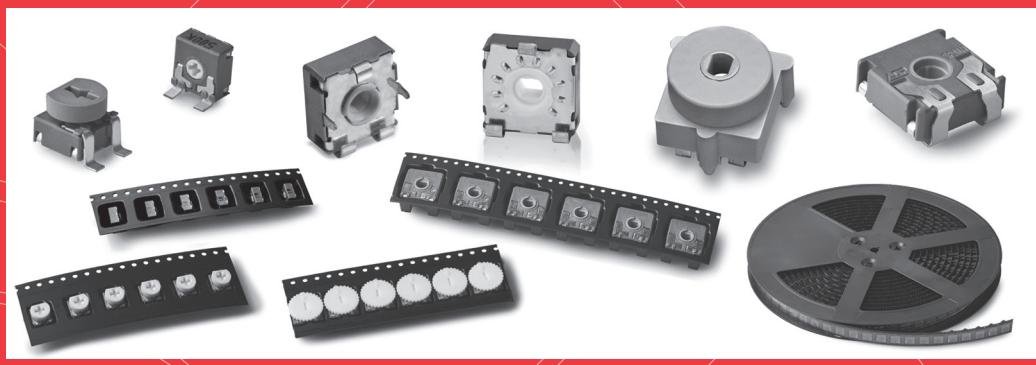
ACP Reflowable Potentiometers



Technical information

Aragonesa de Componentes Pasivos

CONTENT

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, but 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: CA14DVSMD-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	Tolerance CE Series	Life
CA6	D,M,N,X	HSMD VSMD VESMD VS5...PIP	Bulk: Blank 13" reel: T&R 15" reel: T&R15	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.	Standard, 1K cycles: Blank Others: LVXX
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%	
RS9	C,D,E,J,K,M, P,R,Y						N.A.	Standard, 25K-50K cycles: LVXX Others: LVXX
CA14 / CE14	B,D,E,F,G,K, M,N,P,T,X,Z	HSMD (on request) VSMD VSMD…CY					100 ≤ Rn ≤ 1M: ±20% 1M < Rn ≤ 5M ±30%	Standard, 1K cycles: Blank Others: LVXX
RS14	D,F,N,T,Z						N.A.	Up to 1M cycles (please specify the cycles)
CS14	B,D*,E,F*,G,K, M,N*,P,T*,X,Z* (* only these rotors for LV>15K turns)			Lin(A) 100 ≤ Rn ≤ 1M Log (B) Alog (C) 1K ≤ Rn ≤ 1M				Standard, 15K turns: Blank Others: LVXX

Extra features

Assembled accessory

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

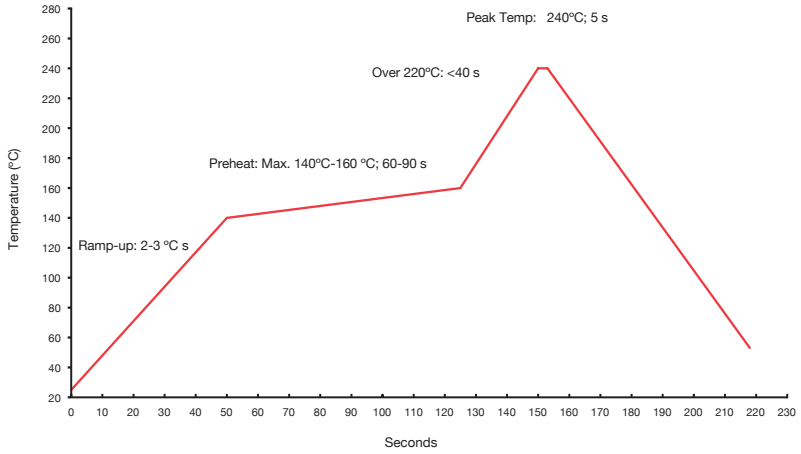
Reflow soldering

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.

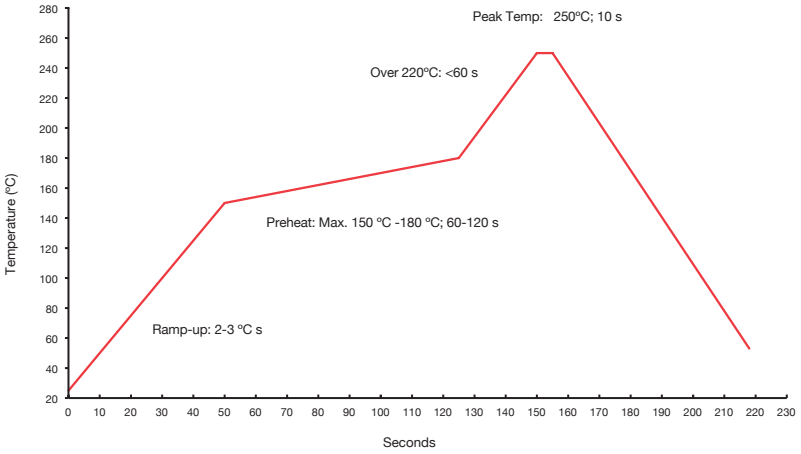
A compromise must always be found in order to secure good functional performance and good solder joints.
Solder profiles are set by customer depending on the PCB layout and component density. To avoid damaging the components there are limits that every manufacturer establishes based on studies and tests. 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 (ºC)	Time (sec)	Temp (ºC)	Time (sec)	Temp (ºC)	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 150ºC. 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 240ºC and higher, even for a few seconds, 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.

