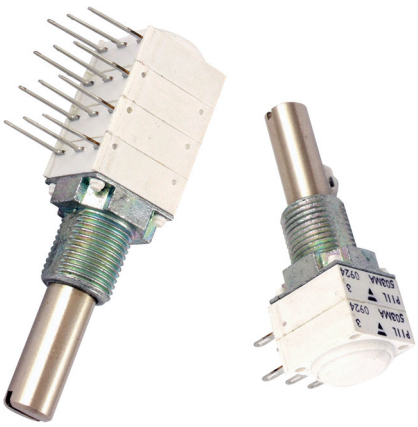
Long Life Cermet Potentiometer 2 Million Cycles



FEATURES

- 2 million cycles
- Cermet element
- 12.5 mm square single turn panel control
- 4, 6 and 6.35 shaft diameters and 29 terminal styles
- Multiple assemblies - up to four modules
- Test according to CECC 41000 or IEC 60393-1
- Low temperature coefficient
- Custom designs on request
- Linearity ± 3 % (± 2 % available)
- Construction: dust proof (sealing in option)
- Professional grade
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

LINKS TO ADDITIONAL RESOURCES

3D Models | Capabilities and Custom Options | Infographics

QUICK REFERENCE DATA	
Multiple module	Up to 4 modules
Switch module	Yes
Detent module	Yes
Special electrical laws	A: linear, L: logarithmic, F: reverse logarithmic and others see specifications
Sealing level	IP 64
Lifespan	2M cycles

VERSATILE	MODULAR	COMPACT	ROBUST

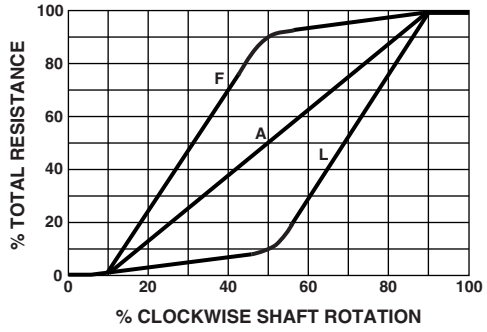
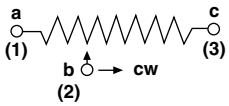
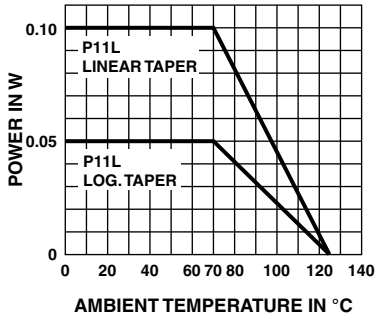
CONFIGURATION EXAMPLE - Dimensions in millimeters (inches) ± 0.5 mm (± 0.02")

Single module, single shaft, vertical mounting, PC pins with support plate, metric bushing and shaft

Dual modules, single shaft, PC pins with front support plates, imperial bushing and shaft

For technical questions, contact: sferpottrimmers@vishay.com

GENERAL SPECIFICATIONS

ELECTRICAL SPECIFICATIONS (initial)	
Resistive element	Cermet
Electrical travel	270° ± 10°
Standard resistance values	1 kΩ, 5 kΩ, 10 kΩ, 50 kΩ
Tolerance — Standard	± 20 %
Tolerance — On request	± 5 % or ± 10 %
Taper	
Circuit diagram	
Power rating at 70 °C — Linear taper	0.1 W at +70 °C
Power rating at 70 °C — Non-linear taper	0.05 W at +70 °C
Power rating at 70 °C — Multiple assemblies	0.1 W at +70 °C per module
Power rating at 70 °C	
Temperature coefficient (typical)	± 150 ppm
Limiting element voltage	350 V
End resistance (typical)	2 Ω
Independent linearity	± 3 % (± 2 % available)
Insulation resistance	10^6 MΩ min.
Dielectric strength	1500 V_{RMS} min.
Attenuation	-
Mechanical endurance	2 000 000 cycles

Note

- Nothing stated herein shall be construed as a guarantee of quality or durability

MECHANICAL (initial)	
Mechanical travel	300° ± 5°
Operating torque (typical)	
Single and dual assemblies	0.4 Ncm to 1.7 Ncm max. (0.57 oz.-inch to 2.55 oz.-inch max.)
Three to four modules (per module)	0.2 Ncm to 0.3 Ncm max. (0.28 oz.-inch to 0.42 oz.-inch max.)
End stop torque	
4 mm dia. shafts	35 Ncm max. (2.9 lb-inch max.)
6 mm and 1/4" dia. shafts	80 Ncm max. (6.8 lb-inch max.)
Tightening torque	
7 mm dia. bushings	150 Ncm max. (13 lb-inch max.)
10 mm and 3/8" dia. bushings	250 Ncm max. (21 lb-inch max.)
Weight	7 g to 9 g per module (0.25 oz. to 0.32 oz.)

