min}/C_{\max}$ (pF)	CATALOGUE NUMBER 2222 809 080..
	TOP AND BOTTOM ADJUSTMENT
4/38	02
5/57	03

ELECTRICAL DATA

Table 2 Electrical characteristics and catalogue numbers

GUARANTEED MAX. $C_{\min}/$ MIN. $C_{\max}$ at 200 kHz (pF)	SHAPE OF HEAD	DIEL.	tan δ at $C_{\max} \times 10^{-4}$		TEMP. COEFF. ⁽²⁾ ($10^{-6}/K$)	MIN. f_{res} at $C_{\max}$ (MHz)	COL. OF DOT	SPQ	CATALOGUE NUMBER
			1 MHz	100 MHz					
4/38	round	PTFE ⁽¹⁾	≤ 10	≤ 25	-200 ± 250	170	yellow	350	2222 809 08002
5/57	round					150	blue	350	2222 809 08003

Notes

1. PTFE = polytetrafluorethylene.
2. C: 60% to 80% of $C_{\max}$; T_{amb} : from +20 °C to +125 °C.

Film dielectric trimmers

2222 809 080..

TESTS AND REQUIREMENTS

Table 3 Test procedures and requirements

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.2		method of mounting	method A	
14		capacitance drift	after TC measurement	$\Delta C/C: \leq 2.0\%$
19		thrust	axial thrust of 2 N	$\Delta C/C: \leq 0.2\%$
21		robustness of terminations:		
21.1	Ua	tensile	1 N	no damage
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle; 0.5 hours at lower and 0.5 hours at upper category temperature	$\Delta C/C: \leq 2.5\%$
23	T	soldering:		
	Ta	solderability	solder bath immersion 3 mm; 235 °C; 2 s	good wetting no mechanical damage
	Tb	resistance to heat	solder bath: 260 °C; 10 s	no mechanical damage
24	Eb	impact bump	4000 $\pm$ 10 bumps; 40 g; 6 ms	$\Delta C/C: \leq 0.5\%$; no mechanical damage
25	Fc	vibration	frequency 10 to 55 Hz; amplitude 0.35 mm; 1.5 hours	$\Delta C/C: \leq 0.2\%$; no mechanical damage
26		climatic sequence:		$\Delta C/C: \leq 2.5\%$
26.1	B	dry heat	16 hours at upper category temperature	$\tan \delta: \leq 10 \times 10^{-4}$ $R_{ins}: \geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 5 \text{ m}\Omega$
26.2	D	damp heat accelerated, first cycle	1 cycle; 24 hours; +40 °C; 95 to 100% RH	voltage proof: 500 V for 1 minute
26.3	Aa	cold	16 hours; -40 °C	visual examination: no mechanical damage
26.5		damp heat accelerated, remaining cycles	1 cycle; 24 hours; +40 °C; 95 to 100% RH	operating torque: 1 to 25 mNm

Film dielectric trimmers

2222 809 080..

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
27	Ca	damp heat steady state	21 days; +40 °C; 90 to 95% RH	$\Delta C/C: \leq 2.5\%$ $\tan \delta: \leq 10 \times 10^{-4}$ $R_{ins}: \geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 5 \text{ m}\Omega$ voltage proof: 500 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 25 mNm
29		mechanical endurance	25 cycles	$\Delta C/C: \leq 0.3\%$ $\Delta C/C$ after axial thrust: $\leq 0.3\%$; rotor contact R: $\leq 5 \text{ m}\Omega$ voltage proof: 500 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 25 mNm

Film dielectric trimmers

2222 809 090..

FEATURES

- High temperature type
- Housing dimensions:
8 mm × 9 mm × 10 mm
- For a basic grid of 2.54 mm
- Versions available
with 1 or 2 rotor contacts
- Top and bottom adjustment
- Vertical version.

APPLICATIONS

- For fine adjustment professional applications.

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and plated brass stator with PTFE film as the dielectric. The stator plate tags are heat sealed to the housing.

The rotor contact surfaces are plated to ensure a long life and a stable contact even under severe climatic conditions. A coloured dot indicates the maximum capacitance.

Flux absorption between the vanes is prevented.

