

Technical information

It includes complete information on the SMD types

Aragonesa de Componentes Pasivos



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POTENTIOMETERS IN THROUGH-HOLE CONFIGURATION

The following features are valid for through-hole configuration when flow or manual soldering processes are used. For pin-in-paste, please, follow SMD specifications (next page).

	CA -Carbon-			CE -Cermet-	
ELECTRICAL	6	9	14	9	14
Resistive element	Carbon film			Cermet	
Variation Laws –Tapers-	Lin (A), Log (B),Antilog (C), Special tapers on request			Lin (A). Also: Log (B), antilog (C) and special tapers	
Range of resistance values ⁽¹⁾ Lin (A) Log (B),Antilog (C)	100Ω ≤ Rn ≤ 5MΩ ⁽¹⁾ 1KΩ ≤ Rn ≤ 2,2MΩ ⁽¹⁾				
Tolerance ⁽¹⁾	100Ω ≤... ≤ 1MΩ: ±20% 1MΩ < ... ≤ 5MΩ: ±30% For Rn Out of range (i.e. Rn < 100Ω, Rn >5MΩ, etc.), tolerance: +50% -30%				
Operating temperature	-25°C < ... < +70°C (85°C on request)			-40° C <...< +125° C	
Temperature coefficient	100Ω to 10KΩ → +200/-300 ppm >10KΩ to 5MΩ → +200/-500 ppm			±100ppm	
Max. power dissipation ⁽²⁾ Lin (A) Log (B),Antilog (C)	At 40° C			At 70° C	
	0.10W 0.06W	0.15W 0.10W	0.25W 0.13W	0.5W	0.7W
Max.Voltage Lin (A) (A) Log (B),Antilog (C)	100VDC 60VDC	200VDC 150VDC	250VDC 200VDC	200VDC	250VDC
Residual Resist	Lin (A), Log (B),Antilog (C) ≤ 5*10 ⁻³ Rn Min. 2Ω			≤ 2Ω	
Mechanical rotation angle	235° ± 10°	240° ± 5°	265° ± 5°	240° ± 5°	265° ± 5°
Electrical rotation angle	215° ± 20°	220° ± 20°	245° ± 20°	220° ± 20°	245° ± 20°
CRV (dynamic)	Contact Resistance Variation (dynamic) ≤ 3% Rn				
CRV (static)	Contact Resistance Variation (static) ≤ 5% Rn				
Linearity	Special requests available (2% Absolute, etc.)				
MECHANICAL	6	9	14	9	14
Rotational life	Conditions: at 10cpm, 23° C and 50% RH (and potentiometer used as a voltage divider)				
Standard Standard Long Life	1000 please, ask ⁽³⁾	1000 10.000 ⁽³⁾	1000 10.000 ⁽³⁾	1000 up to 10.000 ⁽³⁾	1000 up to 10.000 ⁽³⁾
Max. Stop Torque	4 Ncm	5 Ncm	10Ncm	5 Ncm	10 Ncm
Wiper Torque	< 2 Ncm	< 2 Ncm	< 2,5 Ncm	< 2 Ncm	< 2,5 Ncm
Max. Push/pull on rotor	9,8N	40 N	50 N	40 N	50 N
	MCA9		MCA14	MCE9	MCE14
Max. Stop Torque	-	25Ncm ⁽⁴⁾	15Ncm	25 Ncm ⁽⁴⁾	15 Ncm
Max. Push/pull on shaft	-	40N /50N ⁽⁴⁾	50N /25N	40N /50N ⁽⁴⁾	50N /25N
Max.Torque on the nut	-	50 Ncm	80 Ncm	50 Ncm	80 Ncm
Rotational Life	-	10.000 ⁽³⁾	10.000 ⁽³⁾	10.000 ⁽³⁾	10.000 ⁽³⁾
Other features for MCA and MCE are the same as of the corresponding CA and CE models					

⁽¹⁾ Other values available on request

⁽²⁾ Value depends on taper, please, inquire for special cases

⁽³⁾ Longer life available on request, under study.