ENVIRONMENTAL	
Operating temperature range	-55 °C to +125 °C
Climatic category	55/125/56
Sealing	IP64

MARKING

- **Potentiometer module**
  Vishay logo, SAP code of ohmic value, and tolerance in %, identify P11L version, variation law, manufacturing date (four digits), “3” for the lead 3
- **Switch module**
  Version, manufacturing date (four digits), “c” for common lead

PACKAGING

- Box

PERFORMANCES

TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS		
		$\Delta R_T/R_T$ (%)	$\Delta R_{1\text{-}2}/R_{1\text{-}2}$ (%)	OTHER
Electrical endurance	1000 h at rated power 90’/30’ - ambient temp. 70 °C	± 2 %	-	-
Climatic sequence	Dry heat at +125 °C/damp heat cold -55 °C/damp heat, 5 cycles	± 1 %	-	-
Damp heat, steady state	+40 °C, 93 % relative humidity 56 days	± 2 %	-	Insulation resistance: > 1000 MΩ
Change of temperature	-55 °C to +125 °C, 5 cycles	± 0.2 %	-	-
Mechanical endurance	2 million cycles turn angle: ± 60° temperature: 20 °C	± 20 %	-	Independent linearity: ± 10 %
Shock	50 *g*’s, 11 ms 3 shocks - 3 directions	± 0.2 %	± 0.5 %	-
Vibration	10 Hz to 55 Hz 0.75 mm or 10 *g*’s, 6 h	± 0.2 %	-	$\Delta V_{1\text{-}2}/V_{1\text{-}3}$ = ± 0.5 %

OPTION RELATIVE TO APPLICATION

“K14” OPTION for AMS applications (avionics, military, and space)

“K17” OPTION for MEDICAL applications

Option guarantees:

- Reinforced incoming inspection on raw material
- Traceability of all materials used in the composition of the product
- 50-year traceability (AMS market) / 20-year traceability (MEDICAL market)
- Specific marking to identify the number of the manufacturing batch
- Customer information for any process or product modification having an impact on the function, mountability, shape or reliability of the product
- Periodic product monitoring
- Dedicated technical specification

ORDERING INFORMATION (part number)

P	1	1	L	2	F	A	G	O	S	Y	0	0	5	0	2	K	A

MODEL	NUMBER OF MODULES	BUSHING	LOCATING PEG	SHAFT	SHAFT STYLE	LEADS	RESISTANCE CODE/ TOLERANCE/ TAPER OR SPECIAL
P11L	1 2 3 4						

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES	LINEAR TAPER		NON-LINEAR TAPER	
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE
Ω	W	V	W	V
1K	0.1	10.0	0.05	7.1
5K	0.1	22.4	0.05	15.8
10K	0.1	31.6	0.05	22.4
50K	0.1	70.7	0.05	50.0

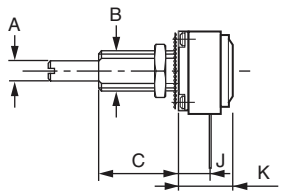
ORDERING INFORMATION (part number)

P	1	1	L	2	F	A	G	O	S	Y	0	0	5	0	2	K	A

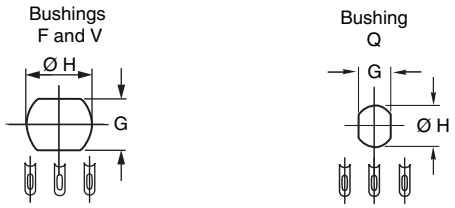
MODEL	NUMBER OF MODULES	BUSHING	LOCATING PEG	SHAFT	SHAFT STYLE	LEADS	RESISTANCE CODE/ TOLERANCE/ TAPER OR SPECIAL

