

# APV Series

## Automotive Grade Thin Film Precision Chip



### FEATURES

- AEC-Q200 Compliance
- Advanced thin film technology
- RoHS compliant
- Special materials, design, and processing for high sulfur applications
- Test proven immunity to humidity, moisture, and sulfur

### APPLICATIONS

- Automotive
- Medical Equipment
- Testing / Measurement Equipment
- Printer Equipment
- Automatic Equipment Controller
- Converters
- Communication Device, Cell Phone, GPS, PDA



### SERIES SPECIFICATIONS

Series	Chip Size	Power @70°C mW	Max. Operating Voltage	Overload Voltage	Resistance Range (Ω)		
					0.05%	0.10%, 0.25%, 0.50%, 1.00%	TCR ppm/°C
APV02	0402	62.5	25	50	49.9Ω-10K	49.9Ω-10K	10
						49.9Ω - 69.8K	15
						49.9Ω-100K	25, 50
APV03	0603	62.5	50	100	10Ω-49.9K	10, 15	
					49.9Ω-10K	25, 50	
APV05	0805	100	100	200	10Ω-100K	10	
					10Ω-1M	15, 25, 50	
APV06	1206	125	150	300	10Ω-200K	10Ω-1M	10, 15, 25, 50
APV11	1210	250	150	300	10Ω-499K	10Ω-1M	10, 15, 25, 50
APV10	2010	250	150	300	10Ω-499K	10Ω-1M	10, 15, 25, 50
APV12	2512	500	150	300	10Ω-499K	10Ω-1M	10, 15, 25, 50

Series	Chip Size	Power @70°C Watts	Max. Operating Voltage	Overload Voltage	Resistance Range (Ω)		
					0.05%	0.10%, 0.25%, 0.50%, 1.00%	TCR ppm/°C
APV03	0603	0.1	75	150	10Ω-49.9K	10Ω -332K	10, 15, 25, 50
APV05	0805	0.125	150	300	10Ω-100K	10Ω-511K	10
						10Ω-1M	15, 25, 50
APV06	1206	0.25	200	400	10Ω-200K	10Ω-1M	10, 15, 25, 50
APV11	1210	0.33	200	400	10Ω-499K	10Ω-1M	10, 15, 25, 50
APV10	2010						

(continued)

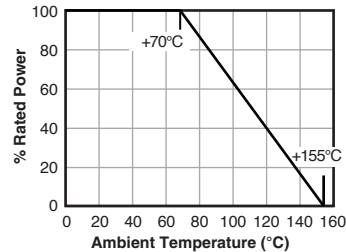
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### CHARACTERISTICS

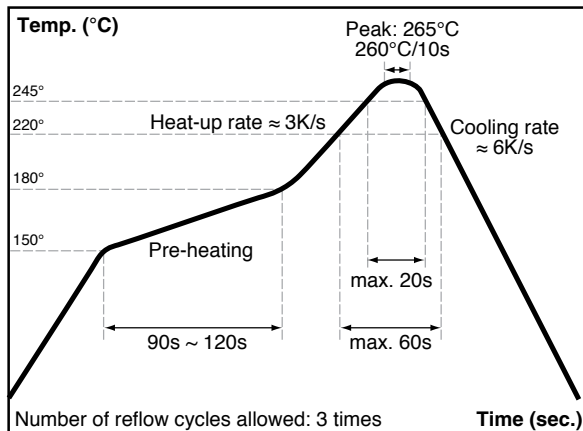
<b>Oper. Temp. Range</b>	-55°C to +155°C
<b>Storage Temperature</b>	15~28°C; Humidity < 80%RH
<b>Rated Voltage</b>	$\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower

### Derating

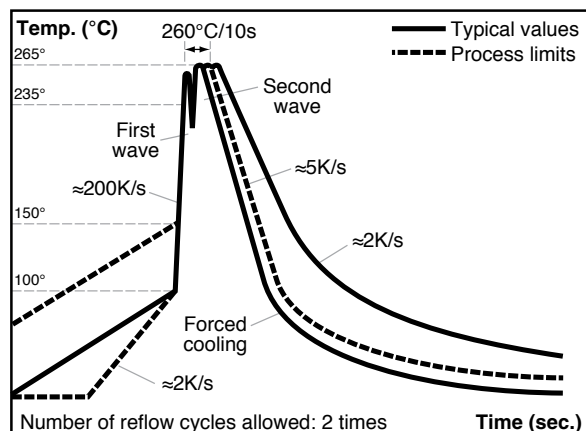


### SOLDERING

#### IR Reflow Soldering

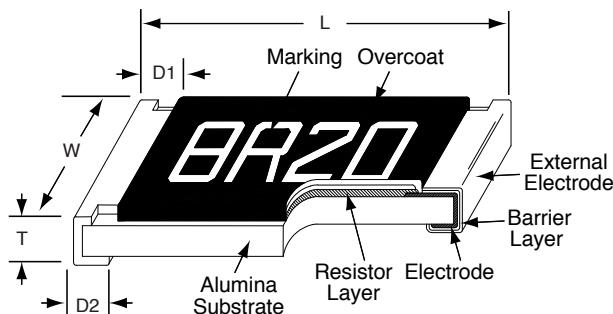


#### Wave Soldering (Flow Soldering)

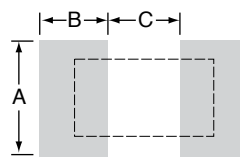


- (1) Time of IR reflow soldering at maximum temperature point 260°C: 10s
- (2) Time of wave soldering at maximum temperature point 260°C: 10s
- (3) Time of soldering iron at maximum temperature point 410°C: 5s

### DIMENSIONS



#### Land pattern



Type	Size	L	W	T	D1	D2	C	B	A	Weigh (g)
APV02	0402	1.00 ±0.05	0.50 ±0.05	0.30 ±0.05	0.20 ±0.10	0.20 ±0.10	0.50	0.50	0.60 ±2	0.54
APV03	0603	1.55 ±0.10	0.80 ±0.10	0.45 ±0.10	0.30 ±0.20	0.30 ±0.20	0.80	1.00	0.90 ±2	1.83
APV05	0805	2.00 ±0.15	1.25 ±0.15	0.55 ±0.10	0.30 ±0.20	0.40 ±0.20	1.00	1.00	1.35 ±2	4.71
APV06	1206	3.05 ±0.15	1.55 ±0.15	0.55 ±0.10	0.42 ±0.20	0.35 ±0.25	2.00	1.15	1.70 ±2	9.02
APV11	1210	3.10 ±0.15	2.40 ±0.15	0.55 ±0.10	0.40 ±0.20	0.55 ±0.25	2.00	1.15	2.50 ±2	10
APV10	2010	4.90 ±0.15	2.40 ±0.15	0.55 ±0.10	0.60 ±0.30	0.50 ±0.25	3.60	1.40	2.50 ±2	23.61
APV12	2512	6.30 ±0.15	3.10 ±0.15	0.55 ±0.10	0.60 ±0.30	0.50 ±0.25	4.90	1.60	3.10 ±2	38.06

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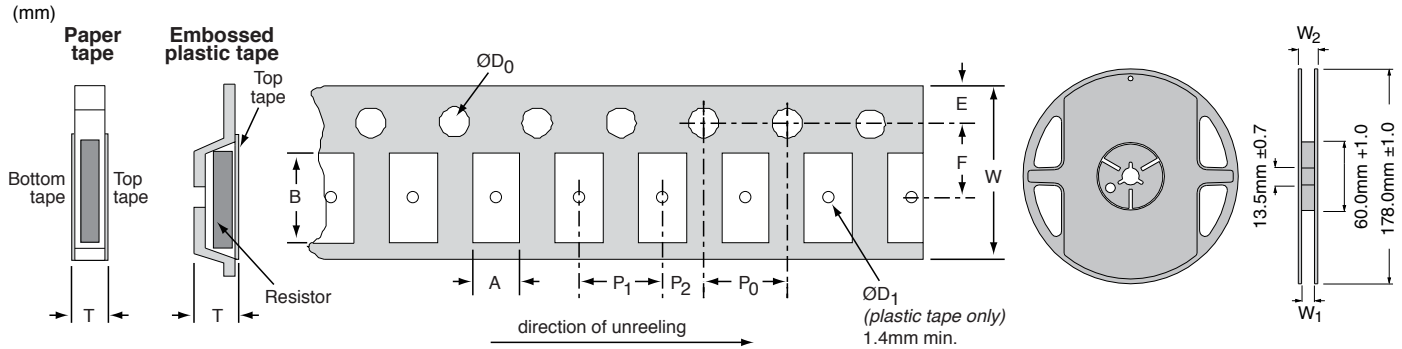
### PERFORMANCE