Technical information table

		CA			CE	
		6	9	14	9	14
Range of resistance value*	Lin (A)	100Ω ≤ Rn ≤ 5MΩ			100Ω ≤ Rn ≤ 5MΩ	
	Log (B),Antilog (C)	1 KΩ ≤ Rn ≤ 1 MΩ			1 KΩ ≤ Rn ≤ 2M2Ω	
Tolerance*	Rn < 100Ω:	-			-	
	100Ω ≤ Rn ≤ 100KΩ	±25%	±30%		±20%	
	100K< Rn ≤ 1MΩ:	±25%	±40%		±20%	
	1MΩ < Rn ≤5MΩ:	±50%	±50%		±30%	
	Rn > 5MΩ:	-			-	
Variation laws		Lin (A), Log (B), Antilog (C) *			Lin (A), Log (B), Antilog (C) *	
Residual resistance		Minimum value 2Ω			≤2Ω	
CRV - Contact Resistance Variation (dynamic)		≤ 3% Rn	≤ 3% Rn	≤ 3% Rn	≤ 3% Rn	≤ 3% Rn
CRV - Contact Resistance Variation (static)		≤ 5% Rn	≤ 5% Rn	≤ 5% Rn	≤ 5% Rn	≤ 5% Rn
Maximum power dissipation	Lin (A)	at 50ºC 0.10W	at 50ºC 0.15W	at 50ºC 0.25W	at 70ºC 0.5W	at 70º C. 0.7W
	Log (B),Antilog (C)	at 50ºC 0.06W	at 50ºC 0.10W	at 50ºC 0.13W	at 70ºC 0.20W	at 70º C. 0.30W
Maximum voltage	Lin (A)	100VDC	200VDC	250VDC	200VDC	250VDC
	Log (B),Antilog (C)	60VDC	150VDC	200VDC		200VDC
Operating temperature*		-25ºC … +70ºC (+85ºC on request)			-40ºC … +90ºC (+125ºC on request)	
Temperature coefficient	100Ω ≤ Rn ≤ 10KΩ	+200/ -500 ppm			±100 ppm	
	10KΩ < Rn ≤ 5MΩ	+200/ -1000 ppm			±100 ppm	
Resistive element		Carbon technology			Cermet	
Angle of rotation (mechanical)		235º ± 10º	240º ± 5º	265º ± 5º	240º ± 5º	265º ± 5º
Angle of rotation (electrical)		215º ± 20º	220º ± 20º	245º ± 20º	220º ± 20º	245º ± 20º
Wiper standard delivery position		50% ± 15º			50% ± 15º	
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.

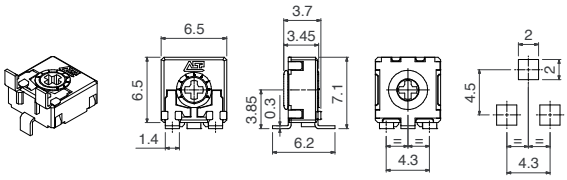
		RS9 Through-hole and SMD	RS14	CS14
Range of resistance value*	Lin (A)	100Ω ≤ Rn ≤ 1MΩ	Standard value is 10K*	100Ω ≤ Rn ≤ 1MΩ
	Log (B),Antilog (C)	1 KΩ ≤ Rn ≤ 1 MΩ	-	1 KΩ ≤ Rn ≤ 1 MΩ
Tolerance*	Rn < 100Ω:	-	-	
	100Ω ≤ Rn ≤ 100KΩ	±30%	±30%	
	100K< Rn ≤ 1MΩ:	±40%	-	±40%
	1MΩ < Rn ≤5MΩ:	±50%	-	±50%
	Rn > 5MΩ:	-	-	
Variation laws		Lin (A). Other tapers available on request	Lin (A) *	
Residual resistance		Lin (A) ≤ 5*10-3*Rn. Minimum value 2Ω	Minimum value 2Ω	
CRV - Contact Resistance Variation (dynamic)		Lin (A) Electrical Angle 220º±20º ≤ 3%Rn. *	≤ 3% Rn	
CRV - Contact Resistance Variation (static)		Lin (A) Electrical Angle 220º±20º ≤ 5%Rn. *	≤ 5% Rn	
Maximum power dissipation	Lin (A)	at 50ºC 0.15W	at 50ºC 0.15W	
	Log (B),Antilog (C)	at 50ºC 0.10W	-	
Maximum voltage	Lin (A)	200VDC	250VDC	
	Log (B),Antilog (C)	150VDC	-	
Operating temperature*		-25ºC … +70ºC (+85ºC on request)	-25ºC … +85ºC	-25ºC … +70ºC, Special Version 120º C *
Temperature coefficient	100Ω ≤ Rn ≤ 10KΩ	+200/ -500 ppm	+200/ -500 ppm	
	10KΩ < Rn ≤ 5MΩ	+200/ -1000 ppm	+200/ -1000 ppm	
Resistive element		Carbon technology	Carbon technology	
Angle of rotation (mechanical)		240º ± 5º	265º ± 5º	360º
Angle of rotation (electrical)		220º ± 20º	245º ± 20º	330º ± 20º
Wiper standard delivery position		50% ± 15º	50% ± 15º	
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	NA	<3.5 Ncm
Mechanical life		Standard: between 25.000 and 50.000cycles. Long life: up to 200.000cycles *	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.

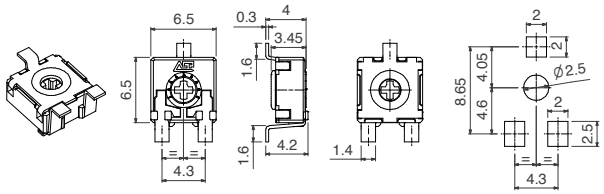
Rotors can be chosen according to customer specifications; the rotors shown here are examples, please refer to the General Catalogue at www.acptechnologies.com