⁽⁴⁾ The 9 series stands higher torque for design reasons.

Should you want to modify any of these features to adapt to a particular application, please, do not hesitate to contact us!

POTENTIOMETERS IN SMD CONFIGURATION

The following features are valid for SMD configuration (and through-hole when pin-in-paste soldering process is used).

Recommended for reflow processing in 6, 9 or 14mm, Carbon (CA) or Cermet (CE), available with special tapers. All our potentiometers are made with high temperature materials. They are RoHS compliant and can be soldered under the lead-free conditions recommended by ACP.

	CA -Carbon-			CE -Cermet-	
ELECTRICAL	6	9	14	9	14
Resistive element	Carbon film			Cermet	
Variation Laws –Tapers-	Lin (A), Log (B),Antilog (C), Special tapers on request			Lin (A). Also: Log (B), antilog (C) and special tapers	
Range of resistive values (Others, on request)	Taper A Taper B,C	100Ω ≤ Rn ≤ 1MΩ 1KΩ ≤ Rn ≤ 1MΩ		Taper A 100Ω ≤ Rn ≤ 5MΩ Taper B,C 1KΩ ≤ Rn ≤ 2M2Ω	
Tolerance 100Ω ≤ Rn ≤ 100KΩ 100KΩ < Rn ≤ 1MΩ	Special tolerances on request ± 25% ± 30% ± 30% ± 25% ± 40% ± 40%			Special tolerances on request 100Ω ≤ Rn ≤ 1MΩ: ±20% 1MΩ < Rn ≤ 5MΩ: ±30%	
Operating temperature	-25°C < ... < +70°C (85°C on request)			-40° C <...< +125° C	
Temperature coefficient	100Ω to 10KΩ → +200/ -500 ppm >10KΩ to 5MΩ → +200/ -1000 ppm			±100ppm	
Max. power dissipation ⁽²⁾ Lin (A) Log (B),Antilog (C)	At 40° C 0.10W 0.15W 0.25W 0.06W 0.10W 0.13W			At 70° C 0.5W 0.7W	
Max.Voltage Lin (A) (A) Log (B),Antilog (C)	100VDC 60VDC	200VDC 150VDC	250VDC 200VDC	200VDC	250VDC
Residual Resist	Lin (A), Log (B),Antilog (C) ≤ 5*10 ⁻³ Rn, but always min 2Ω			≤ 2Ω	
Mechanical rotation angle	235° ±10°	240° ± 5°	265° ± 5°	240° ± 5°	265° ± 5°
Electrical rotation angle	215° ± 20°	220° ± 20°	245° ± 20°	220° ± 20°	245° ± 20°
CRV (dynamic)	Contact Resistance Variation (dynamic) ≤ 3% Rn				
CRV (static)	Contact Resistance Variation (static) ≤ 5% Rn				
Linearity	Special requests available (2% Absolute, etc.)				
Rotational life Standard Standard Long Life	Conditions: at 10cpm, 23°C and 50% RH (and potentiometer used as a voltage divider) 1000 1000 1000 1000 1000 please, ask ⁽³⁾ 10.000 ⁽³⁾ 10.000 ⁽³⁾ up to 10.000 ⁽³⁾ up to 10.000 ⁽³⁾				

⁽¹⁾ Other values available on request

⁽²⁾ Value depends on taper; please, inquire for special cases

⁽³⁾ Longer life available on request, under study.

Should you want to modify any of these features to adapt to a particular application, please, do not hesitate to contact us!

SOLDERING CONDITIONS (lead-free, RoHS compliant) ⁽⁴⁾

Manual soldering	Reflow soldering SMD	Flow (wave) soldering
Soldering tools of 20W max.	Preheating temperature: Max 150°C; 60-90 s	Recommended Alloy: SnAgCu
Maximum temperature of soldering tools: 280°C	Temperature Ramp-up: 2-3°C / s.	Preheating stage: Max 100°C; 30-60 s.
Time: 3 s. max.	Over 220°C: <40 s.	Temperature Ramp-up: 1.2-2.5°C/s.
	Solder temperature: 240°C for 5 +/- 1 s.	Max. wave temp.: 260°C for 4s., (245°C recommended)
	Besides recommended conditions, ACP SMD potentiometers have successfully passed tests at 260°C (air temp) for 10s.	Time within +0°-10°C of peak: 10s. Cooling rate: 5°C/s.



