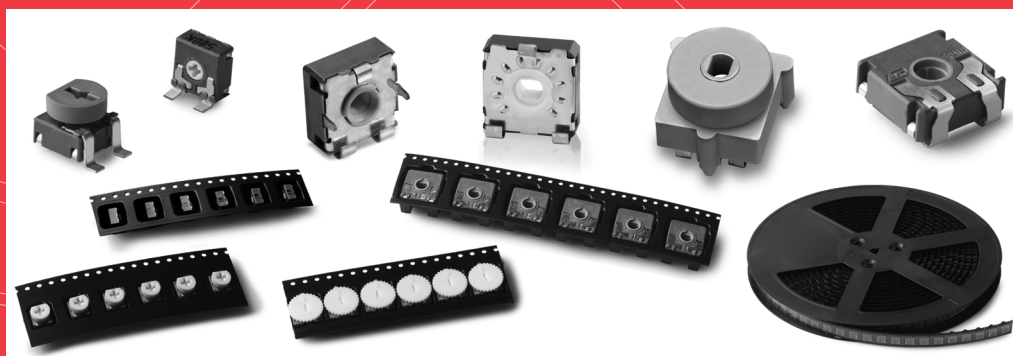


SMD Catalogue



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 offers 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: 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	Bulk: Blank 13" reel: T&R 15" reel: T&R15	Lin(A) 100 ≤ Rn ≤ 5M	Linear: A Log: B Alog: C Others: Special code	100 ≤ Rn ≤ 1M: ±25% 1M<Rn≤ 5M ±50%	N.A.	Standard, 1000 cycles: Blank Others: LVXX
■ CA9 / CE9	C,D,J,K,M,P,R,Y, KA*, MA*, MT* (*No detents possible)	HSMD VSMD VSMD...CY (CY on cell #10)		Log (B) Alog (C) 1K ≤ Rn ≤ 1M		100 ≤ Rn ≤ 1M: ±20% 1M < Rn ≤ 5M ±30%		
■ CA14 / CE14	B,D,E,F,G,K, M,N,P,T,X,Z	HSMD (on request)		Lin(A) 100 ≤ Rn ≤ 1M Log (B) Alog (C) 1K ≤ Rn ≤ 1M		100 ≤ Rn ≤ 100K ±30% 100K < Rn ≤ 1M: ±40% 1M < Rn ≤ 5M: ±50%	N.A.	
■ RS14	D,F,N,T,Z							
■ CS14	B,D*,E,F*,G,K, M,N*,P,T*,X,Z* (* only these rotors for LV>15K turns)	VSMD VSMD...CY (CY on cell #10)					N.A.	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	Cut track, Initial: PCI Final: PCF 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			
■ CA14 / CE14		N.A.						Indep. X%: LNx%			
■ RS14		N.A.						Absolute X%: LAX%			
■ 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.

Reflow soldering

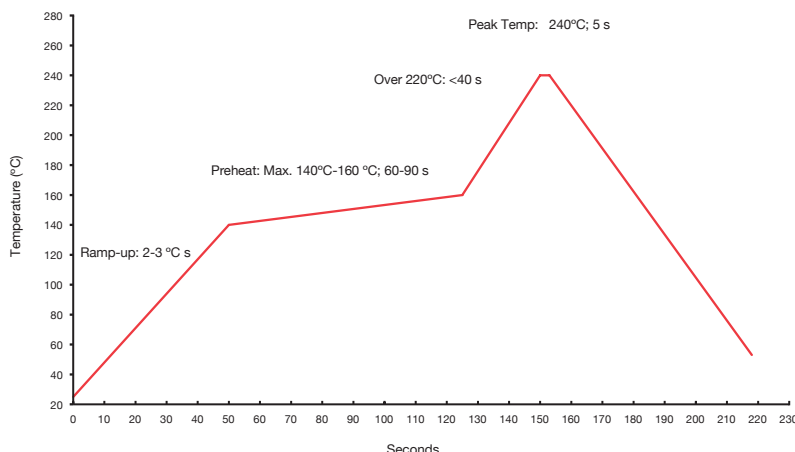
The first challenge that SMD potentiometers must overcome is the reflow soldering profile. Like every other component in this format, potentiometers must be able to withstand the severe heat stress experienced during that process. Our engineers have selected the most adequate metals, plastics and resistive 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.