CA6

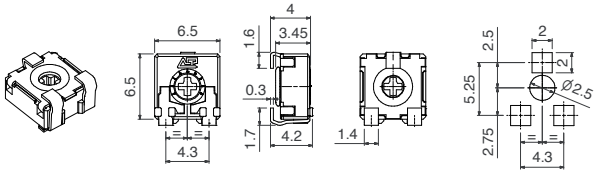
HSMD



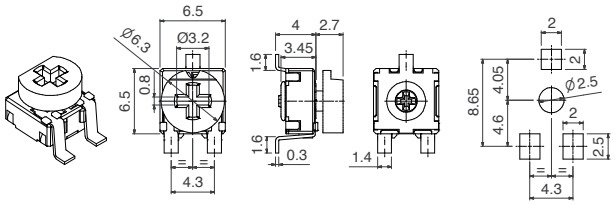
VSMD



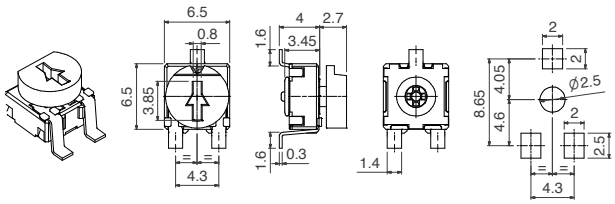
VESMD



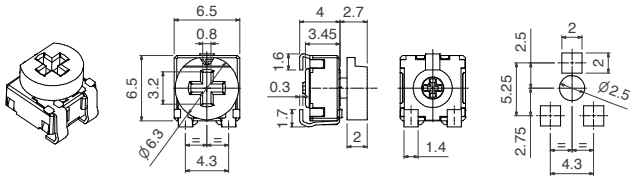
VSMD WT-6030



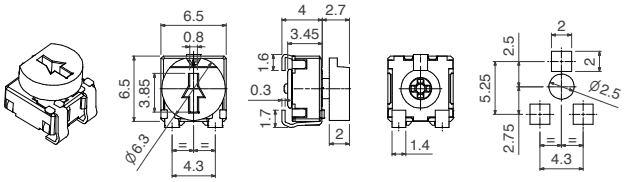
VSMD WT-6037



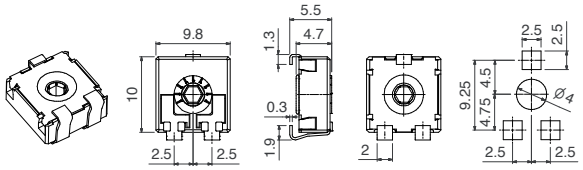
VESMD WT-6030



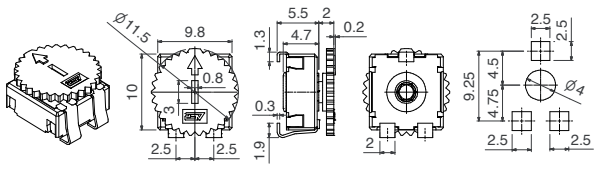
VESMD WT-6037



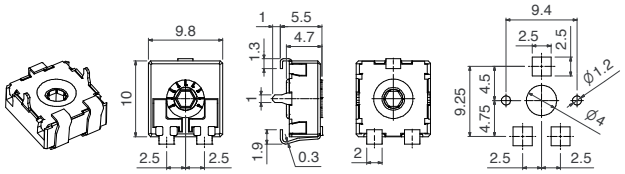
VSMD



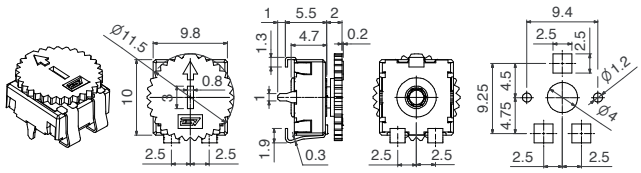
VSMD WT-9002



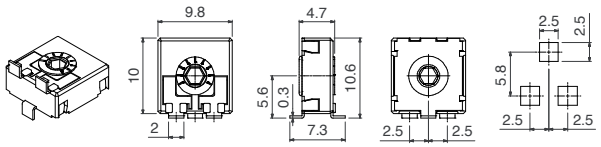
VSMD... CY



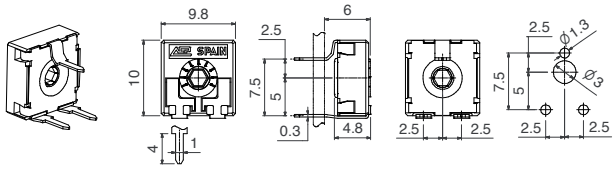
VSMD... CY WT-9002



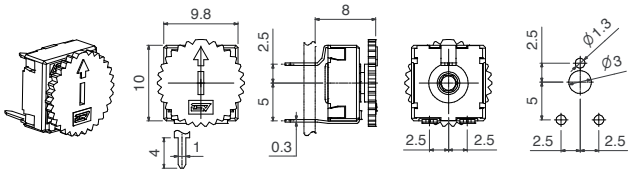
HSMD



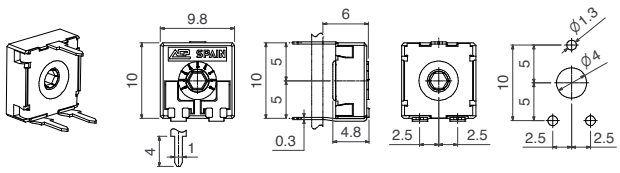
V7,5... PIP



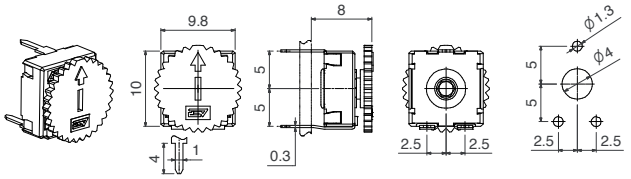
V7,5...PIP WT-9002



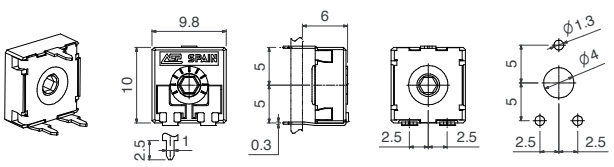