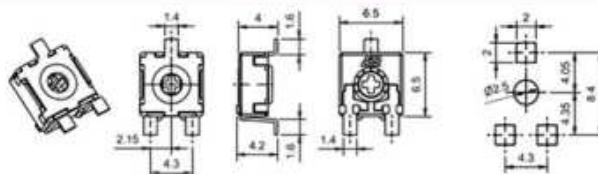
⁽⁴⁾ For other information on soldering conditions, please, contact us.

DRAWINGS OF SMD POTENTIOMETERS

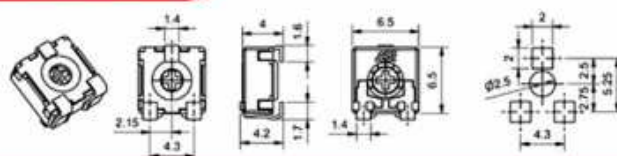
Rotors can be chosen according to customer specifications;
the rotors shown here are examples.

Tols. (mm.):	
<1	±0,1
1 ≤ x < 5	±0,3
≥ 5	±0,5

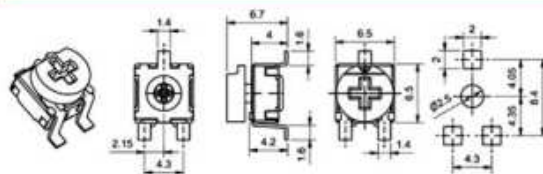
CA6_VSMD



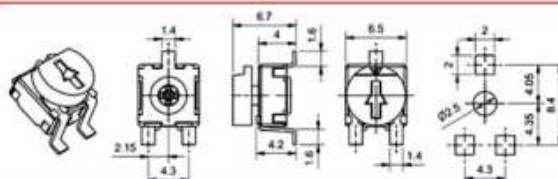
CA6_VESMD (Under request, not readily available)