Item	Requirement	Method
<b>T.C.R.</b>	As specified	JIS-C-5201-1 4.8; IEC-60115-1 4.8; -55°C~+125°C, 25°C is the reference temperature
<b>Short Time Overload</b>	$\Delta R \pm 0.05\%$	JIS-C-5201-1 4.13; RCWV*2.5 or Max. overload voltage whichever is lower for 5 sec.
<b>Insulation Resistance</b>	>1000 M	JIS-C-5201-1 4.6; IEC-60115-1 4.6; Apply 100VDC for 1 minute
<b>Operational Life</b>	Tol. $\leq 0.05\%$ : $\Delta R \pm 0.05\%$ Tol. $> 0.05\%$ : $\Delta R \pm 0.2\%$ $> 7k\Omega$ : $\Delta R \pm 0.2\%$ $\Delta R \pm 0.5\%$ for high power rating	MIL-STD-202 Method 108; Condition D Steady State TA=125°C at rated power. Measurement at 24 $\pm$ 4 hours after test conclusion.
<b>Biased Humidity</b>	$\Delta R \pm 0.1\%$	MIL-STD-202 Method 103; 1000 hrs 85°C/85%RH 10% of operating power.
<b>High Temp. Exposure</b>	$\Delta R \pm 0.2\%$	MIL-STD-202 Method 108; at +155°C for 1000 hrs
<b>Temperature Cycling</b>	$\Delta R \pm 0.1\%$	JESD22 Method JA-104; -55°C to +125°C, 1000 cycles
<b>Bending Strength (Board Flex)</b>	$\Delta R \pm 0.1\%$	JIS-C-5201-1 4.33; Bending once for 60 seconds Bending displacement: 2010 2512 sizes: 2 mm Other sizes: 3 mm
<b>Solderability</b>	95% min. coverage	JIS-C-5201-1 4.17; IEC-60115-1 4.17; 245 $\pm$ 5°C for 3 seconds
<b>Resistance to Soldering Heat</b>	$\Delta R \pm 0.05\%$	JIS-C-5201-1 4.18; IEC-60115-1 4.18; 260 $\pm$ 5°C for 10 seconds
<b>Terminal strength</b>	No broken	AEC-Q200-006; Force of 1.8kg for 60 seconds.
<b>Mechanical Shock</b>	Tol. $\leq 0.05\%$ : $\Delta R \pm 0.05\%$ Tol. $> 0.05\%$ : $\Delta R \pm 0.1\%$	MIL-STD-202 Method 213; Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
<b>Vibration</b>	Tol. $\leq 0.05\%$ : $\Delta R \pm 0.05\%$ Tol. $> 0.05\%$ : $\Delta R \pm 0.1\%$	MIL-STD-202 Method 204; 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
<b>ESD</b>	$\Delta R \pm 0.1\%$	AEC-Q200-002; Human body, 2KV
<b>Resistance to solvents</b>	Marking Unsmearred	MIL-STD-202 Method 215; Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
<b>Sulfur Test</b>	$\Delta R \pm 1\%$	EIA-997(Conditions B); 105 $\pm$ 2°C no power rating for 750 hrs.
<b>Flammability</b>	No ignition of the tissue paper or scorching of the pinewood board	UL-94; V-0 or V-1 are acceptable. Electrical test not required.

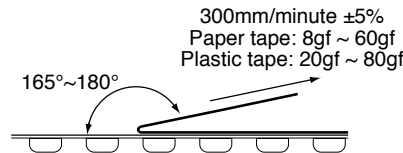
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### TAPE AND REEL