V10...PIP



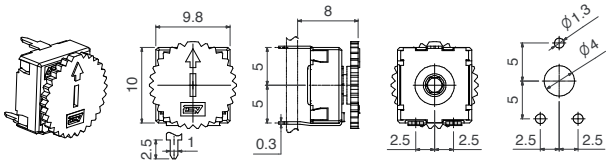
V10...PIP WT-9002



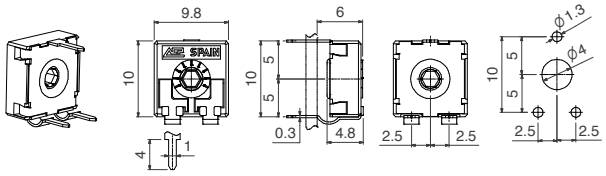
V10...PIP TP25



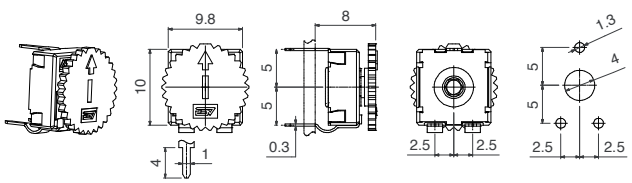
V10...PIP TP25 WT-9002



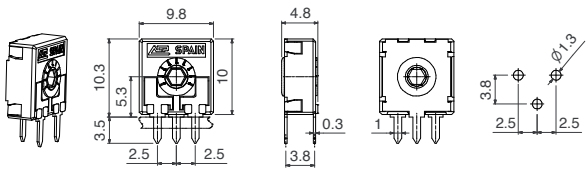
VR10...PIP



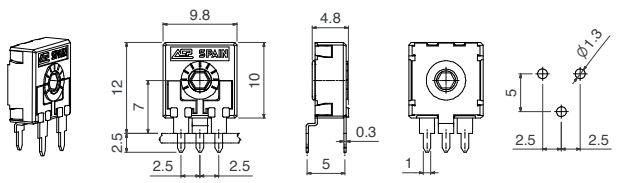
VR10... PIP WT-9002



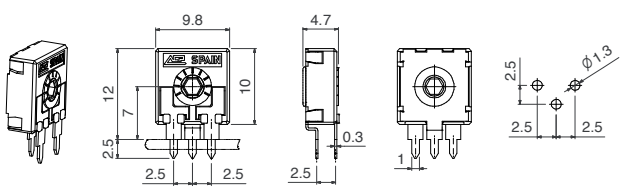
HS3,8...PIP



H5... PIP TP25

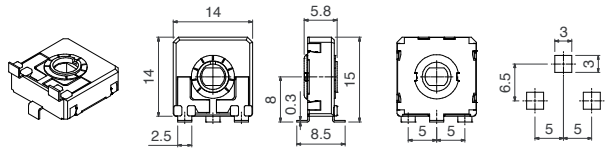


H2,5...PIP TP25

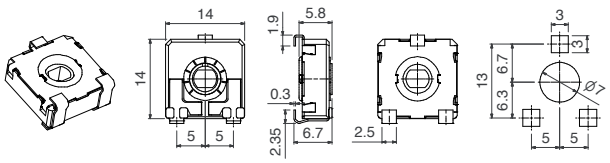


CA14-CE14

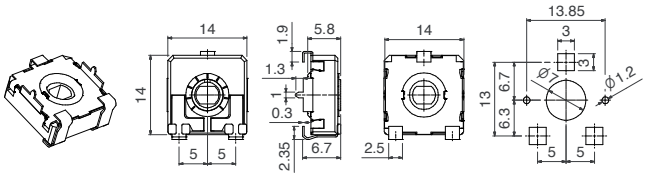
HSMD*



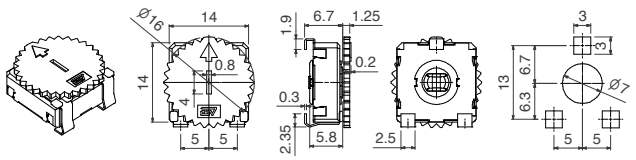
VSMD



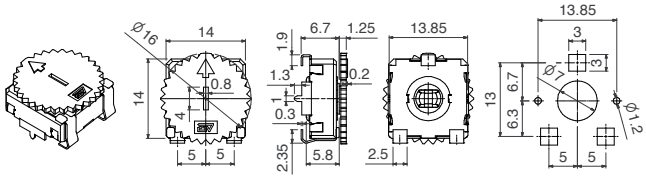
VSMD…CY



VSMD WT-14003



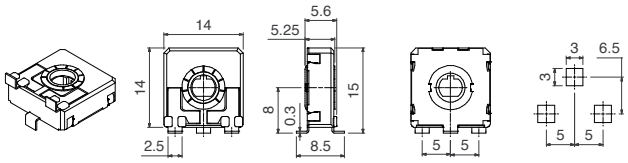
VSMD…CY WT-14003



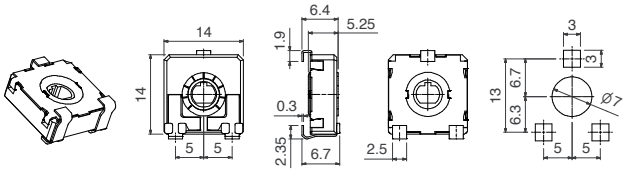
*Under request.