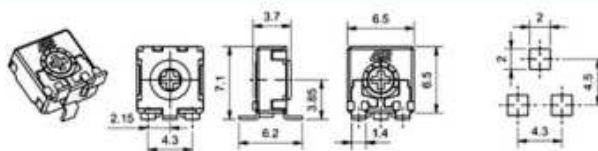
CA6_VSMD WT-6030



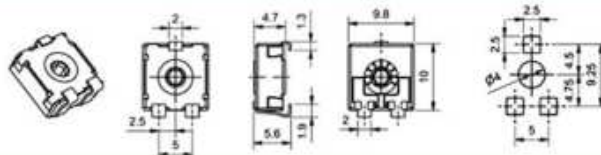
CA6_VSMD WT-6037



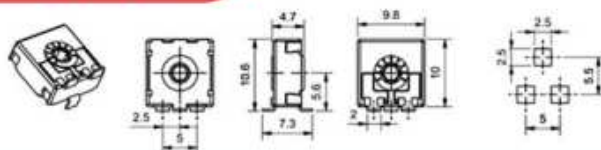
CA6_HSMD

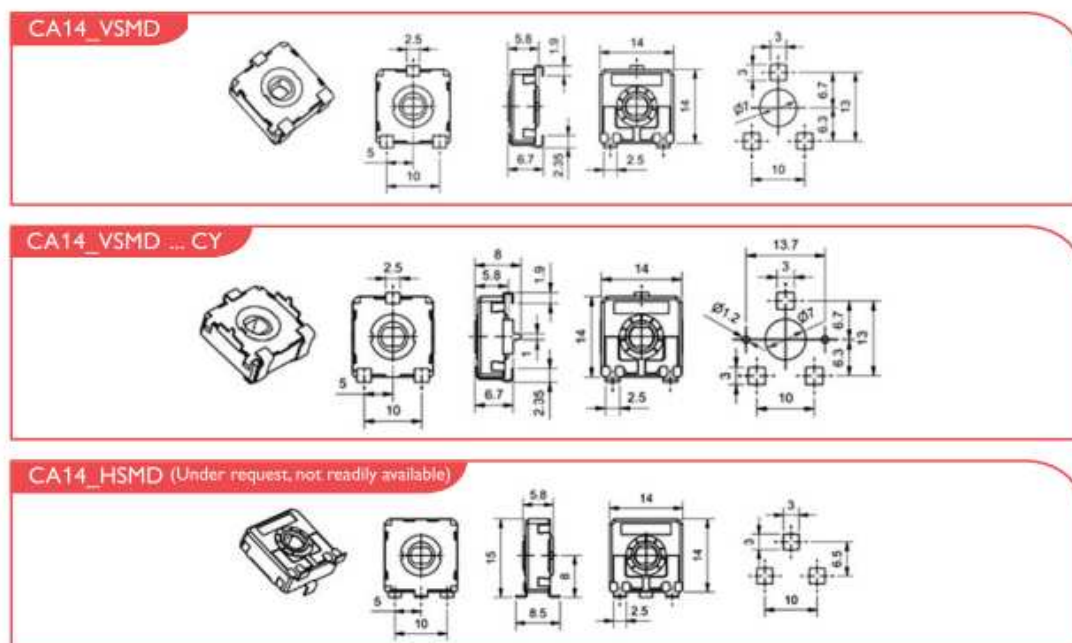


CA9_VSMD



CA9_HSMD (Under request, not readily available)





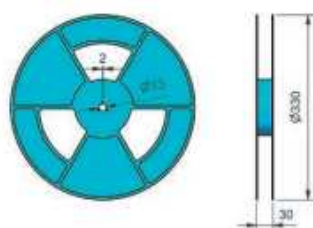
PACKAGING FOR SMD POTENTIOMETERS

Bulk packaging is considered standard.

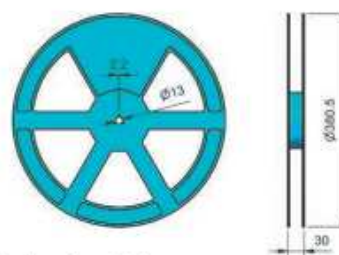
Tape and Reel packaging is available on 13inch reels, 15inch reels are only available on request.

PACKAGING		6		9		14	
Bulk (see pcs/box on page 8)		MOQ: 5000pcs		MOQ: 5000pcs for CA, 3000pcs for CE		MOQ: 5000pcs for CA, 3000pcs for CE	
Tape and Reel-T&R Reel Ø : 330mm, 13" Tape width: 24mm	Trimmer (no thumbwheel), in 13" reel	CA6 V 1200 pcs/reel MOQ = 4800	CA6 H 750 pcs/reel MOQ = 4500	CA9 V 900 pcs/reel MOQ = 4500 pcs	CA9 H-⁽²⁾ Under study	CA14 V 500 pcs/reel MOQ = 5000pcs 350 pcs/reel (with CY) MOQ = 4900pcs.	CA14 H-⁽²⁾ Under study
	With specific thumbwheels:	With 6030 or 6037: 750 pcs/reel, MOQ = 5250	Under request	With 9002: 700 pcs/reel MOQ = 4900	Under study	With 14003: 300 pcs/reel, MOQ = 4800	Under study.
Tape and Reel-T&R Reel : 381mm, 15", Tape width: 24mm	Trimmer (no thumbwheel), in 15" reel	CA6 V 1700 pcs/reel MOQ = 5100	CA6 H 1000 pcs/reel MOQ = 5000	CA9 V 1250 pcs/reel MOQ = 5000 pcs	Under study	CA14 V 800 pcs/reel MOQ = 4800pcs 500 pcs/reel (with CY) MOQ = 5000pcs.	Under study
	(only available on request) With specific thumbwheels:	With 6030 or 6037: 1100 pcs / reel, MOQ = 5500	Under request	Under request	Under request	Under request	Under study

⁽²⁾ Tape and Reel packaging is readily available for V configuration. Packaging for H orientation in Tape and Reel is available under study for 9 and 14mm.



