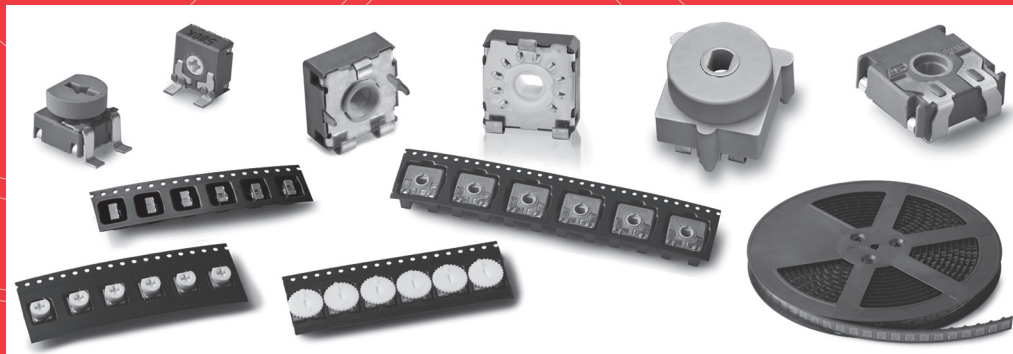


ACP Reflowable Potentiometers



Technical information



Aragonesa de Componentes Pasivos

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INTRODUCTION

ACP brand is worldwide recognized as a reliable and cost effective component manufacturer of SMD potentiometers. This catalogue describes the extended range we offer in this format on both, thick film carbon and cermet technologies. The majority of the standard and special features that the traditional THT (Through Hole Technology) series offer can be supplied also in SMD format. The potentiometers can be packed either in bulk, or Tape-n-Reel for automated assembly onto the PCB.

In addition to the SMD range, THT Pin in Paste options can also be available under demand, with the possibility to be Tape-n-Reel packed.

We welcome you to go through this catalogue to select the most adequate option to suit your needs. Please, contact our sales and technical support network for any assistance. If you do not find what you want, remember that we are specialized in building custom solutions.

Carbon and cermet technologies

ACP SMD potentiometers, like the traditional THT mount, can be manufactured using two different thick film technologies regarding the resistive element: carbon (6, 9 and 14 mm sizes) and cermet (9 and 14mm sizes).

Cermet is more robust and is recommended in high temperature and high power dissipation requirements. The nature of the resistive element and the plastic and metal materials, used in their configuration, are sturdy enough to go through the reflow process with no risk to get damaged.

For less demanding environment and power dissipation requirements, carbon element is the most common used technology. It is a very cost-effective product. On the other hand, it is more sensitive to the reflow heat stress. Here is where our engineers propose materials and processes to make a carbon based potentiometer suitable for SMD.

HOW TO ORDER

Example: CA14DVSM-D-T&R-10KA2020 LV10 DTF CY WT-14003

Standard features

1	2	3	4	5	6	7	8			
Series	Rotor ¹	Model	Pack.	Value ²	Taper	Tolerance CA Series CE Series	Life			
■ CA6	D,M,N,X	HSMD VSMD VESMD VS5...PIP	Bulk: Blank	Lin(A) 100 ≤ Rn ≤ 5M Log (B) Alog (C) 1K ≤ Rn ≤ 1M	Linear: A Log: B Alog: C Others: Special code	100 ≤ Rn ≤ 1M: ±25% 1M<Rn≤ 5M ±50%	N.A.			
■ CA9 / CE9	C,D,J,K,M,P,R,Y, KA*, MA*, MT* (*No detents possible)	HSMD; VSMD VSMD...CY V7,5...PIP V10...PIP V10...PIP TP25 VR10; HS3,8 H5...PIP TP25 H2,5... PIP TP25				100 ≤ Rn ≤ 100K ±30% 100K < Rn ≤ 1M: ±40% 1M < Rn ≤ 5M: ±50%	100 ≤ Rn ≤ 1M: ±20% 1M < Rn ≤ 5M ±30%	Standard, 1K cycles: Blank Others: LVXX		
■ CA14 / CE14	B,D,E,F,G,K, M,N,P,T,X,Z	VSMD; VSMD...CY; HSMD (on request)								
■ RS9	C,D,E,J,K,M, P,R,Y	Idem CA9				15" reel: T&R15	Lin(A):10K	Linear: A	±30%	Standard, 25K-50K cycles: LVXX
■ RS14	D,F,N,T,Z	Idem CA14								N.A.
■ CS14	B,D*,E,F*,G,K, M,N*,P,T*,X,Z* (* only these rotors for LV>15K turns)		Standard, 15K turns: Blank Others: LVXX							

Extra features

Assembled accessory

9	10	11	12	13	14	15	16
Track	Collector: Detents Center. pins	Terminals	Housing	Rotor	Wiper	Linearity	Assembly Ref # ³ Color
■ CA6	N.A.	N.A.				Standard, not controlled: Blank	
■ CA9 / CE9	Cut track, Initial: PCI Final: PCF	Initial: DTI Central: DTC Final: DTF X detents: XDT		Standard color, Grey: Blank	Position Central: Blank Initial: PI Final: PF Others: Special code		Accessory reference -V0 (optional)
■ CA14 / CE14	Pin in Paste: PIP		Standard, Brass: Blank	For other colors than standard: RT - color	For other colors than standard: RT - color	Standard, not controlled: Blank	T&R only on V style mount with 6030 6035 6037 9002 14003
■ RS9	Other track features: Special code		Optional. Steel: SH	For rotors N,T, Z of CS14: RSN	Torque, Low torque: PGB	Indep. X%: LNx% Absolute X%: LAX%	Standard color Neutral: -IN Others, pls. check availability Color- HT (optional)
■ RS14		N.A.					
■ CS14	N.A.	X detents: XDT					

¹ Rotor drawings, ² Standard ohmic values, ³ Accessory drawings : please refer to the General Catalogue at www.acpttechnologies.com

Color chart, for rotor, housing and accessories HT

Grey	Neutral	Red	Blue
GS	IN	RO	AZ

Color chart, for accessories (NO HT)

Black	White	Red
NE	BA	RO

Note: Rotor and Housing are according to UL 94V0.
HT accessories are recommended, V0 versions under request.

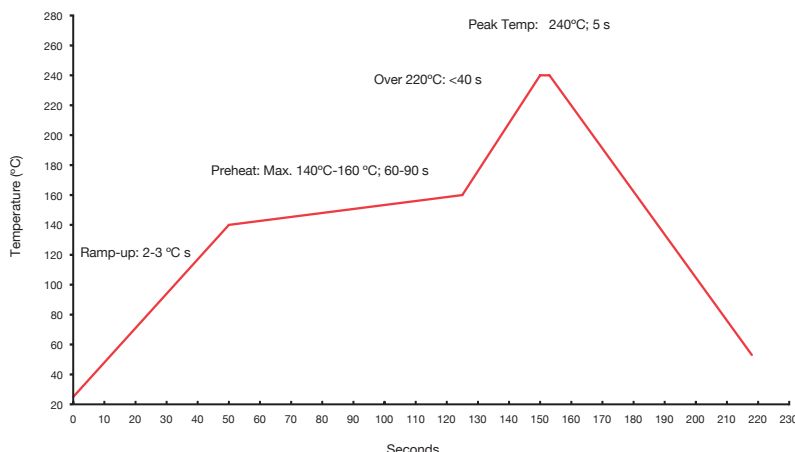
Note: Should the potentiometers be submitted to double reflow, please provide details. We have version readily available for that.