Cleaning with solvents is not advised.

For outline drawings and dimensions see Figs 1 and 2.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
C_{min}/C_{max}	1.4/5.5 to 3/18 pF
Rated voltage (DC)	250 V
Test voltage (DC) for 1 minute	500 V
Maximum contact resistance	5 mΩ
Minimum insulation resistance	10000 MΩ
Category temperature range	-40 to +125 °C
Climatic category (IEC 60068)	40/125/21
Related specification	IEC 60418-1 and 4
Minimum storage temperature	-55 °C

MECHANICAL DATA

DESCRIPTION	VALUE
Effective angle of rotation	180°
Operating torque:	
$C_{max} = 5.5$ pF	1 to 15 mNm
$C_{max} = 9$ and 18 pF	1 to 20 mNm
Maximum axial thrust	2 N

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with "MIL-STD-105D" and "IEC 60410".

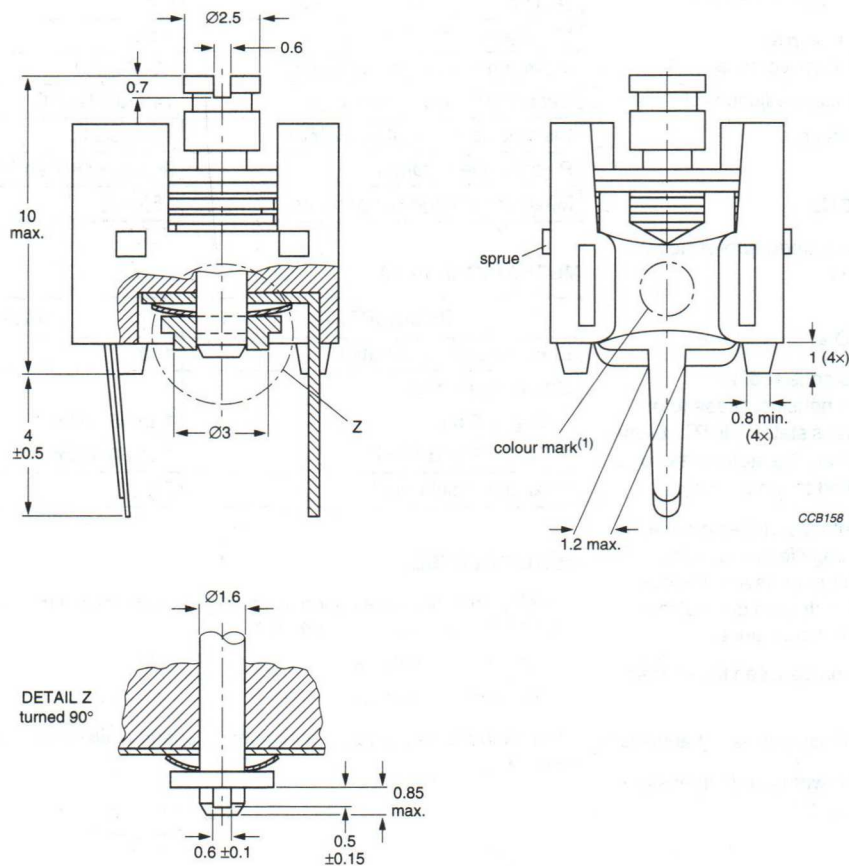
<0.15% major defects

<0.65% minor defects.

Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage.

Film dielectric trimmers

2222 809 090..



Dimensions in mm.