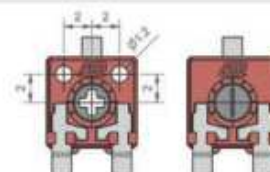
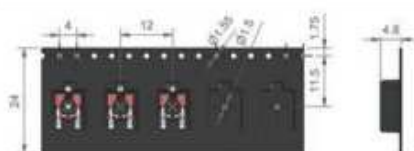
Standard reel: 13 inch



15 inch reel available on request

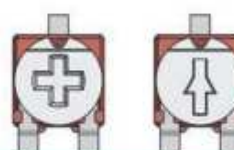
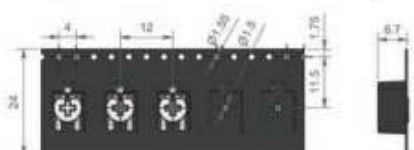
Tape & Reel packaging configurations and recommended nozzle positions.

CA6_VSMD

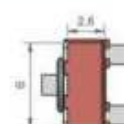
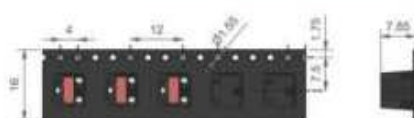


With standard rotor or special blind rotor, suitable for bigger vacuum pick-up nozzle.

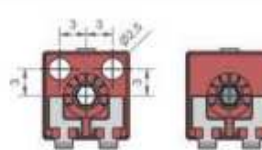
CA6_VSMD WT-6030 or WT-6037 (thumbwheel already inserted and riveted)



CA6_HSMD

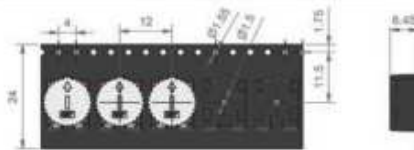


CA9_VSMD or CE9_VSMD

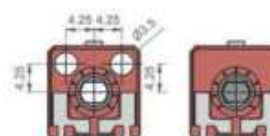


With standard rotor or special blind rotor, suitable for bigger vacuum pick-up nozzle.

CA9_VSMD or CE9_VSMD WT-9002 (with thumbwheel already inserted and riveted)



CA14_VSMD or CE14_VSMD

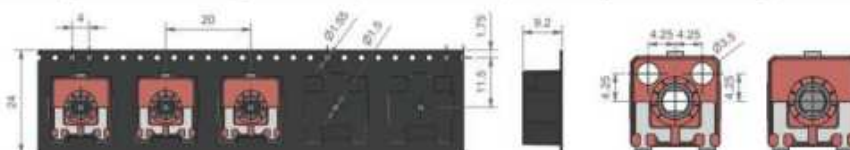


With standard rotor or special blind rotor, suitable for bigger vacuum pick-up nozzle.

CA14_VSMD or CE14_VSMD WT-14003 (with thumbwheel already inserted and riveted)



CA14_VSMD or CE14_VSMD CY (with extra side pins for support and centering)



With standard rotor or special blind rotor, suitable for bigger vacuum pick-up nozzle.

CA14_VSMD or CE14_VSMD CY WT-14003 (with extra side pins for support and centering and thumbwheel already inserted and riveted)