The first challenge that SMD potentiometers must overcome is the reflow soldering profile. Like every other component in this format, potentiometers must be able to withstand the severe heat stress experienced during that process. Our engineers have selected the most adequate metals, plastics and resistive elements to make sure that after that process the electrical and mechanical properties are kept to secure proper functioning in the application.

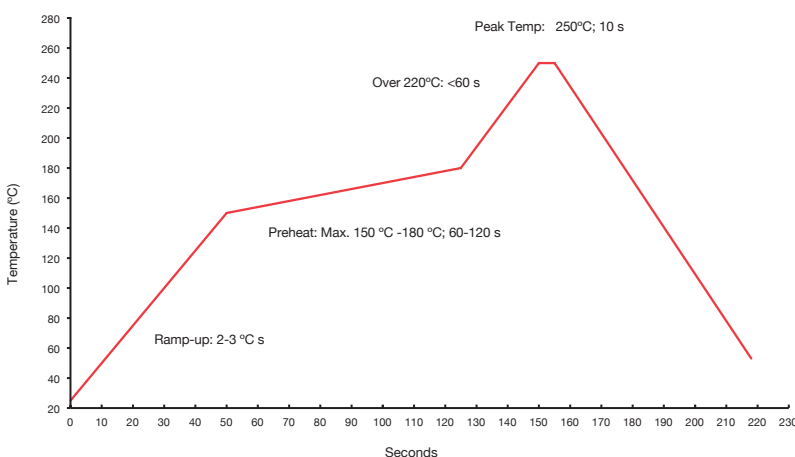
A compromise must always be found in order to secure good functional performance and good solder joints. Solder profiles are set by customer depending on the PCB layout and component density. To avoid damaging the components there are limits that every manufacturer establishes based on studies and tests. At ACP, we feature the SMD potentiometers according to the European Standard EN 60068-2-58. Based on the results obtained, we propose our recommended soldering profiles.

ACP recommended profiles

Carbon Potentiometers



Cermet potentiometers



	Pre-heating		Heating (above liquidous)		Peak	
	Temp (°C)	Time (sec)	Temp (°C)	Time (sec)	Temp (°C)	max. Time(sec)
CA	140-160	60-90	Over 220	<40	240	5
CE	150-180	60-120	Over 220	<60	250	10

Value shift after reflow

The nature of polymer thick film (carbon) resistive elements is such that they are sensitive to temperatures above 150°C. In their manufacturing process, the inks deposited on the different substrates are cured at high temperatures for a certain period of time in order to polymerize them and obtain a stabilized value.

You can imagine that submitting them during the reflow soldering process to temperatures of 240°C and higher, even for a few seconds there, is a heat stress that may modify the polymer structure and originate a value shift. The value change that a carbon potentiometer may experience depends on the resistive value. This has a consequence, tight resistive tolerances on carbon potentiometers will suffer a shift that may result in real resistive values beyond the limits.

This effect is only present on the carbon resistive elements. Cermet Thick film based resistive tracks are very stable and the reflow process does not affect them at all, there are no value changes after that.

		CA			CE	
		6	9	14	9	14
Range of resistance value*	Lin (A)	$100\Omega \leq R_n \leq 5M\Omega$			$100\Omega \leq R_n \leq 5M\Omega$	
	Log (B),Antilog (C)	$1 K\Omega \leq R_n \leq 1 M\Omega$			$1 K\Omega \leq R_n \leq 2M2\Omega$	
Tolerance*	$R_n < 100\Omega$:	-			-	
	$100\Omega \leq R_n \leq 100K\Omega$	$\pm 25\%$	$\pm 30\%$		$\pm 20\%$	
	$100K < R_n \leq 1M\Omega$:	$\pm 25\%$	$\pm 40\%$		$\pm 20\%$	
	$1M\Omega < R_n \leq 5M\Omega$:	$\pm 50\%$	$\pm 50\%$		$\pm 30\%$	
	$R_n > 5M\Omega$:	-			-	
Variation laws		Lin (A), Log (B), Antilog (C) *			Lin (A), Log (B), Antilog (C) *	
Residual resistance		Minimum value 2Ω			$\leq 2\Omega$	
CRV - Contact Resistance Variation (dynamic)		$\leq 3\% R_n$	$\leq 3\% R_n$	$\leq 3\% R_n$	$\leq 3\% R_n$	$\leq 3\% R_n$
CRV - Contact Resistance Variation (static)		$\leq 5\% R_n$	$\leq 5\% R_n$	$\leq 5\% R_n$	$\leq 5\% R_n$	$\leq 5\% R_n$
Maximum power dissipation	Lin (A)	at $50^\circ C$ 0.10W	at $50^\circ C$ 0.15W	at $50^\circ C$ 0.25W	at $70^\circ C$ 0.5W	at $70^\circ C$ 0.7W
	Log (B),Antilog (C)	at $50^\circ C$ 0.06W	at $50^\circ C$ 0.10W	at $50^\circ C$ 0.13W	at $70^\circ C$ 0.20W	at $70^\circ C$ 0.30W
Maximum voltage	Lin (A)	100VDC	200VDC	250VDC	200VDC	250VDC
	Log (B),Antilog (C)	60VDC	150VDC	200VDC		200VDC
Operating temperature*		$-25^\circ C \dots +70^\circ C$ (+ $85^\circ C$ on request)			$-40^\circ C \dots +90^\circ C$ (+ $125^\circ C$ on request)	
Temperature coefficient	$100\Omega \leq R_n \leq 10K\Omega$	$+200/-500$ ppm			± 100 ppm	
	$10K\Omega < R_n \leq 5M\Omega$	$+200/-1000$ ppm			± 100 ppm	
Resistive element		Carbon technology			Cermet	
Angle of rotation (mechanical)		$235^\circ \pm 10^\circ$	$240^\circ \pm 5^\circ$	$265^\circ \pm 5^\circ$	$240^\circ \pm 5^\circ$	$265^\circ \pm 5^\circ$
Angle of rotation (electrical)		$215^\circ \pm 20^\circ$	$220^\circ \pm 20^\circ$	$245^\circ \pm 20^\circ$	$220^\circ \pm 20^\circ$	$245^\circ \pm 20^\circ$
Wiper standard delivery position		$50\% \pm 15^\circ$			$50\% \pm 15^\circ$	
Max. stop torque		4 Ncm	5 Ncm	10 Ncm	5 Ncm	10 Ncm
Max. push/pull on rotor		9.8 N	40 N	50 N	40 N	50 N
Wiper torque*		< 2 Ncm	< 2 Ncm	< 2.5 Ncm	< 2 Ncm	< 2.5 Ncm
Wiper torque with detents*		NA	< 2.5 Ncm	< 3.5 Ncm	< 2.5 Ncm	< 3.5 Ncm
Mechanical life		1.000 cycles (Long life 10.000 cycles)				

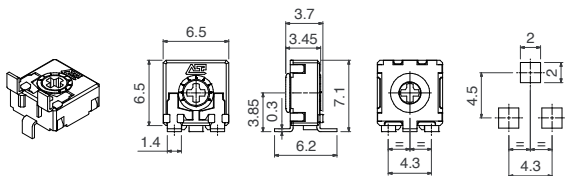
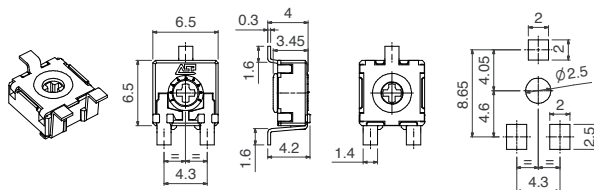
*Other (tapers, resistance value, operating temperature, wiper torque and mechanical life) please inquire.