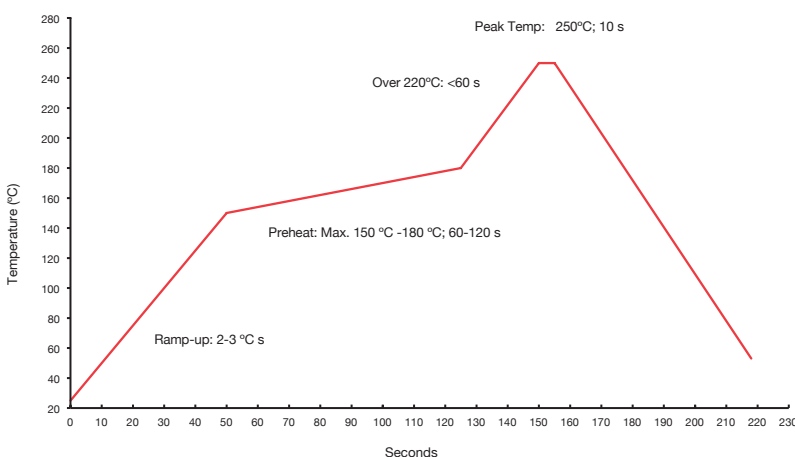
Solder profiles are set by customer depending on the PCB layout and component density. To avoid damaging the components there are limits that every manufacturer establishes based on studies and tests. At ACP, we feature the SMD potentiometers according to the European Standard EN 60068-2-58. Based on the results obtained, we propose our recommended soldering profiles.

ACP recommended profiles

Carbon Potentiometers



Cermet potentiometers



	Pre-heating		Heating (above liquidous)		Peak	
	Temp (°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, 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		RS14	CS14
		6	9	14	9	14		
Range of resistance value*	Lin (A)	$100\Omega \leq R_n \leq 5M\Omega$			$100\Omega \leq R_n \leq 5M\Omega$		Standard value is 10K*	$100\Omega \leq R_n \leq 1M\Omega$
	Log (B),Antilog (C)	$1K\Omega \leq R_n \leq 1M\Omega$			$1K\Omega \leq R_n \leq 2M2\Omega$		-	$1K\Omega \leq R_n \leq 1M\Omega$
Tolerance*	$100\Omega \leq R_n \leq 100K\Omega$	±25%	±30%		±20%			±30%
	$100K\Omega < R_n \leq 1M\Omega$	±25%	±40%		±20%		-	±40%
	$1M\Omega < R_n \leq 5M\Omega$	±50%	±50%		±30%		-	±50%
Variation laws		Lin (A), Log (B), Antilog (C) *			Lin (A), Log (B), Antilog (C) *		Lin (A) *	
Residual resistance		Minimum value 2Ω			≤2Ω		Minimum value 2Ω	
CRV - Contact Resistance Variation (dynamic)		≤ 3% Rn*	≤ 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*	≤ 5% Rn*	
Maximum power dissipation	Lin (A)	at 50°C 0.10W	at 50°C 0.15W	at 50°C 0.25W	at 70°C 0.5W	at 70°C 0.7W	at 50°C 0.15W	
	Log (B),Antilog (C)	at 50°C 0.06W	at 50°C 0.10W	at 50°C 0.13W	at 70°C 0.20W	at 70°C 0.30W	-	
Maximum voltage	Lin (A)	100VDC	200VDC	250VDC	200VDC		250VDC	
	Log (B),Antilog (C)	60VDC	150VDC	200VDC	200VDC		-	
Operating temperature		-25°C ... +70°C (+85°C on request)			-40°C ... +90°C (+125°C on request)		-25°C ... +85°C	-25°C ... +70°C, Special Version 120°C*
Temperature coefficient	$100\Omega \leq R_n \leq 10K\Omega$	+200/-500 ppm			±100 ppm		+200/-500 ppm	
	$10K\Omega < R_n \leq 5M\Omega$	+200/-1000 ppm			±100 ppm		+200/-1000 ppm	
Resistive element		Carbon technology			Cermet		Carbon technology	
Angle of rotation (mechanical)		235° ± 10°	240° ± 5°	265° ± 5°	240° ± 5°	265° ± 5°	265° ± 5° 360°	
Angle of rotation (electrical)		215° ± 20°	220° ± 20°	245° ± 20°	220° ± 20°	245° ± 20°	245° ± 20° 330° ± 20°	
Wiper standard delivery position		50% ± 15°			50% ± 15°		50% ± 15°	
Max. stop torque		4 Ncm	5 Ncm	10 Ncm	5 Ncm	10 Ncm	10 Ncm	-
Max. push/pull on rotor		9.8 N	40 N	50 N	40 N	50 N	50 N	35 N / 50 N
Wiper torque*		<2 Ncm	<2 Ncm	<2.5 Ncm	<2 Ncm	<2.5 Ncm	<1.5 Ncm	15,000 turns <2.5 Ncm, >15,000 turns <1.5 Ncm
Wiper torque with detents*		NA	<2.5 Ncm	<3.5 Ncm	<2.5 Ncm	<3.5 Ncm	NA	<3.5 Ncm
Mechanical life		1,000 cycles (Long life 10,000 cycles)					100,000 cycles. Up to 1,000,000 cycles	15,000 turns. Up to 1,000,000 turns

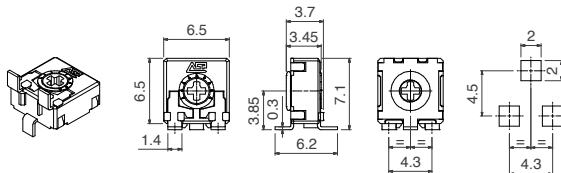
*Other (tapers, resistance value, operating temperature, wiper torque and mechanical life) please inquire.