PACKAGING FOR THROUGH-HOLE POTENTIOMETERS BULK

PACKAGING	Potentiometer model	+ Shaft or thumbwheel inserted	Pieces per box	
			Standard box (150x100x70)	Under request (140x140x70)
6	H2,5 – V2,5 – V5 – VS5 – HSMD – VSMD	Only potentiometers	1.000	3.000
		6001, 6030, 6032, 6037	1.000	2.000
		6022, 6023, 6024, 6031	500	t.b.d.
		6025, 6028	300	t.b.d.
9	H2,5 – H3,8 – H5 – HS3,8 – V7,5 – V10 – VR10 – MAV10* - MTV10*	Only potentiometers	500 (400 *)	1.250 (1000 *)
		9002	250	750
		9004, 9005, 9006, 9009, 9010, 9018, 9039, 9041, 9047, 9048, 9051, 9053, 9054, 9055, 9056, 9059, 9060, 9061, 9063, 9064, 9067	200	600
		9071, 9072	400	t.b.d.
		MTX2	150	t.b.d.
		MTX4	75	t.b.d.
		MTX6	50	t.b.d.
		MTX8	40	t.b.d.
14	H2,5 – H4 – H5 – HA5 – HL5 – HC0 – H0 – V12,5 – VA12,5 – VL12,5 – V15 – V17,5* – VD11* - VD7,5* – VR12,5	Only potentiometers	200 (150 *)	500 (400 *)
		14003, 14117, 14042	100	t.b.d.
		14008, 14015, 14056, 14066, 14067, 14072, 14073, 14081, 14084, 14187, 14250	75	t.b.d.
		14065	75	300
		-	50	t.b.d.

* - Quantity for models with *

t.b.d.: to be determined

Examples of CA9 (or CE9) with detents:



Examples of CA14 (or CE14) with detents:



POTENTIOMETERS WITH DETENTS

In through-hole or SMD, 9mm or 14mm, Carbon (CA) or Cermet (CE), available with special tapers.

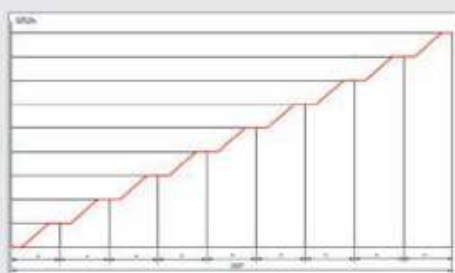
Our potentiometers with **detents can be combined with special tapers** for a solution that unites the precision, the voltage level and the angular position in a cost-effective way.

Detents are particularly recommended when it is important to control the exact wiper position on the resistive track. Our detents substitute expensive external mechanisms used to set the position. ACP's solution is more economical and provides better position tolerances, with the same feeling. Combinations of different detent strengths are available.



SPECIFICATIONS	9	14
Resistance values Tolerance	Standard and special resistance values and tolerances are the same as for the potentiometers without detents.	
Variation Laws –Tapers-	Lin (A), Log (B), Antilog (C) and special tapers on request.	
Rotation Angle -Mechanical - Electrical	240° ± 5° 220° ± 20°	265° ± 5° 245° ± 20°
Standard detents are evenly distributed along the mechanical angle, special options are available.		
Rotational life We have the possibility of making longer life, please, inquire with your request.	Up to 10.000 cycles on standard detents	Up to 10.000 cycles on standard detents
Wiper torque	< 2,5 Ncm	< 3,5 Ncm
Max. Stop Torque	5 Ncm	10 Ncm
CRV	Contact Resistance Variation: dynamic: ≤ 3% Rn, static: ≤ 5% Rn	
NUMBER OF DETENTS:	9	14
For feeling only, no specific value is expected in each detent.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10... max.: 20, evenly distributed	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 17, 21, 22, 27... max.: 38, evenly distributed
To assure the value in each detent	≤ 10 positions with different voltage values	≤ 14 positions with different voltage values

APPLICATION NOTE: Detents and special tapers working as analog switches



Many control applications have special requirements for non-overlapping values at specific positions.

ACP can custom-design tapers that combine with detents to provide both the value in each position and set the desired position with strict tolerances. The result would be a product that can be used to feed the analog input of a microprocessor and select different functions based on the different positions set by the detents.

APPLICATION NOTE: Combinations of detent strength for different functions

Different detent feelings or strengths are available. We can also combine those different feelings. For example, we can use a strong detent feeling to set the stop position and then regulate the transition with lighter detents.

The potentiometer in the picture shows a stronger detent that corresponds to stop function and the rest of the potentiometer has lighter detents, only for feeling.