		RS9 SMD	RS14 SMD	CS14 SMD (upon availability)
Range of resistance value*	Lin (A)	Standard value is 10K*		100Ω ≤ Rn ≤ 1MΩ
	Log (B),Antilog (C)	-		1 KΩ ≤ Rn ≤ 1 MΩ
Tolerance*	100Ω ≤ Rn ≤ 100KΩ	±30%		
	100K< Rn ≤ 1MΩ:	-		±40%
	1MΩ < Rn ≤5MΩ:	-		±50%
Variation laws		Lin (A) *		
Residual resistance		Minimum value 2Ω		-
CRV - Contact Resistance Variation (dynamic)		≤ 3% Rn		
CRV - Contact Resistance Variation (static)		≤ 5% Rn		
Max. power dissipation	Lin (A)	at 50°C 0.15W		
Maximum voltage	Lin (A)	200VDC	250VDC	
Operating temperature*		-25°C ... +70°C (+85°C on request)	-25°C ... +85°C	-25°C ... +70°C (+120°C on request)
Temperature coefficient	100Ω ≤ Rn ≤ 10KΩ	+200/ -300 ppm	+200/ -500 ppm	
	10KΩ < Rn ≤ 5MΩ	+200/ -1000 ppm	+200/ -1000 ppm	
Resistive element		Carbon technology		
Angle of rotation (mechanical)		240° ± 5°	265° ± 5°	360°
Angle of rotation (electrical)		220° ± 20°	245° ± 20°	330° ± 20°
Wiper standard delivery position		50% ± 20°		
Max. stop torque		5 Ncm	10 Ncm	-
Max. push/pull on rotor		40 N	50 N	35 N / 50 N
Wiper torque*		<2 Ncm	<1.5 Ncm	15.000 turns <2.5 Ncm >15.000 turns <1.5Ncm
Wiper torque with detents*		NA		<3.5 Ncm
Mechanical life		Standard: between 25.000 and 50.000 cycles. Long life: up to 200.000 cycles *	100.000 cycles. Up to 1.000.000 cycles	15.000 turns Up to 1.000.000 turns

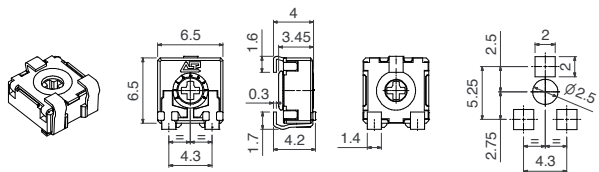
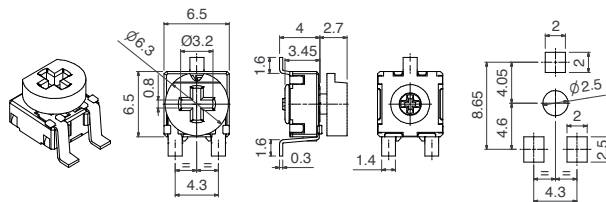
*Other (tapers, resistance value, operating temperature, wiper torque and mechanical life) please inquire.

Rotors can be chosen according to customer specifications; the rotors shown here are examples, please refer to the General Catalogue at www.acpttechnologies.com

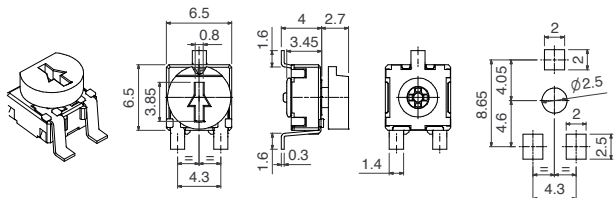
CA6

HSMD**VSMD**

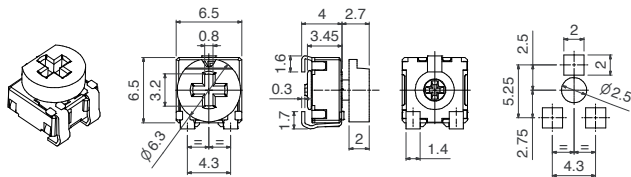
VESMD

**VSMD WT-6030**

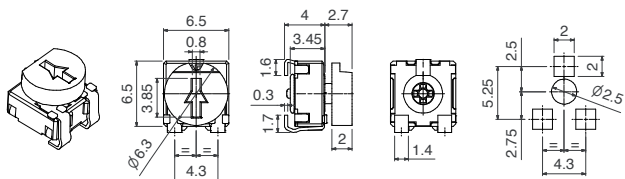
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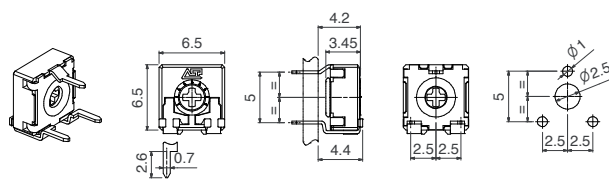
VESMD WT-6030