Technical information drawings

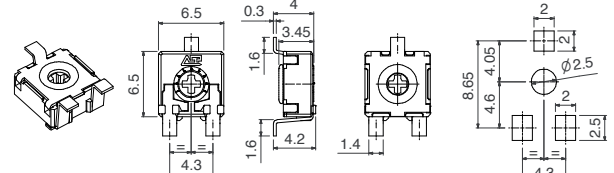
Rotors can be chosen according to customer specifications; the rotors shown here are examples, please refer to the General Catalogue at www.acpttechnologies.com

CA6

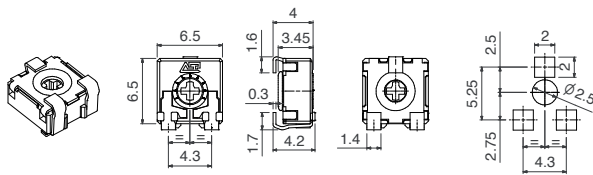
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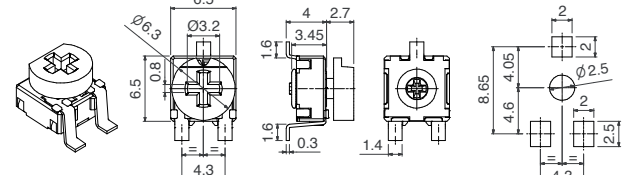
VSMD



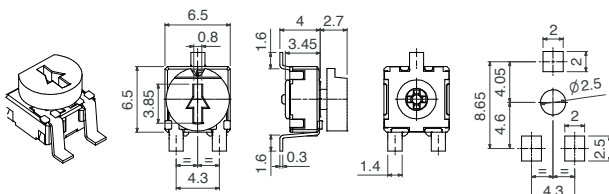
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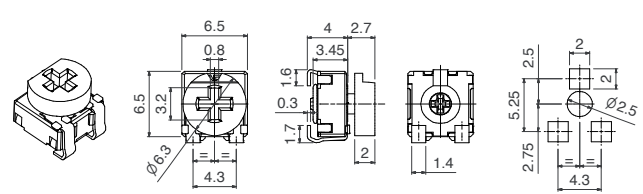
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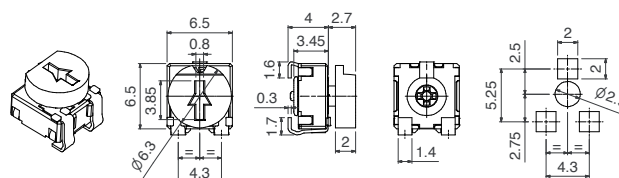
VSMD WT-6037



VESMD WT-6030

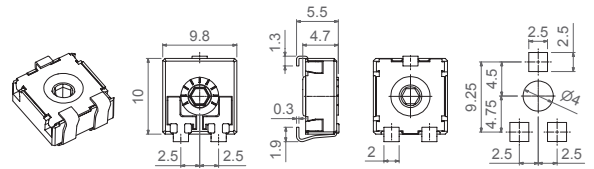


VESMD WT-6037



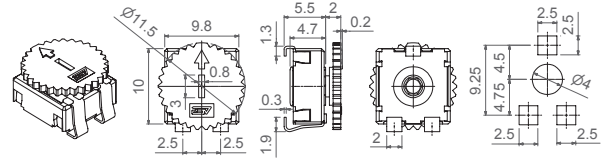
	HSMD	VSMD
1. Definition	HSMD is a condition characterized by a persistent and severe form of stress-related disorder, often resulting from exposure to traumatic events. It is a subset of PTSD, but with more severe and chronic symptoms.	VSMD is a condition characterized by a persistent and severe form of stress-related disorder, often resulting from exposure to traumatic events. It is a subset of PTSD, but with more severe and chronic symptoms.
2. Prevalence	HSMD is a relatively rare condition, with a prevalence rate of approximately 1-2% in the general population.	VSMD is a relatively rare condition, with a prevalence rate of approximately 1-2% in the general population.
3. Causes	HSMD is often caused by exposure to traumatic events, such as combat, natural disasters, or severe accidents. It can also be caused by chronic stress and trauma.	VSMD is often caused by exposure to traumatic events, such as combat, natural disasters, or severe accidents. It can also be caused by chronic stress and trauma.
4. Symptoms	HSMD is characterized by a range of symptoms, including persistent and severe anxiety, depression, and a sense of hopelessness. It can also lead to physical symptoms, such as chronic pain and fatigue.	VSMD is characterized by a range of symptoms, including persistent and severe anxiety, depression, and a sense of hopelessness. It can also lead to physical symptoms, such as chronic pain and fatigue.
5. Treatment	HSMD is typically treated with a combination of psychotherapy and medication. Cognitive-behavioral therapy (CBT) and exposure therapy are common treatments. Medications such as antidepressants and anxiolytics may also be used.	VSMD is typically treated with a combination of psychotherapy and medication. Cognitive-behavioral therapy (CBT) and exposure therapy are common treatments. Medications such as antidepressants and anxiolytics may also be used.
6. Prognosis	HSMD is a chronic condition, and the prognosis is generally poor. It can persist for years, and the symptoms may worsen over time.	VSMD is a chronic condition, and the prognosis is generally poor. It can persist for years, and the symptoms may worsen over time.