	Ø	L
F	3/8"	3/8"
Q	7	8
V	10	9.5

BUSHING DIMENSIONS



PANEL CUT OUT



BUSHINGS			mm (± 0.5)	mm (± 0.5)	INCHES (± 0.02)
			V	Q	F
A	Shafts	Ø	6	4	1/4
B	Bushing	Ø	10	7	3/8
C		L	9.5	8	3/8
J	Lead versions X.. Y..		7	5	0.278
	K		11.1	9.1	0.436
G	Panel		8.2	6.2	0.323
H	Cutout	Ø	10.5	7.5	0.394
	Thread		0.75	0.75	32 thread/inch
	Wrench nut		12	10	0.500

Note

- Hardware supplied in separate bags

ORDERING INFORMATION (part number)

P	1	1	L	2	F	A	G	O	S	Y	0	0	5	0	2	K	A

MODEL	NUMBER OF MODULES	BUSHING	LOCATING PEG	SHAFT	SHAFT STYLE	LEADS	RESISTANCE CODE/ TOLERANCE/ TAPER OR SPECIAL

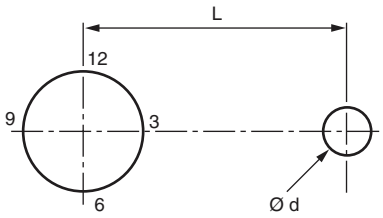
LOCATING PEG	
A =	see table below
B =	
C =	
0 =	without peg

LOCATING PEGS (anti-rotation lug)

The locating peg is provided by a plate mounted on the bushing and positioned by the module sides. Four set positions are available, clock face orientation: 12, 3, 6, 9.

All P11 bushings have a double flat. When panel mounting holes have been punched accordingly, an anti-rotation lug is not necessary.

Locating peg code C not available for bushing Q.



CODE	Ø d (mm)	L (mm)	e (mm)
A	2	6.2	0.7
B	2	7.75	0.7
C	3.5	13.5	1.1

Locating pegs are supplied in separate bags with nuts and washers

ORDERING INFORMATION (part number)

P	1	1	L	2	F	A	G	O	S	Y	0	0	5	0	2	K	A

MODEL	NUMBER OF MODULES	BUSHING	LOCATING PEG	SHAFT	SHAFT STYLE	LEADS	RESISTANCE CODE/ TOLERANCE/ TAPER OR SPECIAL

SHAFT

	Ø	L
AP = Custom shaft		
EA	4	9.5
EB	4	12.5
EJ	4	22
FG	6	16
FL	6	25
FR	6	50
GG	1/4"	5/8"
GH	1/4"	3/4"
GJ	1/4"	7/8"
GL	1/4"	1"
GO	1/4"	1.5"

SHAFT STYLE

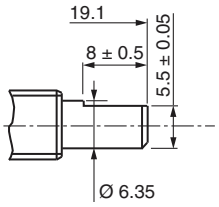
S = slotted
R = round
F = flatted
D = custom

SHAFTS - Dimensions in millimeters (inches)

The shaft length is always measured from the mounting face.
Standard shafts are designed by a 3 letters code (3 digits). Shaft slots and flats are aligned with the wiper position (± 10°); picture shows shaft with wiper at middle of mechanical/electrical course.
All standard shafts are slotted except flatted and splined, see exceptions for bushing.

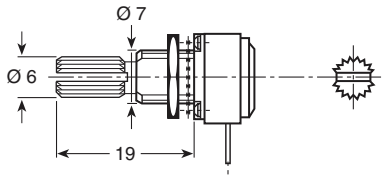
FLATTED SHAFT

Bushing: F
Shaft: GHF



SPLINED SHAFT

Bushing: Q
Shaft: FHK



CUSTOM SHAFTS

When special shafts are required - flat, threated ends, special shaft lengths, etc. a drawing is required.