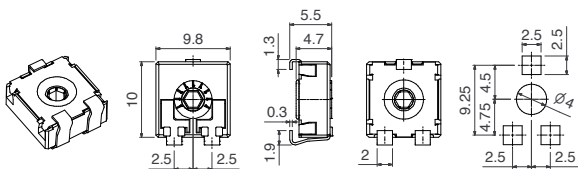
VESMD WT-6037



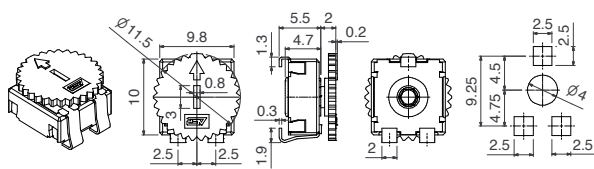
VS5...PIP



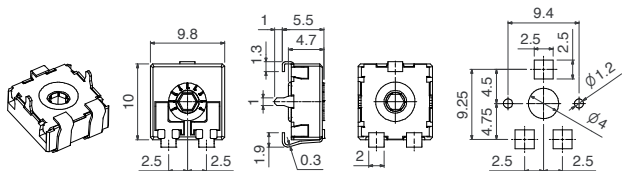
VSMD



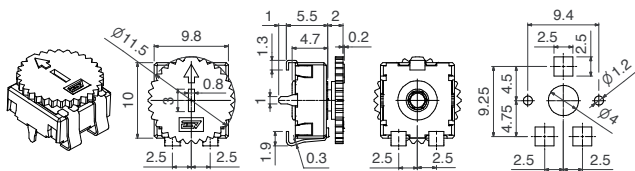
VSMD WT-9002



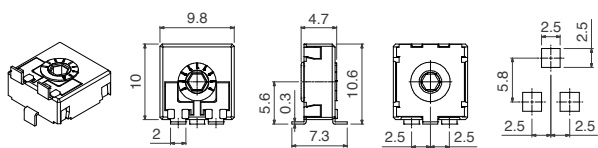
VSMD... CY



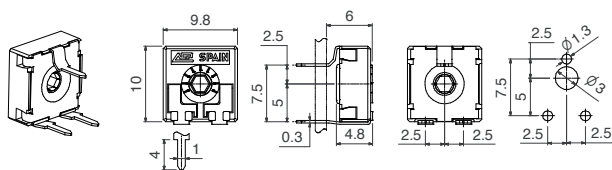
VSMD... CY WT-9002



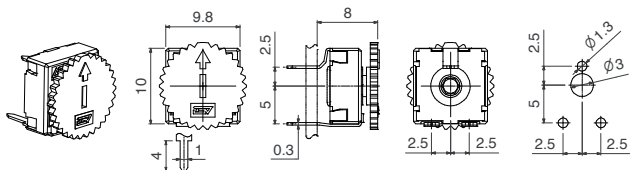
HSMD



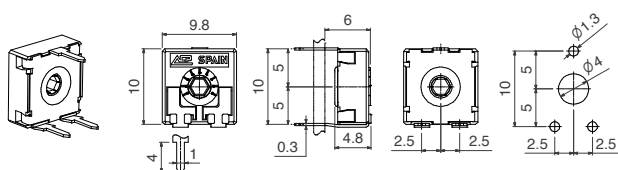
V7.5... PIP



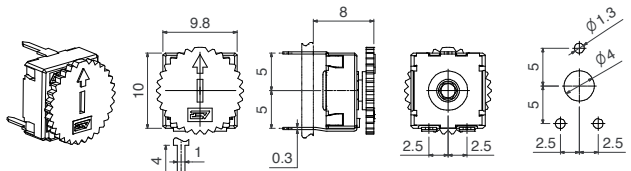
V7.5...PIP WT-9002



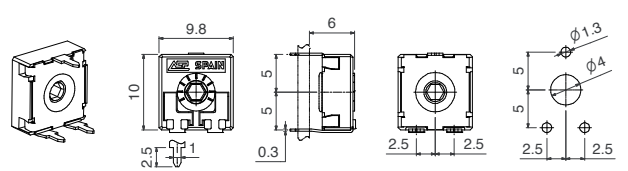
V10...PIP



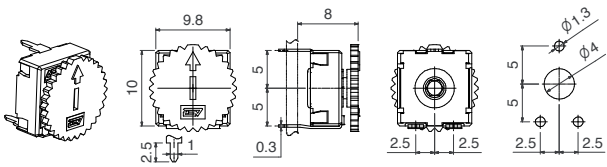
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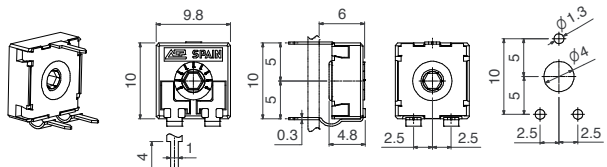
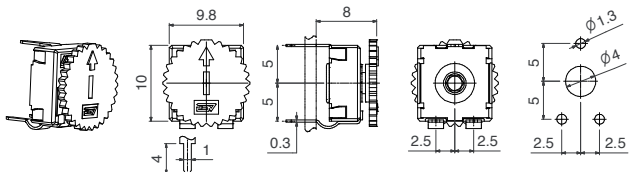
V10...PIP TP25



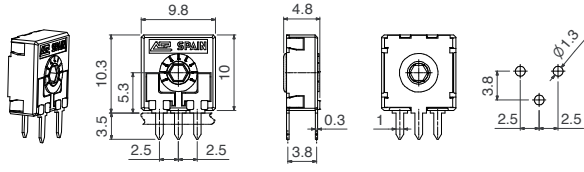
V10...PIP TP25 WT-9002



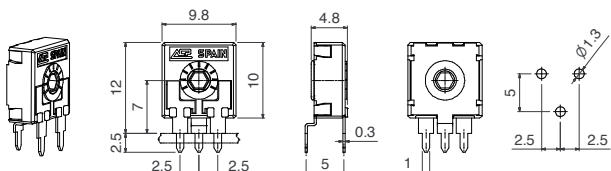
VR10...PIP

**VR10... PIP WT-9002**

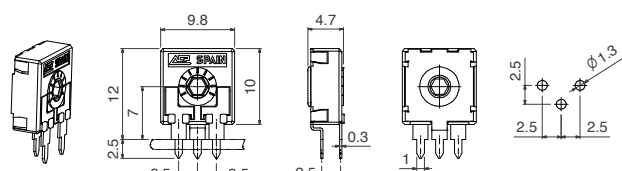
HS3,8...PIP



H5... PIP TP25

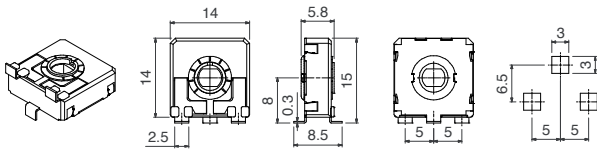


H2.5...PIP TP25

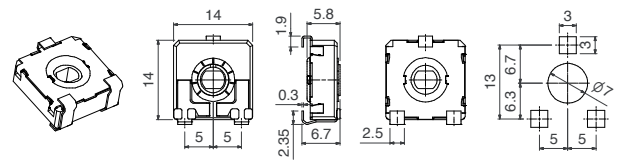


CA14-CE14

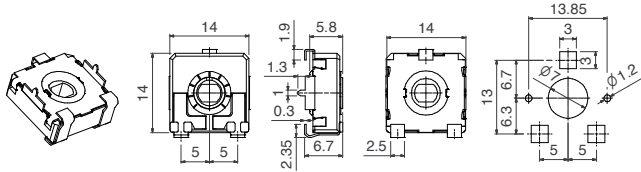
HSMD*



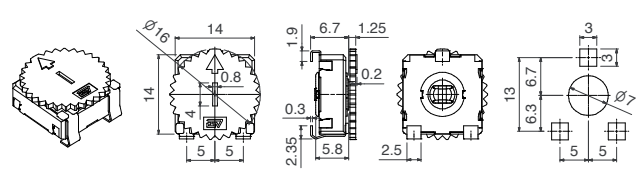
VSMD



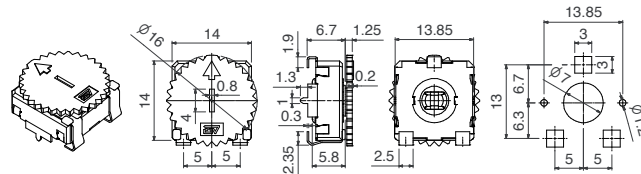
VSMD...CY



VSMD WT-14003



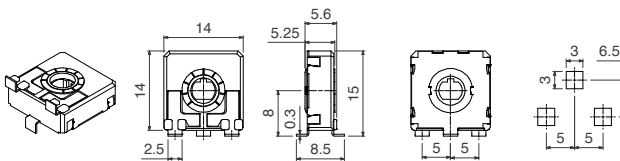
VSMD...CY WT-14003



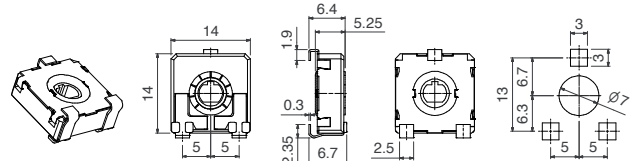
*Under request.