VSMD

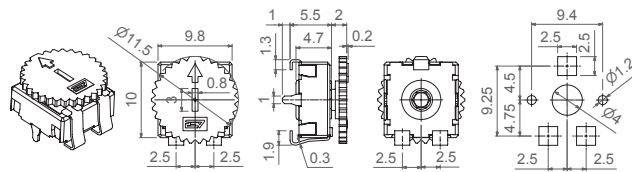


VSMD...CY

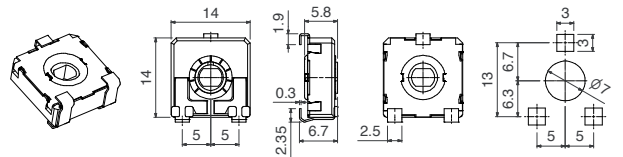
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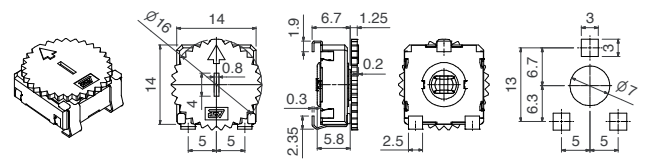
VSMD...CY WT-9002

[illegible]

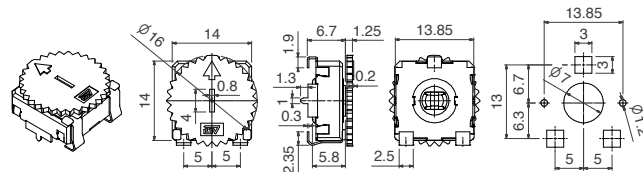
VSMD



VSMD...CY VSMD WT-14003



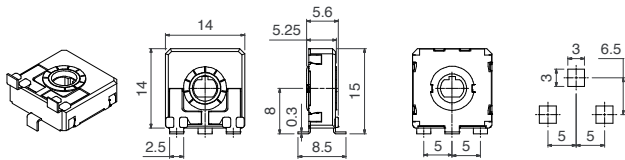
VSMD...CY WT-14003



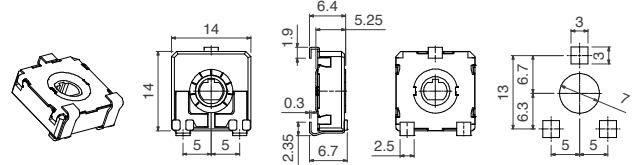
6  www.acptechnologies.com

RS14

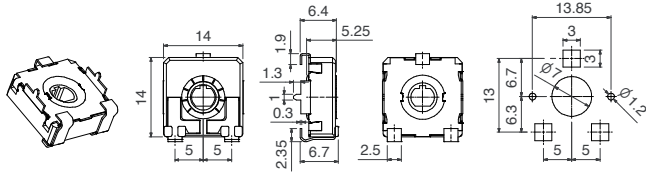
HSMD*



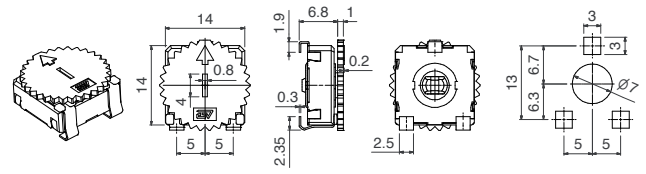
VSMD



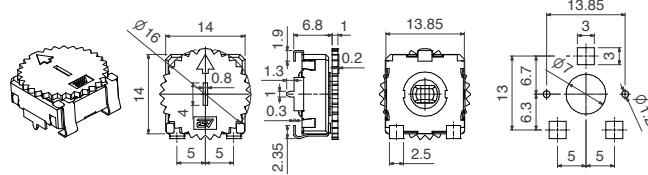
VSMD...CY



VSMD WT-14003



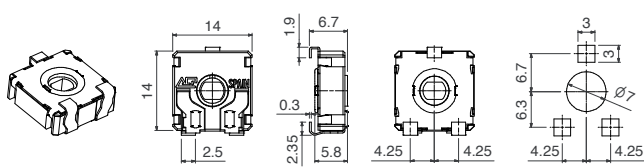
VSMD...CY WT-14003



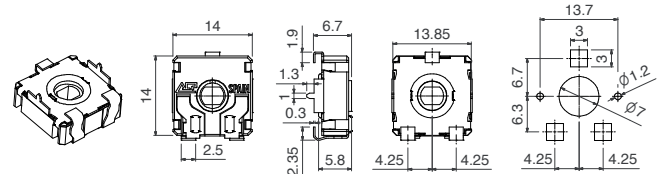
*Under request.

CS14

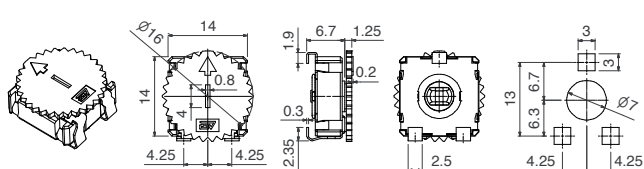
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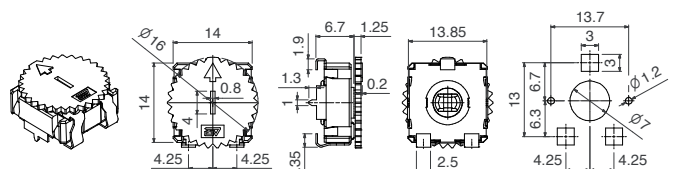
VSMD...CY



VSMD WT-14003



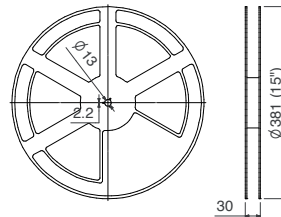
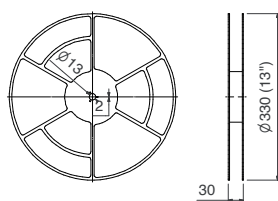
VSMD...CY WT-14003



Packaging options T&R drawings

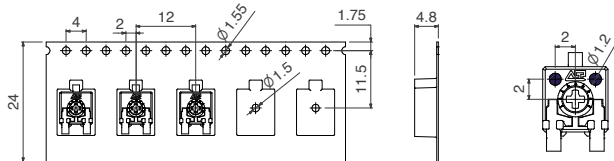