STANDARD COMBINATION OF SHAFT STYLES AND BUSHINGS

SHAFT DIA.	BUSHING CODE	SHAFT LENGTH AND STYLE AVAILABLE IN STANDARD (others on request)					
6	V	FGS	FLS	FRS			
6.35	F	GGS	GHS	GJS	GLS	GOS	GHF
4	Q	EAS	EBS	EJS	FHK		

ORDERING INFORMATION (part number)

P	1	1	L	2	F	A	G	O	S	Y	0	0	5	0	2	K	A

MODEL	NUMBER OF MODULES	BUSHING	LOCATING PEG	SHAFT	SHAFT STYLE	LEADS	RESISTANCE CODE/ TOLERANCE/ TAPER OR SPECIAL

LEADS

Available leads

A00	W00	X00	Y00	Z00
A10	W10	X03	Y03	Z03
A13	W20	X04	Y04	Z04
A14		X10		Z10
A20		X13		Z13
A23		X14		Z14
A24		X20		Z20
		X23		Z23
		X24		Z24

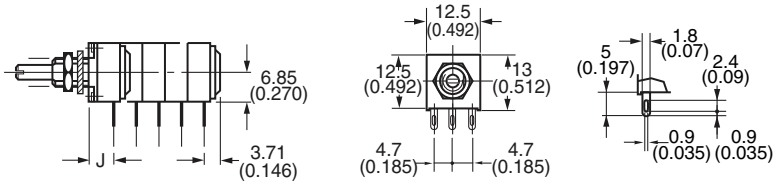
FIRST DIGIT	
Y	Soldering lugs
X	PCB pins
Z	PCB pins with front support plate
A	PCB pins with front and back support plates
W	PCB pins - vertical mounting with 2 extra pins - 1 module only (more modules on request)

SECOND DIGIT	
0	Y = 4.65 (0.183") A, X, Z, W = 5.08 (0.200") pin spacing pins section 0.9 x 0.3 (0.035" x 0.012")
1	2.54 (0.100") pin spacing pin section 0.6 x 0.3 (0.024" x 0.012")
2	5.08 (0.200") pin spacing pins section 0.6 x 0.3 (0.024" x 0.012")

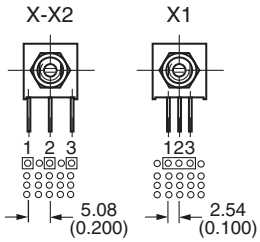
THIRD DIGIT	
0	5.08 (0.200") space between modules
3	7.62 (0.300") space between modules
4	10.16 (0.400") space between modules

DIMENSIONS in millimeters (inches) ± 0.5 mm (± 0.02")

SOLDER LUGS Y

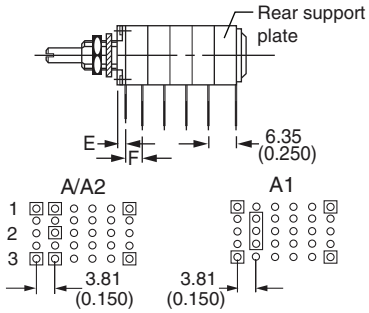


PCB PIN OUT

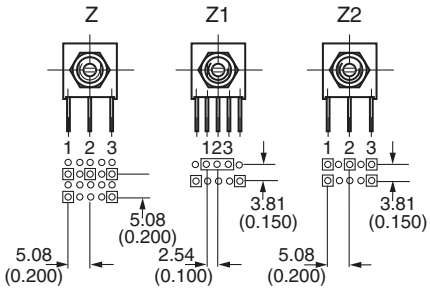


HORIZONTAL MOUNTING

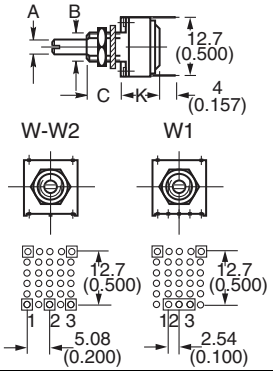
FRONT AND REAR SUPPORT PLATES



FRONT SUPPORT PLATE



VERTICAL MOUNTING



THE POSITION OF EACH MODULE IS FREE

BUSHINGS		MILLIMETERS (± 0.5)		INCHES (± 0.02)
		V	Q	F
E	Leads Z00	3.85	1.85	0.150
E	Leads Z1. Z2. A..	3.6	1.6	0.140
F		Leads Z0: 5.08 (0.200")		Leads A...Z1, Z2: 3.81 (0.150")
J	Leads X.. Y..	7	5	0.278

ORDERING INFORMATION (part number)