RS14

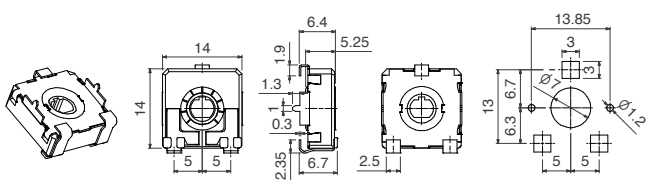
HSMD*



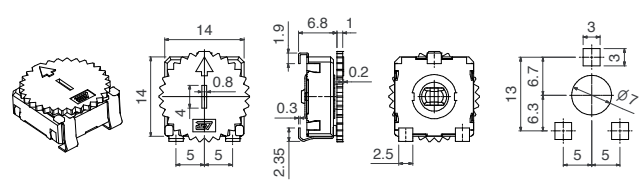
VSMD



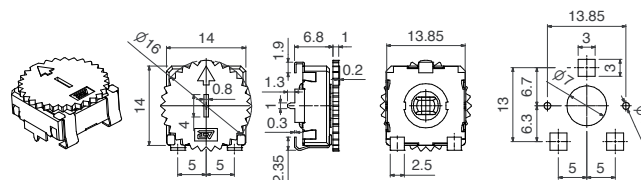
VSMD...CY



VSMD WT-14003

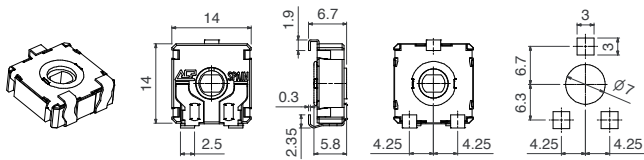


VSMD...CY WT-14003

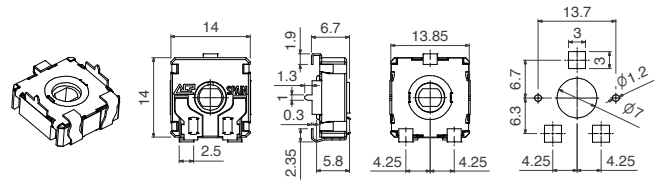


*Under request.

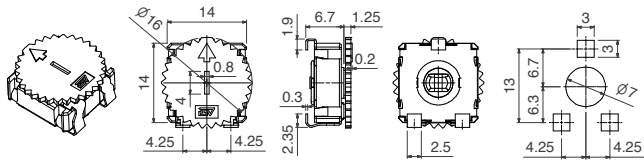
VSMD



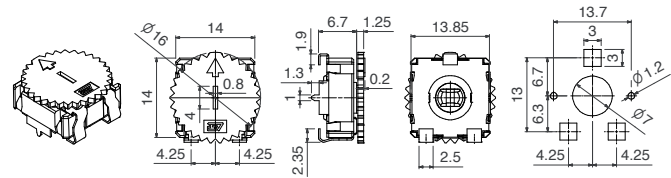
VSMD...CY



VSMD WT-14003



VSMD...CY WT-14003



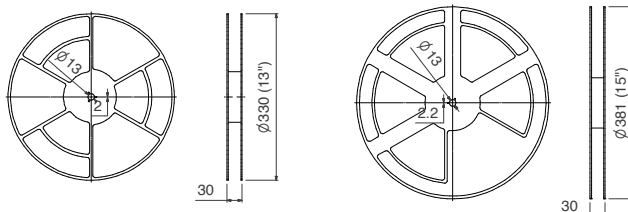
SMD

	Accessory	Qty	CA6			CA9-CE9 / RS9			CA14-CE14 / RS14 / CS14		
			VSMD	VESMD	HSMD	VSMD	VSMD...CY	HSMD	VSMD	VSMD...CY	HSMD
13" Reel (Standard), with 24mm width tape	None, only potentiometers	pcs/reel	1.200	1.000	750	900	750	350	500	350	Under Request
		MOQ	4.800	5.000	4.500	4.500	4.500	4.900	5.000	4.900	
	With Knob		Knob types 6030, 6035, 6037						Knob type 14003		
		pcs/reel	750	700	700	700	550	Under Request	450	350	Under Request
		MOQ	5.250	4.900	4.900	4.900	4.950		4.950	4.900	
15" Reel, with 24mm width tape	None, only potentiometers	pcs/reel	1.700	1.500	1.000	1.250	1.000	475	800	500	Under Request
		MOQ	5.100	4.500	5.000	5.000	5.000	4.750	4.800	5.000	
	With Knob		Knob types 6030, 6035, 6037						Knob type 14003		
		pcs/reel	1.100	1.000	1.000	950	800	Under Request	750	450	Under Request
		MOQ	5.500	5.000	5.000	4.750	4.800		4.500	4.950	

PIP

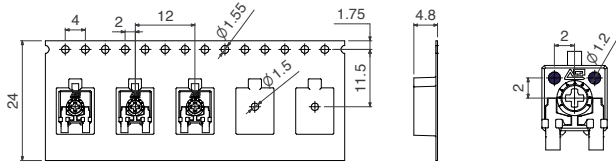
	Accessory	Qty	6mm Series CA6 VS5	9mm Series CA9-CE9 / RS9					
				H2,5...TP25	H5... TP25	HS3,8	V7,5	V10	V10...TP25
13" Reel (Standard), with 24mm width tape	None, only potentiometers	pcs/reel	900	250	250	250	250	250	250
		MOQ	4.500	5.000	5.000	5.000	5.000	5.000	5.000
	With Knob	pcs/reel	Knob type 9002						
		MOQ		250	250	250	250	250	250
15" Reel, with 24mm width tape	None, only potentiometers	pcs/reel	1.200	350	350	350	400	400	400
		MOQ	4.800	5.100	5.100	5.100	4.800	4.800	4.800
	With Knob	pcs/reel	Knob type 9002						
		MOQ		350	350	350	400	400	400
				5.100	5.100	5.100	4.800	4.800	4.800

T&R13" y T&R15"