	Accessory	Qty	6mm Series CA6			9mm Series CA9-CE9				14mm Series		
			VSMD	VESMD	HSMD	VSMD	VSMD...CY	HSMD	HS3,8 (THT)	CA14-CE14 / RS14 / CS14	VSMD...CY	CA14-CE14 / RS14
			1.200	1.000	750	900	750	350	250	VSMD	VSMD...CY	HSMD
13" Reel (Standard), with 24mm width tape	None, only potentiometers	pcs/reel	4.800	5.000	4.500	4.500	4.500	4.900	5.000	500	350	Under Request
		MOQ								5.000	4.900	
	With Knob	pcs/reel	Knob types 6030, 6035, 6037			Knob type 9002				Knob type 14003		
		MOQ	750	700	700	700	550	Under Request	Under Request	450	350	Under Request
15" Reel, with 24mm width tape	None, only potentiometers	pcs/reel	5.250	4.900	4.900	4.900	4.950	Under Request	Under Request	4.950	4.900	Under Request
		MOQ	1.700	1.500	1.000	1.250	1.000	475	375	800	500	Under Request
	With Knob	pcs/reel	5.100	4.500	5.000	5.000	5.000	4.750	4.875	4.800	5.000	Under Request
		MOQ	Knob types 6030, 6035, 6037			Knob type 9002				Knob type 14003		
			1.100	1.000	1.000	950	800	Under Request	Under Request	750	450	Under Request
			5.500	5.000	5.000	4.750	4.800			4.500	4.950	

T&R13" y T&R15"