P	1	1	L	2	F	A	G	O	S	Y	0	0	5	0	2	K	A

MODEL	NUMBER OF MODULES	BUSHING	LOCATING PEG	SHAFT	SHAFT STYLE	LEADS	RESISTANCE CODE/ TOLERANCE/ TAPER OR SPECIAL
							Resistance code: 1K = 102 5K = 502 10K = 103 50K = 503 Tolerance code: standard: M = ± 20 % on request: K = ± 10 %, J = ± 5 % Taper: A, L, F or special code given by Vishay

SPECIAL CODES GIVEN BY VISHAY

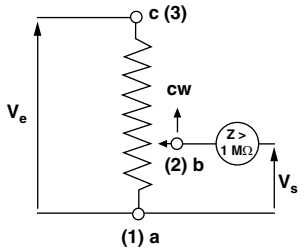
Option available:

- Custom shaft
- Specific design on request
- Specific linearity
- Multiple assemblies with various modules

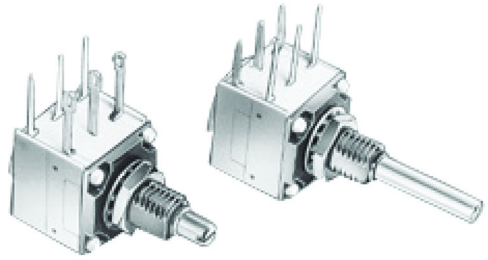
APPLICATION NOTE

The potentiometer shall be used in voltage divider with an impedance load at least 100 times higher than the total potentiometer nominal resistance value.

Advised load impedance:
1 MΩ min. for resistance range of 1 kΩ to 50 kΩ



P11L OPTION: ROTARY SWITCH MODULES



- Rotary switch
- Current up to 2 A
- Actuation CW or CCW position
- Sealing IP60

MODULES: RS ON/OFF SWITCH
RSI CHANGEOVER SWITCH

The position of each module is free.

RS and RSI rotary switches are housed in a standard P11L module size 12.7 mm x 12.7 mm x 5.08 mm (0.5" x 0.5" x 0.2"). They have the same terminal styles as the assembled electrical modules.

An assembly can comprise 1 or more switch modules.

Switch actuation is described as seen from the shaft end.
D: means actuation in maximum CCW position
F: means actuation in maximum CW position

The switch actuation travel is 25° with a total mechanical travel of 300° ± 5° and electrical travel of electrical modules is 238° ± 10°.

Leads finish: gold plated

RSD SINGLE POLE SWITCH, NORMALLY OPEN

In full CCW position, the contact between 1 and 3 is open. It is made at the beginning of the travel in CW direction.

RSF SINGLE POLE SWITCH, NORMALLY OPEN

In full CW position, the contact between 1 and 3 is open. It is made at the beginning of the travel in CCW direction.

RSID SINGLE POLE CHANGEOVER

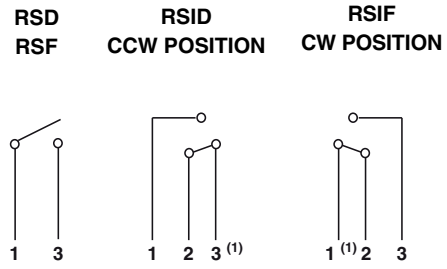
In full CCW position, the contact is made between 3 and 2 and open between 3 and 1. Switch actuation (CW direction) reverses these positions.

RSIF SINGLE POLE CHANGEOVER

In full CW position, the contact is made between 1 and 2 and open between 1 and 3. Switch actuation (CCW direction) reverses these positions.

SWITCH SPECIFICATIONS		
Switching power maximum		0.5 VA =
Switching current maximum		0.1 A, 5 V =
Maximum current through element		2 A
Contact resistance		100 mΩ
Dielectric strength	Terminal to terminal	1000 V_{RMS}
	Terminal to bushing	2000 V_{RMS}
Maximum voltage operation		5 V =
Insulation resistance between contacts		10^6 MΩ
Life at $P_{max.}$		100 000 actuations
Minimal travel		25°
Operating temperature		-40 °C to +85 °C

ELECTRICAL DIAGRAM



Note

(1) Common

ORDERING INFORMATION (First order only)

RSID

RSD	SPST: single pole, open switch in CCW position - 2 pins
RSF	SPST: single pole, open switch in CW position - 2 pins
RSID	SPDT: single pole, changeover switch in CCW position - 3 pins
RSIF	SPDT: single pole, changeover switch in CW position - 3 pins

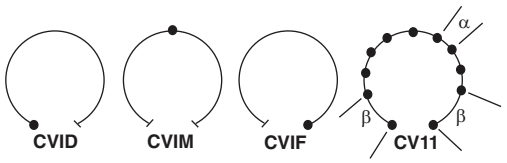
P11L OPTION: DETENT MODULES

The detents mechanism is housed in a standard P11L module.
Up to 21 detent positions available.