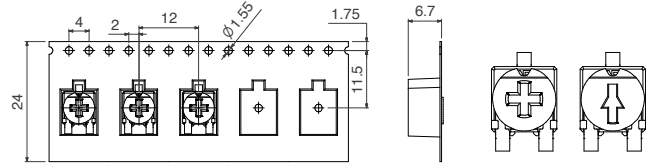


CA6

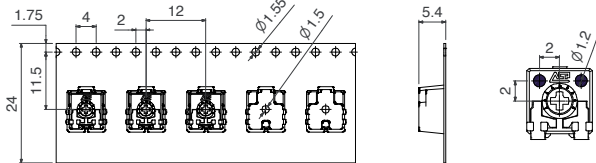
VSMD-T&R



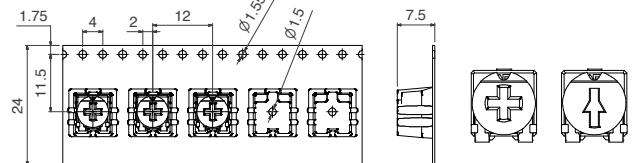
VSMD-T&R...WT- 6030 / 6035 / 6037



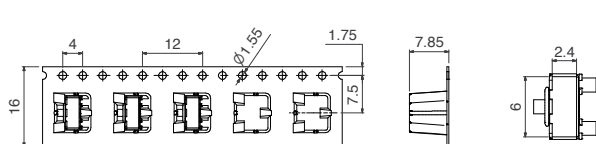
VESMD-T&R



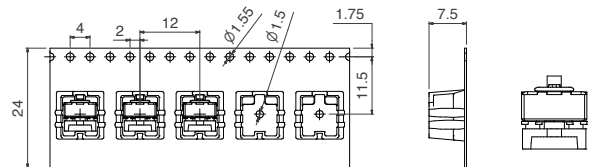
VESMD-T&R...WT -6030 / 6035 / 6037



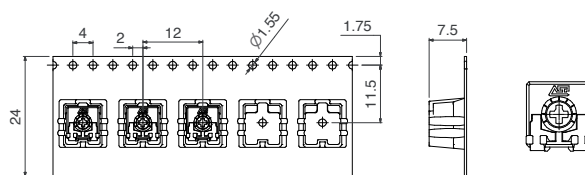
HSMD-T&R



HSMD-T&R...WT- 6030 / 6035 / 6037

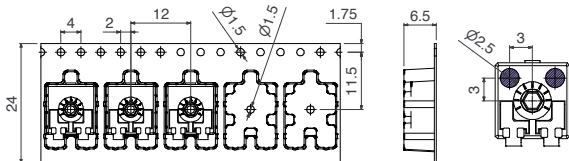


VS5-T&R...PIP

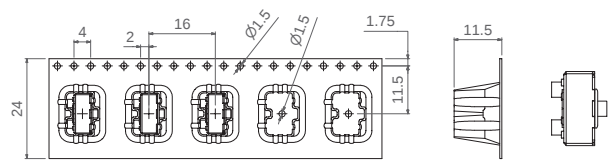


CA9-CE9 y RS9

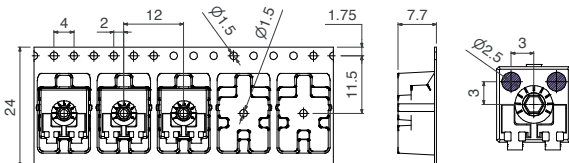
VSMD-T&R



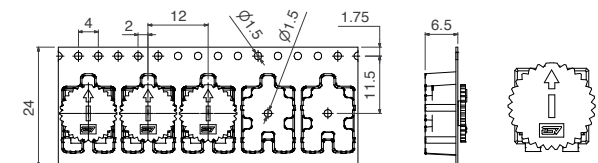
HSMD-T&R



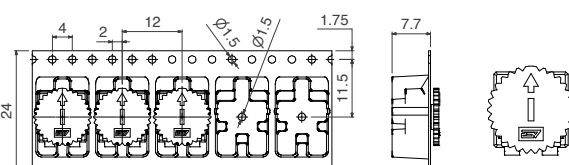
VSMD-T&R...CY



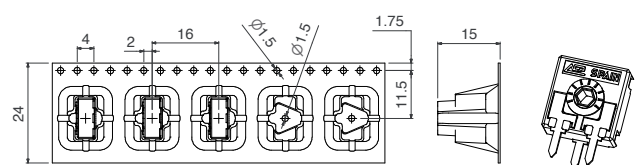
VSMD-T&R...WT-9002



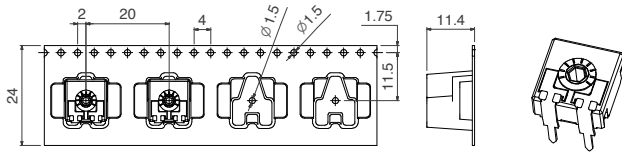
VSMD-T&R...CY WT-9002



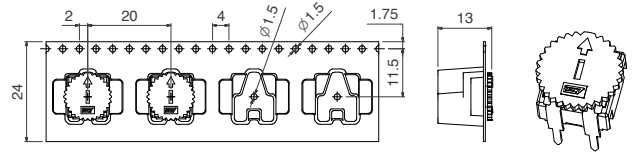
HS3,8-T&R...PIP



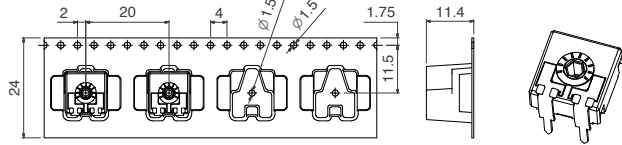
V7,5-T&R...PIP



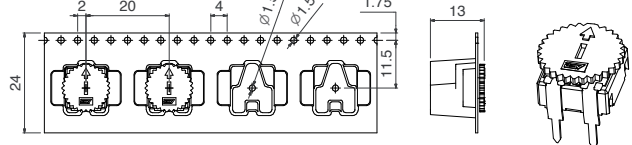
V7,5-T&R... PIP WT-9002



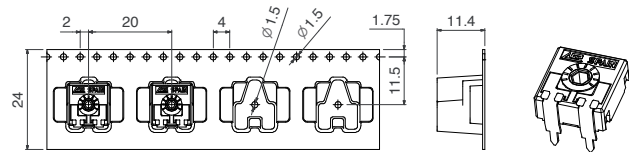
V10-T&R...PIP



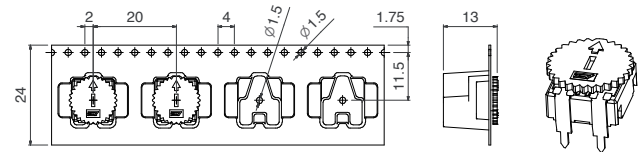
V10-T&R...PIP WT-9002



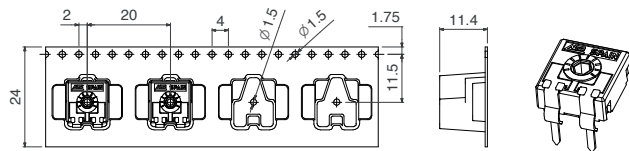
V10-T&R...PIP TP25



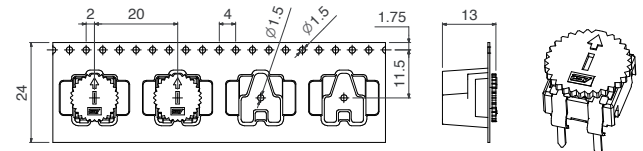
V10-T&R...PIP TP25 WT-9002



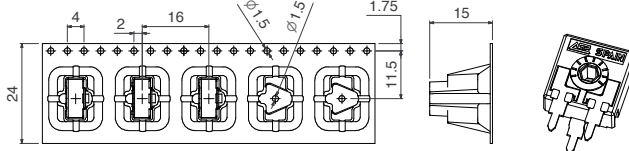
VR10-T&R...PIP



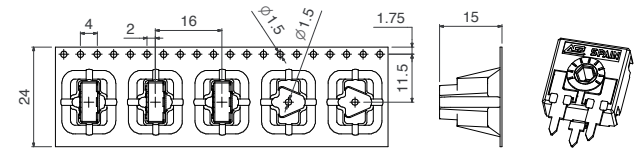
VR10-T&R...PIP WT-9002



H5-T&R...PIP TP25

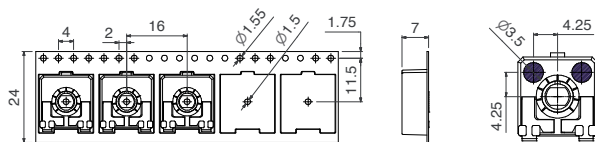


H2,5-T&R... PIP TP25

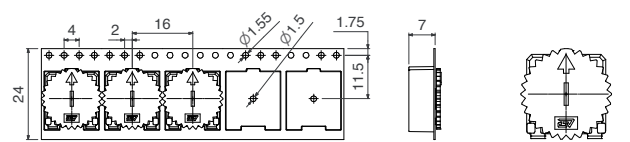


CA14-CE14

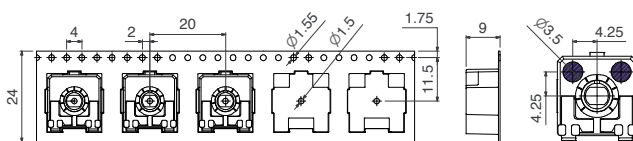
VSMD-T&R



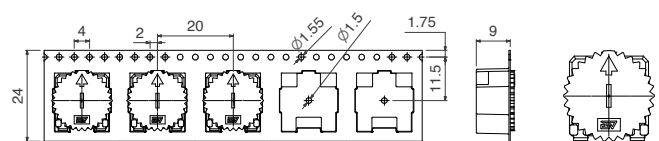
VSMD-T&R...WT-14003



VSMD-T&R...CY

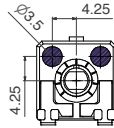
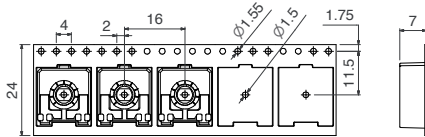


VSMD-T&R...CY WT-14003

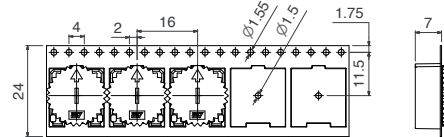


RS14

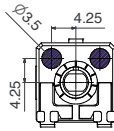
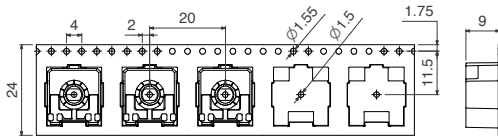
VSMD-T&R



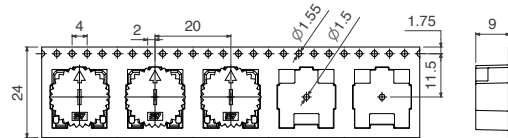