ROTARY SWITCHES - Technical Features

Low-cost switches in 6, 9, or 14mm. Two outputs: ON-OFF-ON (Single Pole Double Throw: SPDT)

Available in Carbon (CA). Cermet options in CE or MCE can be studied under request.

The standard COM products come in through-hole configuration; for SMD, please submit your enquiry.

	COM CA			COM MCA	
ELECTRICAL	6	9	14	9	14
Power ratio	15V/12mA	24V/15mA	24V/15mA	24V/15mA	24V/15mA
Resistance at "ON" position	$\leq 5\Omega$	$\leq 5\Omega$	$\leq 5\Omega$	$\leq 5\Omega$	$\leq 5\Omega$
Dielectric strength ⁽¹⁾	600V	1500V	1500V	1500V	1500V
Insulation resistance ⁽¹⁾	100M Ω	100M Ω	100M Ω	100M Ω	100M Ω
Mechanical life ⁽³⁾	1000 cycles	1000 cycles	1000 cycles	1000 cycles	1000 cycles
Switching angle at "ON" position ⁽²⁾	$30^\circ \pm 15^\circ$	$30^\circ \pm 15^\circ$	$30^\circ \pm 15^\circ$	$30^\circ \pm 15^\circ$	$30^\circ \pm 15^\circ$
Operating temperature ⁽²⁾	-25° ... +70°	-25° ... +70°	-25° ... +70°	-25° ... +70°	-25° ... +70°
MECHANICAL					
Substrate	Polyester film	Polyester film	Polyester film	Polyester film	Polyester film
Torque on the nut	-	-	-	50 Ncm	80 Ncm
Angle of rotation (mechanical)	$235^\circ \pm 10^\circ$	$240^\circ \pm 5^\circ$	$265^\circ \pm 5^\circ$	$240^\circ \pm 5^\circ$	$265^\circ \pm 5^\circ$
Wiper torque ⁽²⁾	< 2Ncm	< 2Ncm	< 2,5Ncm	< 2Ncm	< 2,5Ncm
Max. stop torque	4Ncm	5Ncm	10Ncm	25Ncm	15Ncm
Max push/ pull on the rotor	9,8N	40N	50N	40N / 50N ⁽⁴⁾	50N / 25N

⁽¹⁾ Wiper set to 50% track position and a commutation angle in "ON" position of 30°.

⁽²⁾ Other values available on request .

⁽³⁾ Higher values available on request..

⁽⁴⁾ The 9 series stands higher torque for design reasons.

These are standard features; other specifications can always be studied on request. Should you want to modify any of these features to adapt to a particular application, please, do not hesitate to contact us!

ROTARY SENSOR RS14 - Technical Features

Low cost solution for position control and sensing. Up to 1.000.000 cycles (send us your request)

Available in SMD or through-hole configuration.

ELECTRICAL		MECHANICAL	
Electric use	Voltage Divider	Resistive element	Carbon technology
Angle of rotation (electrical)	$245^{\circ} \pm 20^{\circ}$	Angle of rotation (mechanical)	$265^{\circ} \pm 5^{\circ}$
Range of resistance values Lin (A)	10K Ω ⁽¹⁾	Mechanical life	Up to 1.000.000 cycles ⁽¹⁾
Tolerance	(at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and $50\% \pm 25\% \text{ RH}$) $\pm 30\%$ ⁽¹⁾	Wiper position	Middle position; $50\% \pm 15^{\circ}$
Variation laws	Lin (A): standard Log (B), Antilog (C) and others, available on request	Wiper torque	$< 1 \text{ Ncm}$
Linearity	$\pm 3\%$ ⁽¹⁾	Max. stop torque	10 Ncm
Maximum power dissipation at 40°C , for taper Lin (A)	0,15 W	Max. push/pull on rotor	50 N
Operating temperature	$-40^{\circ}\text{C} \dots +85^{\circ}\text{C}$		

⁽¹⁾ Other values available on request.

These are standard features. Should you want to modify any of these features to adapt to a particular application, or you are interested in a customized gear-shaft, accessory or lever please, do not hesitate to contact us!