	A	B	W	E	F	P0	P1	P2	D0	D1	T	W1	W2	Qty.
<b>Paper tape</b>														
APV02	0.70 ±0.05	1.16 ±0.05	8.00 ±1.0	1.75 ±0.05	3.5 ±0.05	4.00 ±1.0	2.00 ±0.05	2.00 ±0.05	1.55 ±0.05	-	0.40 ±0.03	9.5 ±1.0	11.5 ±1.0	10,000
APV03	1.10 ±0.05	1.90 ±0.05	8.00 ±1.0	1.75 ±0.05	3.5 ±0.05	4.00 ±1.0	4.00 ±1.0	2.00 ±0.05	1.55 ±0.05	-	0.60 ±0.03	9.5 ±1.0	11.5 ±1.0	5,000
APV05	1.60 ±0.05	2.37 ±0.05	8.00 ±1.0	1.75 ±0.05	3.5 ±0.05	4.00 ±1.0	4.00 ±1.0	2.00 ±0.05	1.55 ±0.05	-	0.75 ±0.05	9.5 ±1.0	11.5 ±1.0	5,000
APV06	2.00 ±0.05	3.55 ±0.05	8.00 ±1.0	1.75 ±0.05	3.5 ±0.05	4.00 ±1.0	4.00 ±1.0	2.00 ±0.05	1.55 ±0.05	-	0.75 ±0.05	9.5 ±1.0	11.5 ±1.0	5,000
APV11	2.75 ±0.05	3.40 ±0.05	8.00 ±1.0	1.75 ±0.05	3.5 ±0.05	4.00 ±0.5	4.00 ±1.0	2.00 ±0.05	1.60 ±1.0	-	0.75 ±0.05	9.5 ±1.0	11.5 ±1.0	5,000
<b>Embossed plastic tape</b>														
APV10	2.85 ±1.0	5.45 ±1.0	12.0 ±1.0	1.75 ±1.0	5.5 ±0.5	4.00 ±0.5	4.00 ±1.0	2.00 ±0.5	1.50+0.10	1.4 min.	1.00 ±0.20	13.5 ±1.0	15.5 ±1.0	4,000
APV12	3.40 ±1.0	6.65 ±1.0	12.0 ±1.0	1.75 ±1.0	5.5 ±0.5	4.00 ±0.5	4.00 ±1.0	2.00 ±0.5	1.50+0.10	1.4 min.	1.00 ±0.20	13.5 ±1.0	15.5 ±1.0	4,000



### ORDERING INFORMATION

High power (otherwise blank)	RoHS Compliant	Tape and reel
<b>A P V H 0 3 A 1 0 R 2 A E T</b>		
<b>APV series</b>	<b>Size</b>	<b>TCR</b>
	02 = 0402	A = 10ppm
	03 = 0603	Z = 15ppm
	05 = 0805	W = 25ppm
	06 = 1206	V = 50ppm
	10 = 2010	
	11 = 1210	
	12 = 2512	
	<b>Resistance</b>	<b>Tolerance</b>
	10R2 = 10.2Ω	A = 0.05%
	1K00 = 1KΩ	B = 0.1%
	10K0 = 10KΩ	C = 0.25%
		D = 0.5%
		F = 1%

### 0805 - 2512 4-digit Marking

Examples	Code E96	Code E96	Code E96	Code E96	Code Multiplier
1000 = 100Ω	01 100	25 178	49 316	73 562	A 10 <sup>0</sup>
2201 = 2.2KΩ	02 102	26 182	50 324	74 576	B 10 <sup>1</sup>
1002 = 10KΩ	03 105	27 187	51 332	75 590	C 10 <sup>2</sup>
4992 = 49.9KΩ	04 107	28 191	52 340	76 604	D 10 <sup>3</sup>
1003 = 100KΩ	05 110	29 196	53 348	77 619	E 10 <sup>4</sup>
	06 113	30 200	54 357	78 634	F 10 <sup>5</sup>
	07 115	31 205	55 365	79 649	G 10 <sup>6</sup>
	08 118	32 210	56 374	80 665	H 10 <sup>7</sup>
	09 121	33 215	57 383	81 681	X 10 <sup>-1</sup>
	10 124	34 221	58 392	82 698	Y 10 <sup>-2</sup>
	11 127	35 226	59 402	83 715	Z 10 <sup>-3</sup>
	12 130	36 232	60 412	84 732	
	13 133	37 237	61 422	85 750	
	14 137	38 243	62 432	86 768	
	15 140	39 249	63 442	87 787	
	16 143	40 255	64 453	88 806	
	17 147	41 261	65 464	89 825	
	18 150	42 267	66 475	90 845	
	19 154	43 274	67 487	91 866	
	20 158	44 280	68 499	92 887	
	21 162	45 287	69 511	93 909	
	22 165	46 294	70 523	94 931	
	23 169	47 301	71 536	95 953	
	24 174	48 309	72 549	96 976	

### 0603 3-digit Marking

Examples

- 14C = 13K7Ω
- 13C = 13K3Ω
- 68B = 4K99Ω
- 68X = 49.9Ω

### 0603 3-digit Marking for E24

Examples	E24
101 = 100Ω	10 11 12 13 15 16 18
102 = 1KΩ	20 22 24 27 30 33 36
	39 43 47 51 56 62 68
	75 82 91