RS14

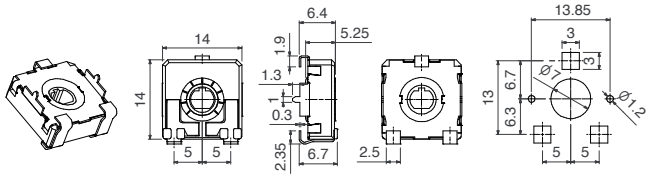
HSMD*



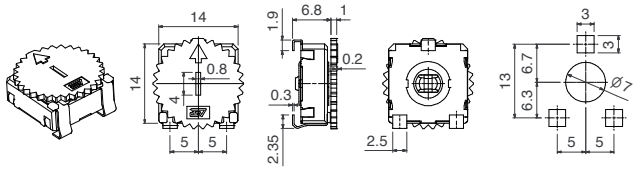
VSMD



VSMD…CY



VSMD WT-14003



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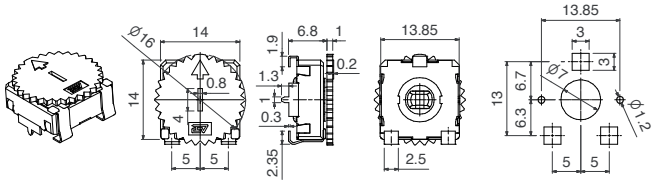
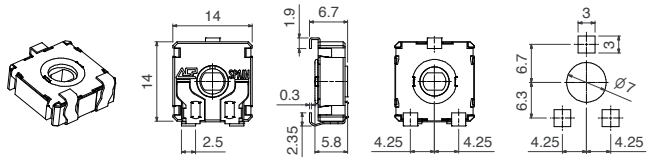


*Under request.

VSMD



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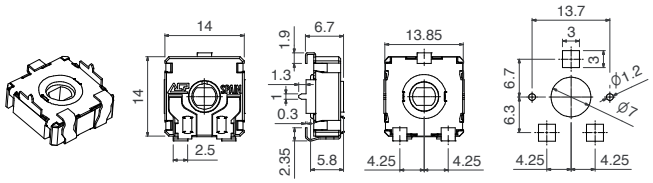

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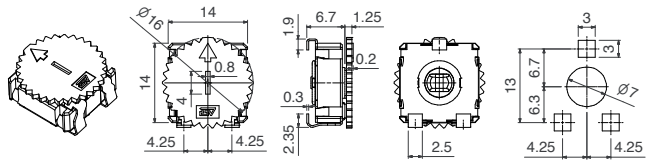

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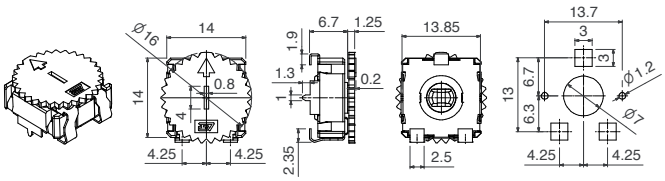


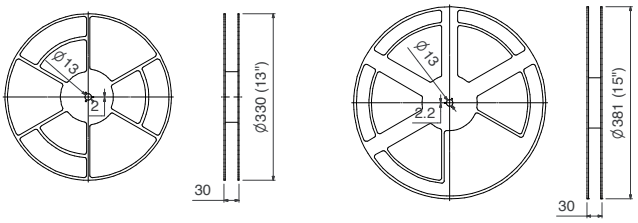
SMD

	Accessory	Qty	6mm Series CA6 VSMD	6mm Series CA6 VESMD	6mm Series CA6 HSMD	9mm Series CA9-CE9 / RS9 VSMD	9mm Series CA9-CE9 / RS9 VSMD...CY	9mm Series CA9-CE9 / RS9 HSMD	14mm Series CA14-CE14 / RS14 / CS14 VSMD	14mm Series CA14-CE14 / RS14 VSMD...CY	14mm Series CA14-CE14 / RS14 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

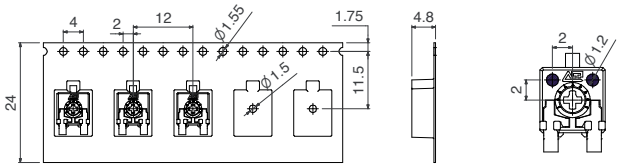
	Accessory	Qty	9mm Series CA9-CE9 / RS9 H2,5...TP25	H5... TP25	HS3,8	V7,5	V10	V10...TP25	VR10
13" Reel (Standard), with 24mm width tape	None, only potentiometers	pcs/reel	250	250	250	250	250	250	250
		MOQ	5.000	5.000	5.000	5.000	5.000	5.000	5.000
	With Knob		Knob type 9002						
		pcs/reel	250	250	250	250	250	250	250
		MOQ	5.000	5.000	5.000	5.000	5.000	5.000	5.000
15" Reel, with 24mm width tape	None, only potentiometers	pcs/reel	350	350	350	400	400	400	400
		MOQ	5.100	5.100	5.100	4.800	4.800	4.800	4.800
	With Knob		Knob type 9002						
		pcs/reel	350	350	350	400	400	400	400
		MOQ	5.100	5.100	5.100	4.800	4.800	4.800	4.800

T&R13" y T&R15"