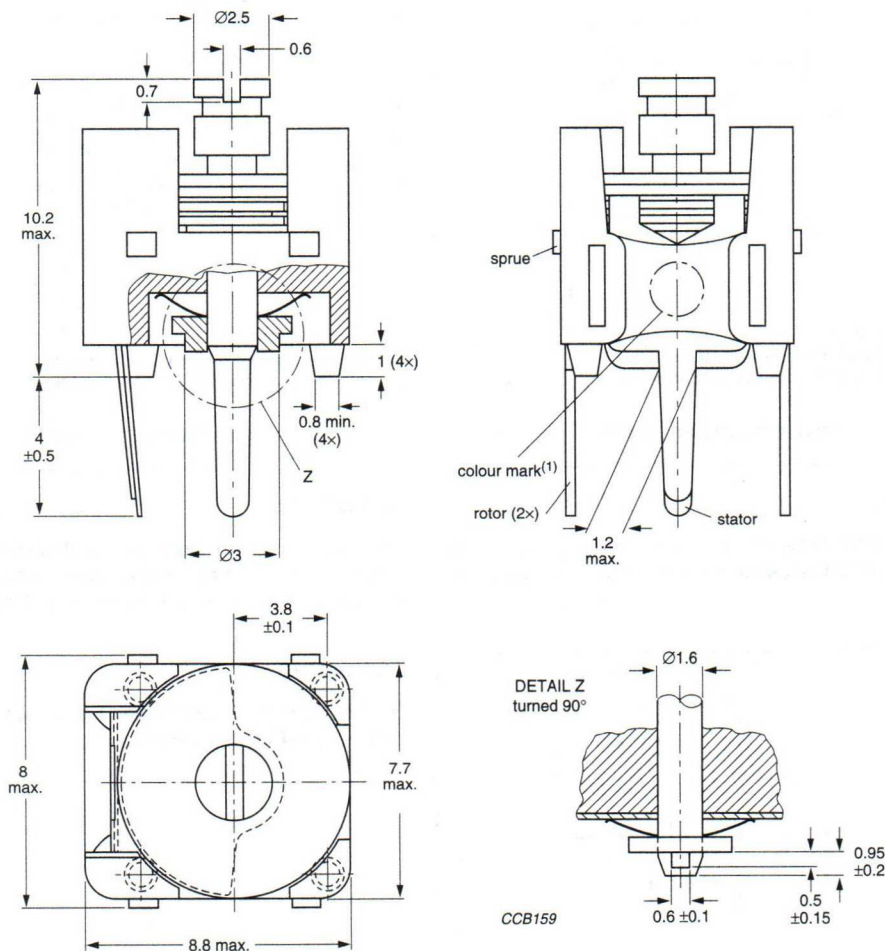
For hole pattern see Fig.3.

(1) For colour of dot see Table 2.

Fig.1 Trimmers 2222 809 090.. series, with one rotor contact.

Film dielectric trimmers

2222 809 090..



Dimensions in mm.

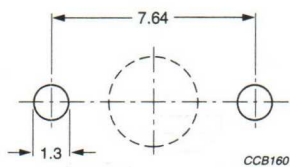
For hole pattern see Fig.4.

(1) For colour of dot see Table 2.

Fig.2 Trimmers 2222 809 090.. series, with two rotor contacts.

Film dielectric trimmers

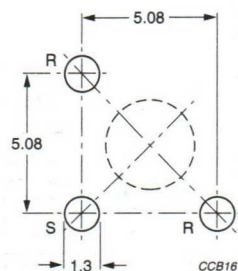
2222 809 090..



Dimensions in mm.

The large hole is for bottom adjustment and the diameter is determined by user's requirements.

Fig.3 Hole pattern; see Fig.1.



Dimensions in mm.

R = rotor, S = stator.

The large hole is for bottom adjustment and the diameter is determined by user's requirements.

Fig.4 Hole pattern; see Fig.2.

Adjustment

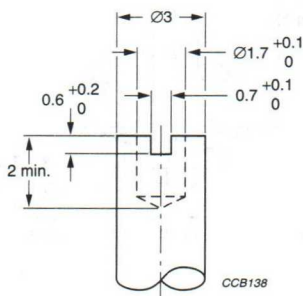
For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.5.

MOUNTING

The trimmer can be mounted on printed-circuit boards with a basic grid of 2.54 mm and a minimum hole diameter of 1.25 mm. For hole patterns see Figs 3 and 4.

PACKAGING

Blister packs of 105 units each. For smallest packaging quantities (SPQ) see Table 2.



Dimensions in mm.

Fig.5 Bottom adjustment key.

Film dielectric trimmers

2222 809 090..