VSMD-T&R...WT-14003



VSMD-T&R...CY

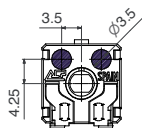
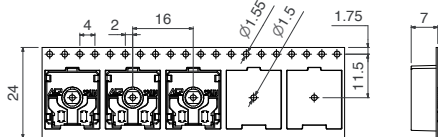


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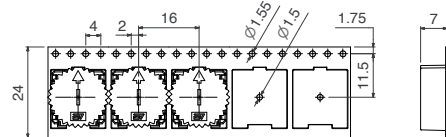


CS14

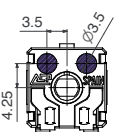
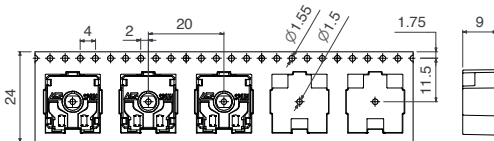
VSMD-T&R



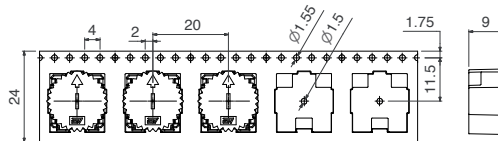
VSMD-T&R... WT-14003



VSMD-T&R...CY



VSMD-T&R...CY WT-14003



ACP's patented detent (DT) feature is especially suitable for control applications where the end user will turn a knob inserted in the potentiometer. Detents add a click feeling to the turning of the potentiometer and a control of the angle position of the wiper, assuring a particular output value.

The standard configuration is an even distribution of the detents along the mechanical angle. Hence, the output value obtained in each detent is proportional to the angle turned from the initial position, within the tolerance limits of the corresponding taper: linear, log, antilog, cut track or special.

Our patented design with two wipers has improved the performance of these potentiometers, giving them more stable electrical parameters, improved reliability and Contact Resistance Variation (CRV) and narrower tolerances for detent positioning. Detents can be light or strong, or even a combination of different feelings is possible.

Applications of the detents are: 1) to provide a haptic “click” feeling along the travel of the potentiometer or 2) to additionally secure a non-overlapping output of contiguous positions. The table below describes the maximum number of detents offered for both options.

One common example is a potentiometer with detents and matching non-overlapping voltage values in specific angular positions used to provide in a voltage value to a microcontroller. Examples of 10 DT potentiometer matched with 10 flat zones electrical curve on a CA9/CE9.