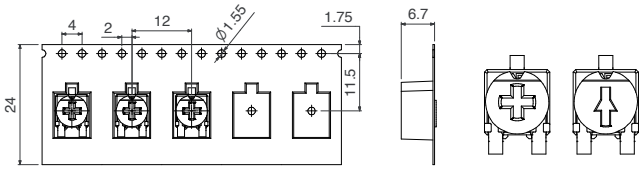


CA6

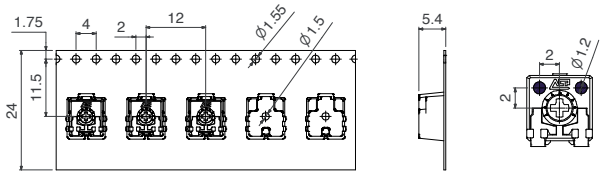
VSMD-T&R



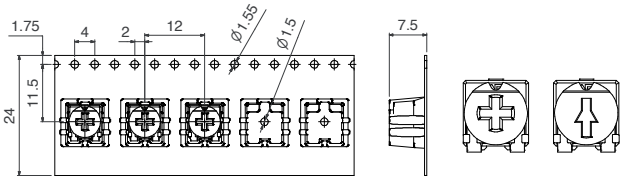
VSMD-T&R...WT- 6030 / 6035 / 6037



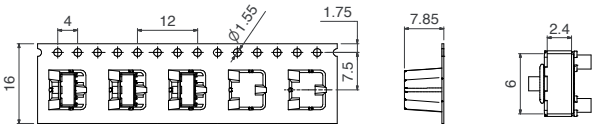
VESMD-T&R



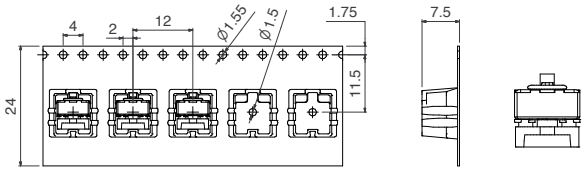
VESMD-T&R...WT -6030 / 6035 / 6037



HSMD-T&R

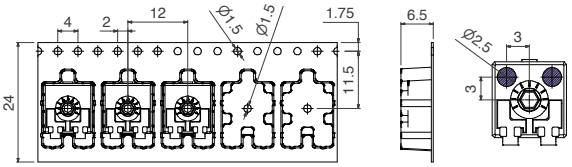


HSMD-T&R...WT- 6030 / 6035 / 6037

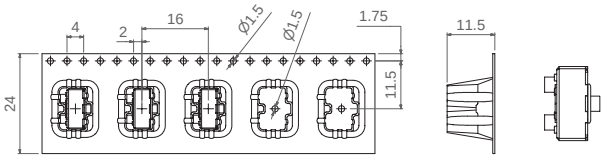


CA9-CE9 y RS9

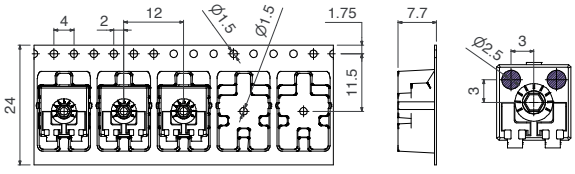
VSMD-T&R



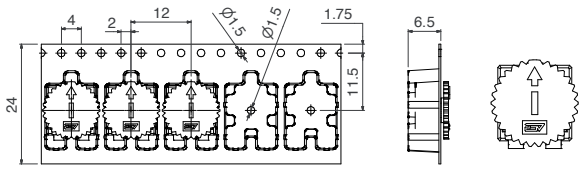
HSMD-T&R



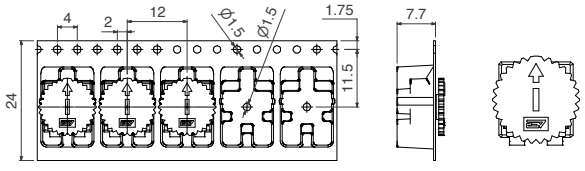
VSMD-T&R...CY



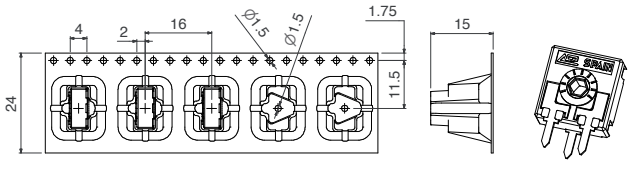
VSMD-T&R...WT-9002



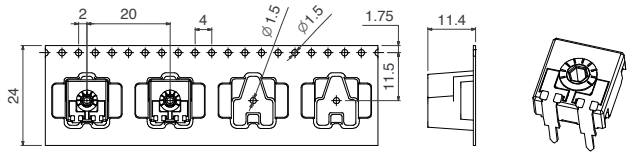
VSMD-T&R...CY WT-9002



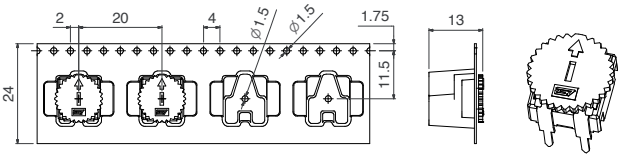
HS3,8-T&R...PIP



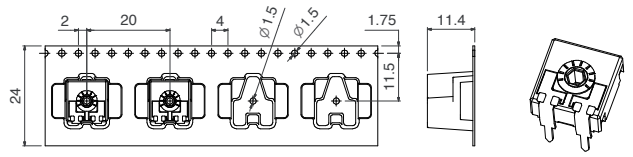
V7,5-T&R...PIP



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



V10-T&R...PIP



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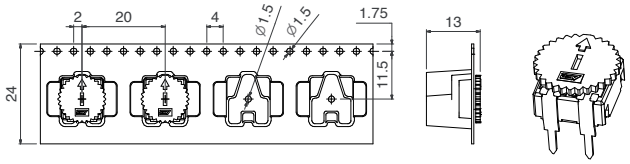
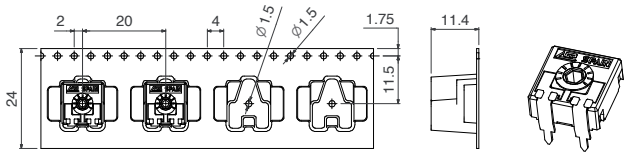
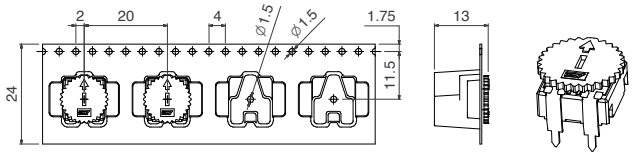