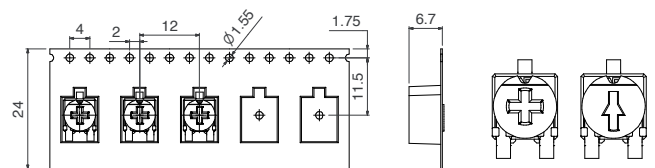


CA6

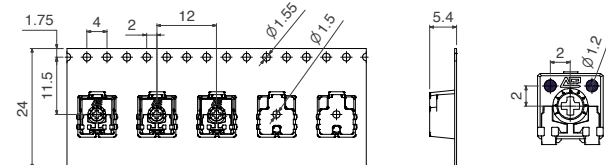
VSMD



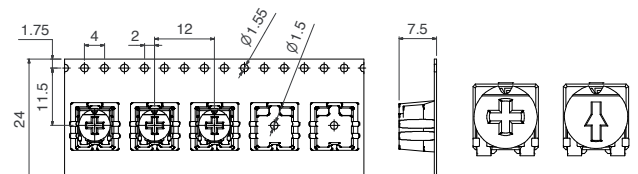
VSMD WT- 6030 / 6035 / 6037



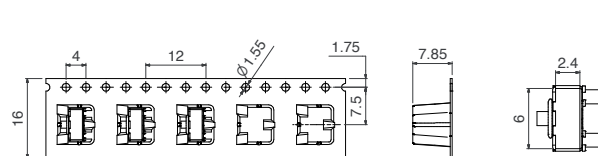
VESMD



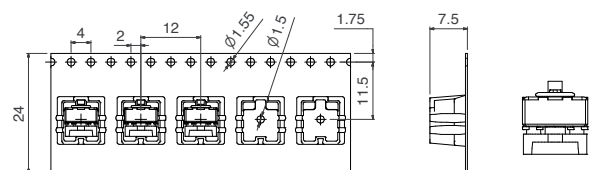
VESMD WT -6030 / 6035 / 6037



HSMD

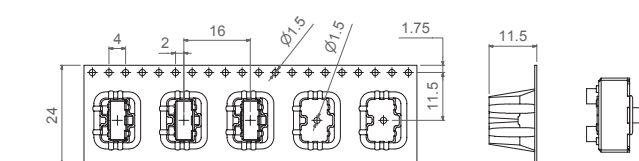


HSMD WT- 6030 / 6035 / 6037

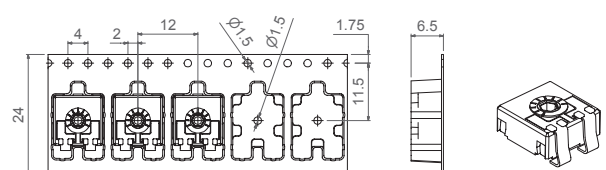


CA9-CE9

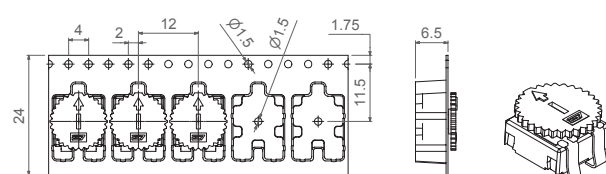
HSMD



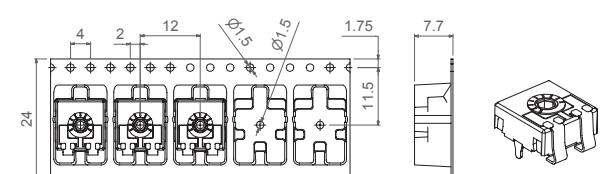
VSMD

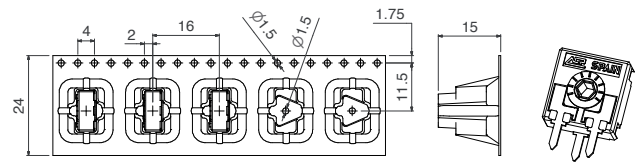
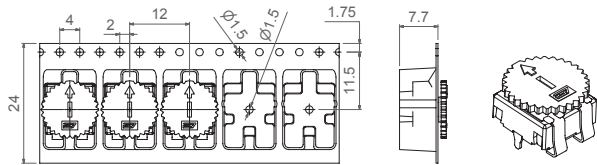
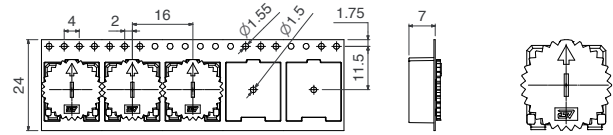
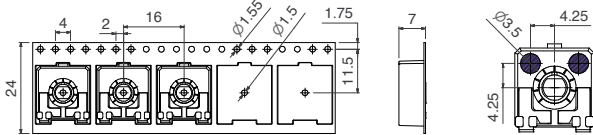
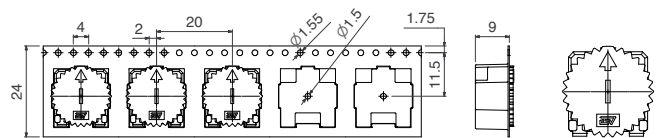