Count detents as follows: 1 for CCW position, 1 for full CW position, plus the other positions forming equal resistance increments (linear taper) - not equal angles.

Available: CVID - CVIF - CVIM
CV3 - CV11 - CV21

Mechanical endurance: 50 000 cycles



$\alpha = \frac{270°}{n - 1}$

$\beta = \alpha + 15°$

ORDERING INFORMATION (First order only for special code creation)

CV1M

CV1M	1 detent at half travel
CV1D	1 detent at CCW position
CV1F	1 detent at CW position
CV3	3 detents
CV11	11 detents
CV21	21 detents

P11L OPTION: NEUTRAL MODULES "EN"

Neutral or screen module is housed in a standard P11L module.
It is used as a screen between two electrical modules.

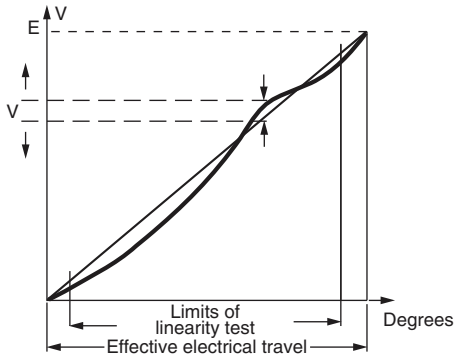
The leads can be connected to ground.

ORDERING INFORMATION (First order only for special code creation)

EN

EN	Neutral module

P11L OPTION: SPECIAL LINEARITY - CONFORMITY



The independent linearity (conformity for the non-linear laws) is the maximum gap ΔV between the actual variation curve and the theoretical variation curve the nearest to it. The linearity and the conformity are expressed in percentage of the total applied voltage E

$$\text{linearity conformity} = \frac{\pm \Delta V_{max.}}{E}$$

They are measured over 90 % of actual electrical travel (centered).
On request linearity can be guaranteed in linear taper.

ORDERING INFORMATION (First order only)

J123

J123	Independent linearity ± 3 % (linear law)
J145	Independent linearity ± 2 % (linear law)

For other request, contact us.

EXAMPLES OF FIRST ORDER INFORMATION

FIRST EXAMPLE: triple module (switch is counted as a module)

P	1	1	L	3	V	A	F	G	S	Y	0	0					

MODEL P11L	3 MODULES	BUSHING V	LOCATING PEG	STANDARD SHAFT 16 mm FMS SLOTTED	SOLDER LUGS	SPECIAL TO BE DEFINED BY VISHAY

ORDERING INFORMATION:

PART NUMBER	**P11L3VAFGSY00.....**	
SHAFT AND BUSHING	**See drawing of special shaft attached**	
MODULE NO. 1	**503 M A**	
MODULE NO. 2	**103 M A**	**J123**
MODULE NO. 3	**503 M A**	

PART NUMBER DESCRIPTION (used on some Vishay document or label, for information only)

P11L	3	V	A	FG	S	Y00				T1927		e3
MODEL	MODULES	BUSHING	LOCATING PEG	SHAFT	SHAFT STYLE	LEADS	VALUE	TOL.	TAPER	SPECIAL	SPECIAL	LEAD (Pb)-FREE

ACCESSORIES

Potentiometers are delivered with accessories (nut, washer...)	
Additional Accessories (to order separately)	www.vishay.com/doc?51051
Control knobs	www.vishay.com/doc?51101

RELATED DOCUMENTS

APPLICATION NOTES	
Potentiometers and Trimmers	www.vishay.com/doc?51001
Guidelines for Vishay Sfernice Resistive and Inductive Components	www.vishay.com/doc?52029
Capabilities and Custom Options	www.vishay.com/doc?48463

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