V10-T&R...PIP TP25



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



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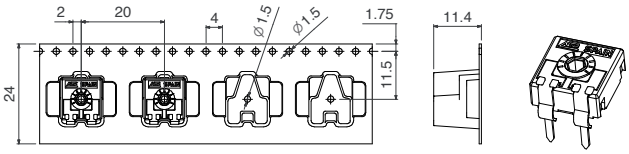
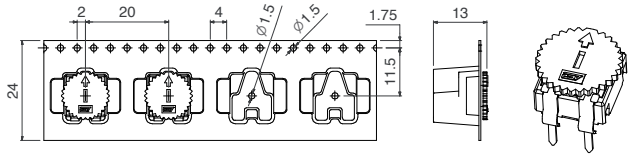
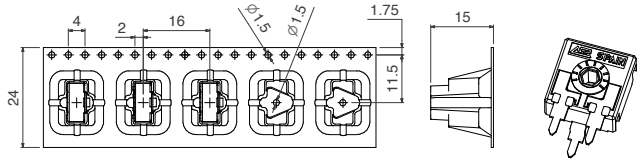


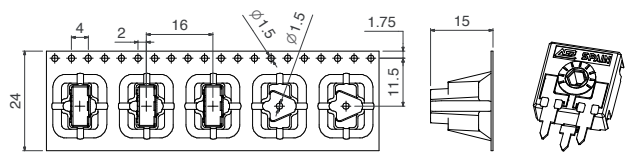
VR10-T&R...PIP WT-9002



H5-T&R...PIP TP25

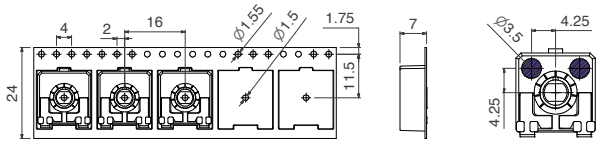


H2,5-T&R... PIP TP25

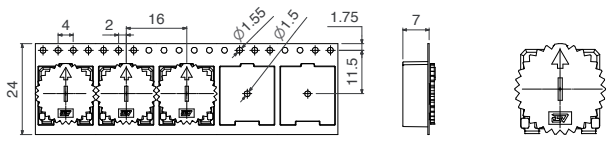


CA14-CE14

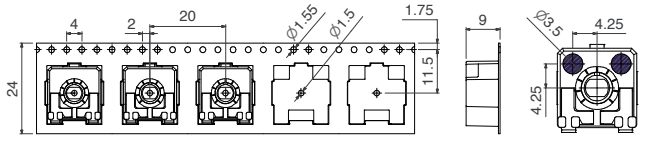
VSMD-T&R



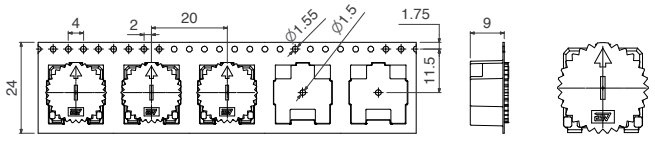
VSMD-T&R...WT-14003



VSMD-T&R...CY

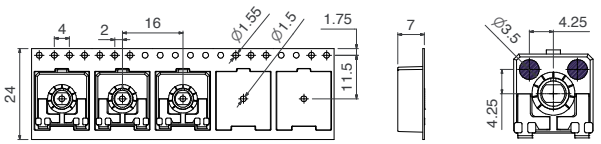


VSMD-T&R...CY WT-14003



RS14

VSMD-T&R



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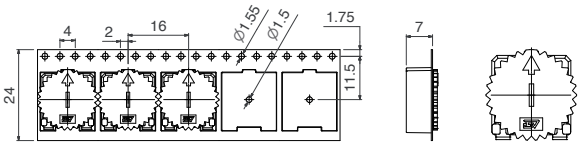

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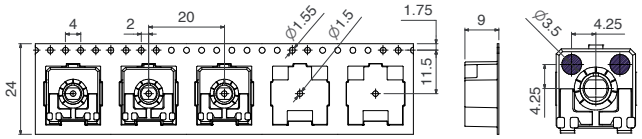

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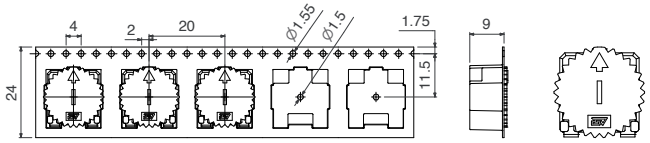
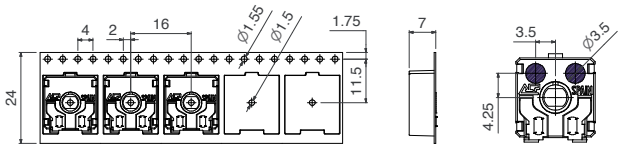
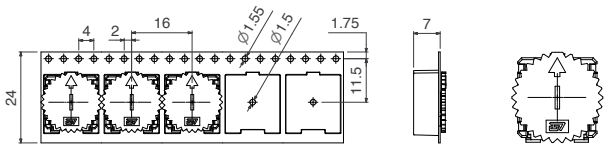


CS14

VSMD-T&R



VSMD-T&R... WT-14003



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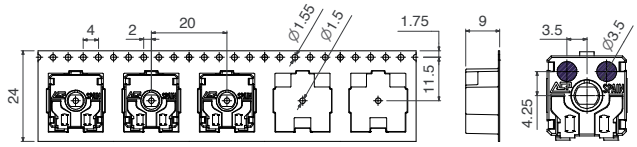

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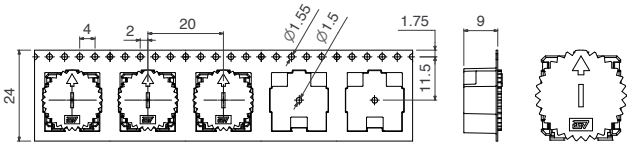