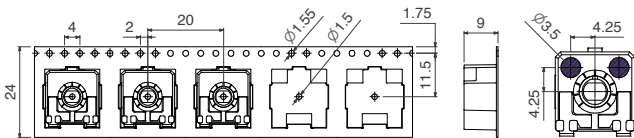
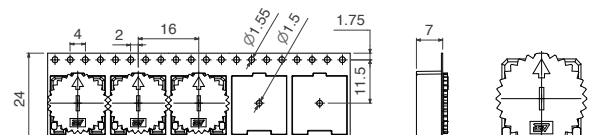
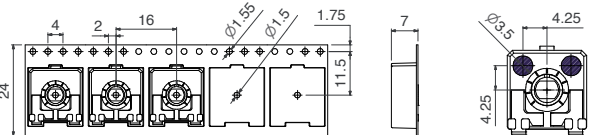
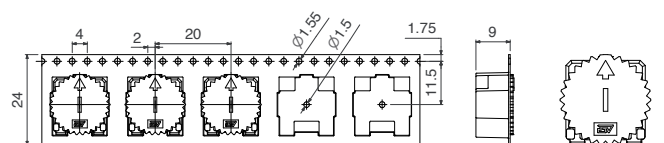
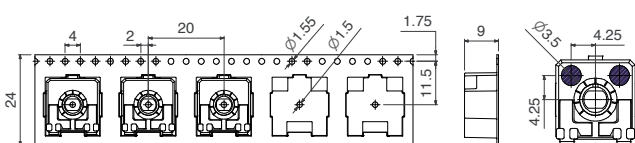
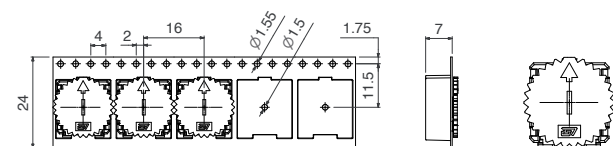
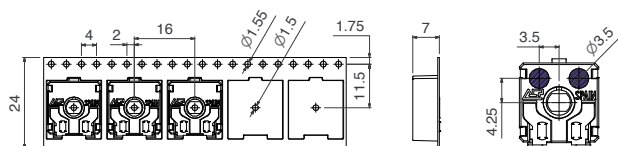
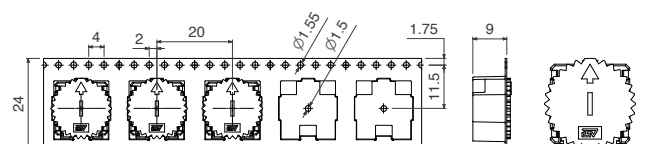
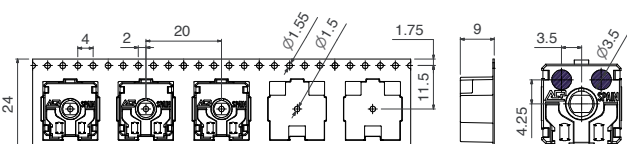


VSMD WT-9002



VSMD...CY



VSMD...CY WT-9002
HS3,8

CA14-CE14
VSMD
VSMD WT-14003

VSMD...CY
VSMD...CY WT-14003

RS14
VSMD
VSMD WT-14003

VSMD...CY
VSMD...CY WT-14003

CS14
VSMD
VSMD WT-14003

VSMD...CY
VSMD...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) 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.