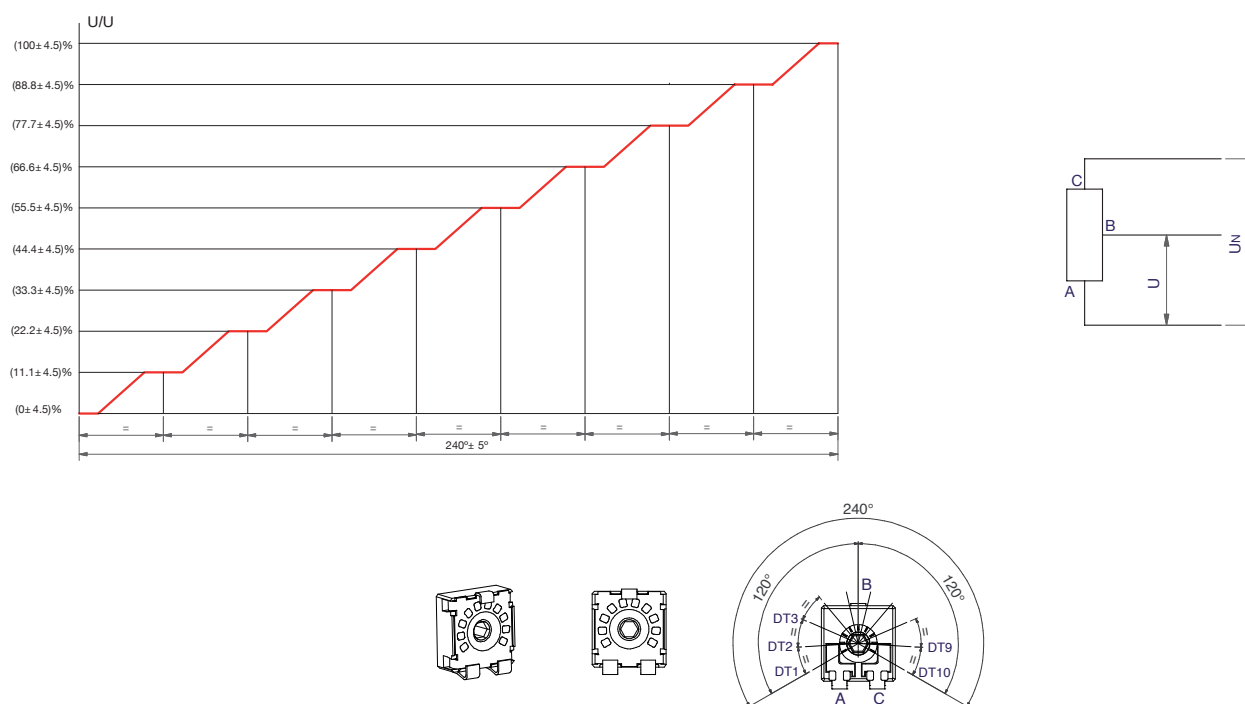


TABLE OF DETENT OPTIONS

Model	Mechanical angle	Electrical angle	Detents for feeling	Detents with silver zones, non-overlapping	Maximum silver zones	Wiper torque with DTs	Mechanical life
CA6	235°	215°	-	-	5	-	-
CA9	240°	220°	1,2,3,4,5,6,7,8,9,10... max.:20 evenly distributed	≤10 positions with different voltage values	10	≤2,5Ncm	Standard 1.000 cycles. Up to 10.000 cycles are available
CE9	240°	220°	1,2,3,4,5,6,7,8,9,10... max.:20 evenly distributed	≤10 positions with different voltage values	10	≤2,5Ncm	
CA14	265°	245°	1,3,4,5,6,7,8,9,10,13,14,17,22,27...max.: 38 evenly distributed	≤14 positions with different voltage values	14	≤3,5Ncm	
CE14	265°	245°	1,3,4,5,6,7,8,9,10,13,14,17,22,27...max.: 38 evenly distributed	≤11 positions with different voltage values	11	≤3,5Ncm	
RS9	240°	220°	-	-	10	-	Standard 25K-50K cycles.
RS14	265°	245°	-	-	14	-	-
CS14*	360°	330°	maximum: 50 detents evenly distributed	≤17 positions with different voltage values	17	≤3,5Ncm	Up to 1.000.000 cycles, inquiry.

* External customer detents: ACP recommends to avoid the dead area use, for external detents. Please, use the electrical angle (330°) in order to avoid wrong configurations.

SMD Rotary Potentiometer Switch

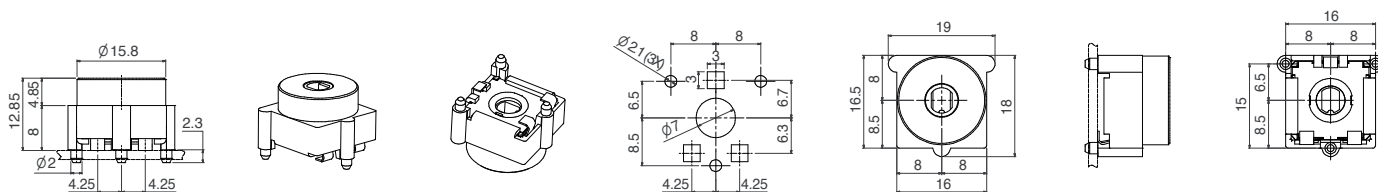
This Rotary Potentiometer Switch in SMD version is the ideal alternative to Absolute Encoders and Rotary Switches for control applications like Program Selector Switches in White Goods, where robust click feeling is required along the full circumference: Washing Machines, Dishwashers, Dryers, Electrical Ovens etc., Controls in other Appliances like Ranges, Microwave Ovens, Kitchen Robots, etc., and HVAC in Automotive: Air Flow Distribution Switch, Temperature Setting and Fan Speed Selection.

How to order

Example: Q16RVSM-D-10KA3030 LV10 16DT 3N PDT1

Standard features

1	2	3	4	5	6	7	8	9	10	11	12	13
Series	Rotor	Model	Packaging	Value	Taper	Tolerance	Life	N° Detents	Det.torque.	Flammability	Delivery position	Special marking
Q16	R (Standard) Others under study	VSMD	Blank Bulk T&R Under request	10K (Standard) Others Under request	A Linear	±30% Others Under request	LV10 Standard, 10K turns LVXX Others	16DT Standard 8DT Others under study	3N Standard 3Ncm	(leave blank) Standard: Non self extinguishable V0 All plastic parts self extinguishable according to UL 94 V0 Q-V0 Only Q16 housing and rotor self extinguishable V0	PDT1 Standard, position at detent 1: PDTXX Position at detent XX= (position number)	GRE



Graph showing the relationship between the normalized voltage U/U_n (Y-axis) and the electrical angle (X-axis) for a 12-pulse rectifier. The Y-axis ranges from $(0+2.27)\%$ to $(100-2.27)\%$. The X-axis ranges from 15° to 15° (labeled 360°).

The graph displays a red line representing the average voltage and a shaded area representing the ripple. The shaded area is labeled "ISOLATED AREA".

Key data points on the Y-axis (from bottom to top):

- $(0+2.27)\%$
- $(5.68 \pm 3.41)\%$
- $(12.50 \pm 3.41)\%$
- $(19.32 \pm 3.41)\%$
- $(26.14 \pm 3.41)\%$
- $(32.95 \pm 3.41)\%$
- $(39.77 \pm 3.41)\%$
- $(46.59 \pm 3.41)\%$
- $(53.41 \pm 3.41)\%$
- $(60.23 \pm 3.41)\%$
- $(67.05 \pm 3.41)\%$
- $(73.86 \pm 3.41)\%$
- $(80.68 \pm 3.41)\%$
- $(87.50 \pm 3.41)\%$
- $(94.32 \pm 3.41)\%$
- $(100-2.27)\%$

Key data points on the X-axis (from left to right):

- 15°
- $DT1$
- $DT2$
- $DT3$
- $DT4$
- $DT5$
- $DT6$
- $DT7$
- $DT8$
- $DT9$
- $DT10$
- $DT11$
- $DT12$
- $DT13$
- $DT14$
- $DT15$
- $DT16$
- 15°

The graph is labeled "CENTRAL POSITION" and "ISOLATED AREA".

DETENT	VALUE
1	(0+2.27)% Un
2	(5.68±3.41)% Un
3	(12.50±3.41)% Un
4	(19.32±3.41)% Un
5	(26.14±3.41)% Un
6	(32.95±3.41)% Un
7	(39.77±3.41)% Un
8	(46.59±3.41)% Un
9	(53.41±3.41)% Un
10	(60.23±3.41)% Un
11	(67.05±3.41)% Un
12	(73.86±3.41)% Un
13	(80.68±3.41)% Un
14	(87.50±3.41)% Un
15	(94.32±3.41)% Un
16	(100-2.27)% Un



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July 2026



Company certified by IQNet (Aenor) under:
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ISO 14001
IATF 16949