Detents – silver zones

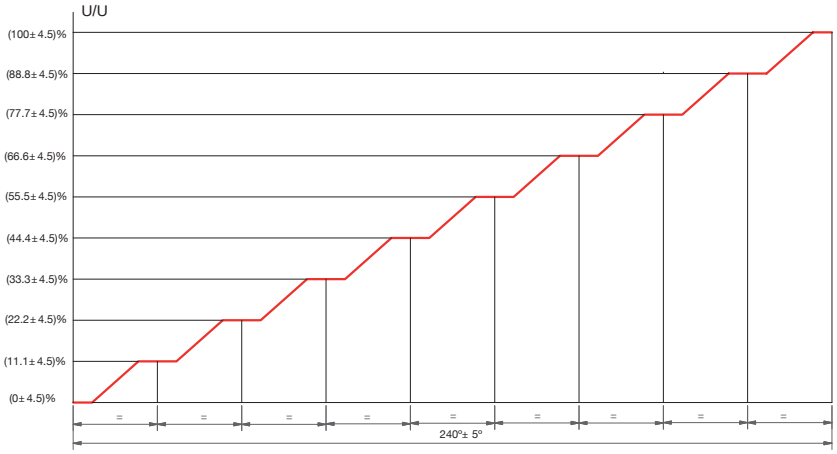
ACP's patented detent (DT) feature is especially suitable for control applications where the end user will turn a knob inserted in the potentiometer. Detents add a click feeling to the turning of the potentiometer and a control of the angle position of the wiper, assuring a particular output value.

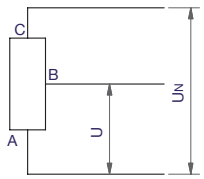
The standard configuration is an even distribution of the detents along the mechanical angle. Hence, the output value obtained in each detent is proportional to the angle turned from the initial position, within the tolerance limits of the corresponding taper: linear, log, antilog, cut track or special.

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) just to provide a haptic "click" feeling along the travel of the potentiometer or 2) in addition to that, to 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 feed in a voltage value to a microcontroller. Examples of 10 DT potentiometer matched with 10 flat zones electrical curve on a CA9/CE9.





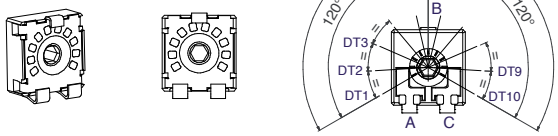


TABLE OF DETENT OPTIONS

Model	Mechanical angle	Electrical angle	Detents for feeling	Detents with silver zones, non-overlapping	Maximum silver zones	Wiper torque with DTs	Mechanical life
CA6	235º	215º	-	-	5	-	-
CA9	240º	220º	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	240º	220º	1,2,3,4,5,6,7,8,9,10… max.:20 evenly distributed	≤10 positions with different voltage values	10	≤2,5Ncm	
CA14	265º	245º	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	265º	245º	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	240º	220º	-	-	10	-	Standard, 25K-50K cycles:
RS14	265º	245º	-	-	14	-	Up to 1M cycles (please specify the cycles)
CS14*	360º	330º	maximum: 50 detents evenly distributed	≤17 positions with different voltage values	17	≤3,5Ncm	Standard, 15K turns

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

Q16

SMD Rotary Potentiometer Switch

Q16 is a particular application of the CS14 product family when robust and precise detents are required. This ACP patented design consists of a 16x15mm. rectangular shape external housing with a built-in detent mechanism, fitted on a CS14 V potentiometer.

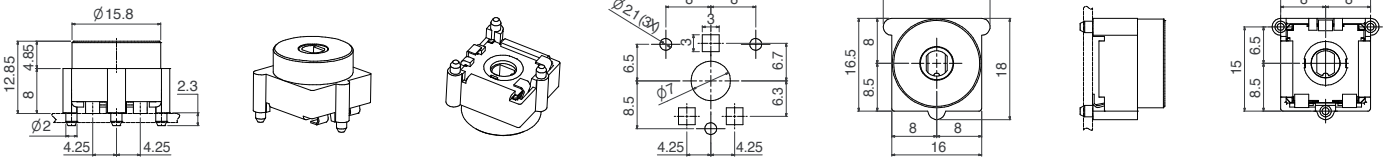
This Rotary Potentiometer Switch in SMD version is the ideal alternative to Absolute Encoders and Rotary Switches for control applications like Program Selector Switches in White Goods, where robust click feeling is required along the full circumference: Washing Machines, Dishwashers, Dryers, Electrical 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

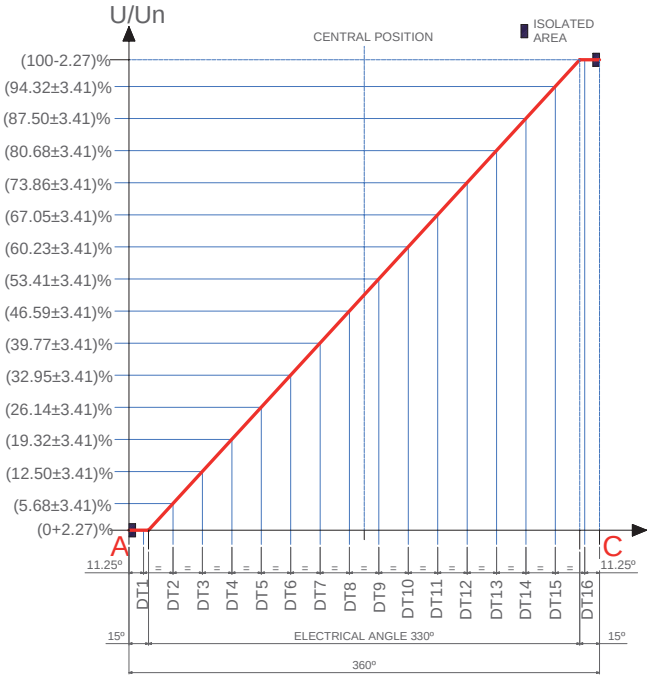
Example: Q16RVSMD-10KA3030 LV10 16DT 3N PDT1

Standard features

1	2	3	4	5	6	7	8	9	10	11	12	13
Series	Rotor	Model	Packaging	Value	Taper	Tolerance	Life	Nº 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



The CS14 core potentiometer has a linear taper that provides the voltage ratios indicated at each detent shown in the graph. Non overlapping voltage between contiguous positions is guaranteed.



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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