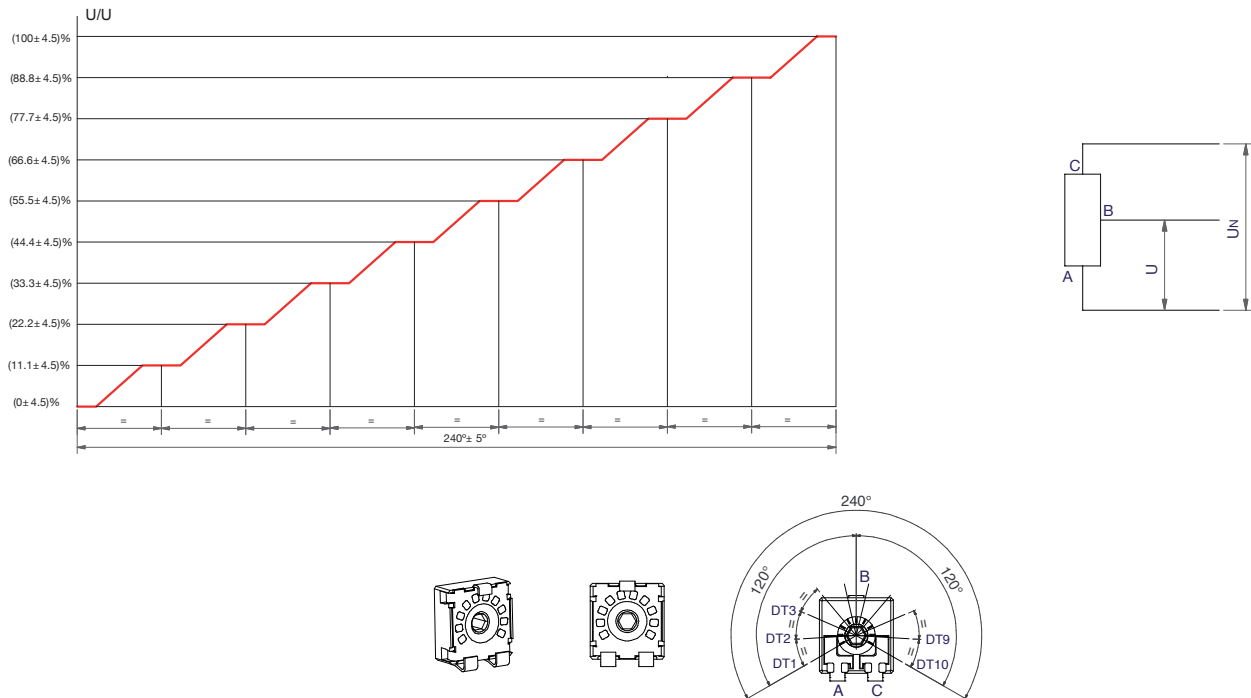


TABLE OF DETENT OPTIONS

Model	Mechanical angle	Electrical angle	Detents for feeling	Detents with silver zones, non-overlapping	Maximum silver zones	Wiper torque with DTs	Mechanical life
CA6	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	
RS14	265°	245°	-	-	14	-	-
CS14	360°	330°	maximum: 50 detents evenly distributed	≤17 positions with different voltage values	17	≤3,5Ncm	Standard 15.000 turns.

SMD Rotary Potentiometer Switch

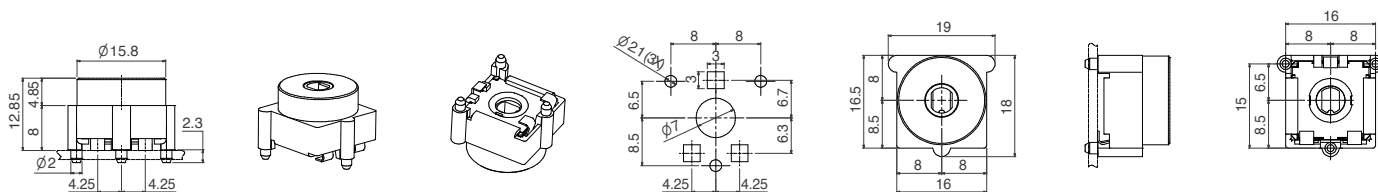
This Rotary Potentiometer Switch in SMD version is the ideal alternative to Absolute Encoders and Rotary Switches for control applications like Program Selector Switches in White Goods, where robust click feeling is required along the full circumference: Washing Machines, Dishwashers, Dryers, Electrical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

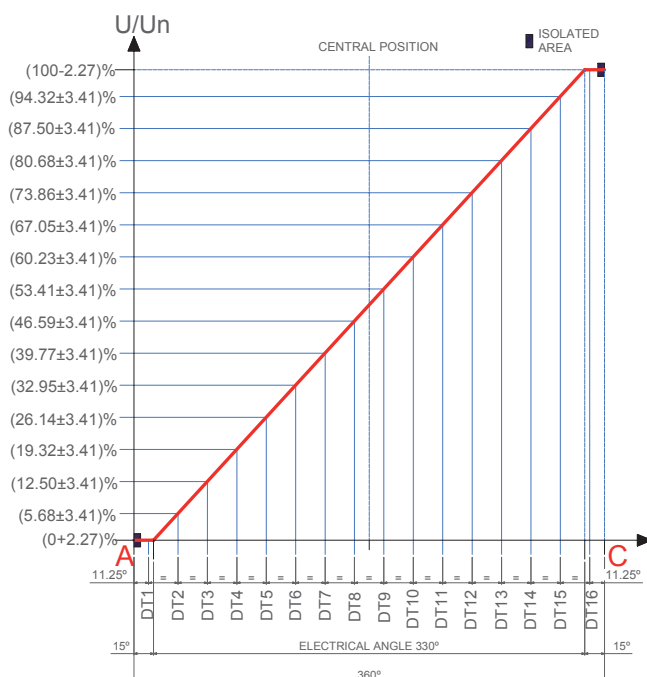
Example: Q16RVSM-D-10KA3030 LV10 16DT 3N PDT1

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



The CS14 core potentiometer has a linear taper that provides the voltage ratios indicated at each detent shown in the following table. The voltage ratio 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



Aragonesa de Componentes Pasivos, S.A.

Polígono industrial, s/n
P.O. Box 43 (Apartado de correos 43)
E-50500 Tarazona - Zaragoza - Spain
Tel.: (+34) 976 643 063
(+34) 976 199 101
Fax.: (+34) 976 643 464
www.acptechnologies.com

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Company certified by IQNet (Aenor) under:
ISO 9001
IATF 16949