ORDERING INFORMATION

Table 1 Selection chart

C_{min}/C_{max} (pF)	CATALOGUE NUMBER 2222 809 090..	
	ROUND HEAD TOP AND BOTTOM ADJUSTMENT	
	VERSION WITH 1 ROTOR CONTACT	VERSION WITH 2 ROTOR CONTACTS
1.4/5.5	04	01
2/9	05	02
3/18	06	03

ELECTRICAL DATA

Table 2 Electrical characteristics and catalogue numbers

GUARANTEED MAX. C_{min} / MIN. C_{max} at 200 kHz (pF)	SHAPE OF HEAD	DIEL.	tan δ at $C_{max} \times 10^{-4}$		TEMP. COEFF. ⁽²⁾ ($10^{-6}/K$)	MIN. f_{res} at C_{max} (MHz)	COL. OF DOT	SPQ	CATALOGUE NUMBER
			1 MHz	100 MHz					
1.4/5.5	round	PTFE ⁽¹⁾	≤ 10	≤ 15	-250 ± 350	850	green	525	2222 809 09004 ⁽³⁾
	round							525	2222 809 09001 ⁽⁴⁾
2/9	round					580	white	525	2222 809 09005 ⁽³⁾
	round							525	2222 809 09002 ⁽⁴⁾
3/18	round					360	red	525	2222 809 09006 ⁽³⁾
	round							525	2222 809 09003 ⁽⁴⁾

Notes

1. PTFE = polytetrafluorethylene.
2. C: 60% to 80% of C_{max} ; T_{amb} : from +20 °C to +125 °C.
3. Version with one rotor contact.
4. Version with two rotor contacts.

Film dielectric trimmers

2222 809 090..

TESTS AND REQUIREMENTS

Table 3 Test procedures and requirements

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.2		method of mounting	method A	
14		capacitance drift	after TC measurement	$\Delta C/C$: $\leq 2.0\%$; $\leq 3.0\%$ for 9 pF
19		thrust	axial thrust of 2 N	$\Delta C/C$: $\leq 0.3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1 N	no damage
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle; 0.5 hours at lower and 0.5 hours at upper category temperature	$\Delta C/C$: $\leq 3\%$
23	T	soldering:		
	Ta	solderability	solder bath immersion 3 mm; 235 °C; 2 s	good wetting no mechanical damage
	Tb	resistance to heat	solder bath: 260 °C; 10 s	no mechanical damage
24	Eb	impact bump	4000 $\pm$ 10 bumps; 40 g; 6 ms	$\Delta C/C$: $\leq 0.5\%$; no mechanical damage
25	Fc	vibration	frequency 10 to 55 Hz; amplitude 0.35 mm; 1.5 hours	$\Delta C/C$: $\leq 0.3\%$; no mechanical damage
26		climatic sequence:		$\Delta C/C$: $\leq 2.5\%$
26.1	B	dry heat	16 hours at upper category temperature	$\tan \delta$: $\leq 10 \times 10^{-4}$ R_{ins} : $\geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 5 \text{ m}\Omega$
26.2	D	damp heat accelerated, first cycle	1 cycle; 24 hours; +40 °C; 95 to 100% RH	voltage proof: 500 V for 1 minute
26.3	Aa	cold	16 hours; -40 °C	visual examination: no mechanical damage
26.5		damp heat accelerated, remaining cycles	1 cycle; 24 hours; +40 °C; 95 to 100% RH	operating torque: 1 to 20 mNm

Film dielectric trimmers

2222 809 090..

IEC 60418-1 CLAUSE	IEC 60068 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
27	Ca	damp heat steady state	21 days; +40 °C; 90 to 95% RH	$\Delta C/C$: $\leq 3\%$ $\tan \delta$: $\leq 10 \times 10^{-4}$ R_{ins} : $\geq 10000 \text{ M}\Omega$; rotor contact R: $\leq 5 \text{ m}\Omega$ voltage proof: 500 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 20 mNm
29		mechanical endurance	25 cycles	$\Delta C/C$: $\leq 3\%$ $\Delta C/C$ after axial thrust: $\leq 0.3\%$; rotor contact R: $\leq 5 \text{ m}\Omega$ voltage proof: 500 V for 1 minute visual examination: no mechanical damage operating torque: 1 to 20 mNm

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DATA HANDBOOK SYSTEM

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