



THUNDER PRECISION RESISTORS



ULTRA HIGH STABILITY

EE1/20, EE1/10, EE1/8

MOLD TYPE RESISTORS

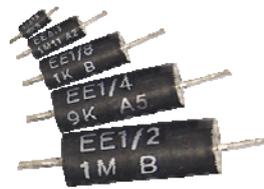
EE1/4, EE1/2

FEATURES

- Advanced thin film technology
- **Very low TCR: lower than ± 5 ppm/°C.**
- **Tolerance up to $\pm 0.02\%$**
- **Excellent overall stability: Class 0.025**
- Very low noise and voltage coefficient
- Bakelite mold provide superior moisture protection
- Power dissipation rating up to 1.0W
- Wide resistance range: 10 Ω to 10M Ω
- Metric sizes:

APPLICATIONS

- Test and measuring instruments
- Sensors
- Industrial electronics
- Medical equipments.
- Military electronics



DESCRIPTION

EE series professional metal film high precision resistors are the perfect choice for most fields of modern professional electronics where high reliability and high stability is of major concern as well as ultra high precision and very low temperature coefficient. The typical applications in the fields of precision test and measuring instruments and precision sensors along with industrial and medical electronics.

Production is strictly controlled and follows and extensive set of instructions established in production procedure for reproducibility. A homogeneous film of metal alloy is deposited on a high grade ceramic rods (93%~96% AL₂O₃) and conditioned to achieve the desired temperature coefficient. Nickel plated steel termination caps are firmly pressed on the metalized rods while the rods are aluminum terminated for eliminate voltage noise and current noise.

A professional laser is pressed on the metalized rods to not only achieve the target value but also perfect electronics performance by smoothly cutting a helical groove in the resistance layer on the ceramic rods without damaging the ceramics. The resistance layers are covered by a protective coating and hard bakelite designed for electrical, mechanical and climatic protection. The leads are covered with a final pure tin plating for keeping perfect solderability and wonderful outlooking. Digital marking is very convenient to recognize and the batch number on the resistors make it very easy to track back for any analysis and improvement requirements.

The result of the determined production is verified by an extensive testing procedure performed on 100% of the individual resistors. Temperature coefficient test will be 100% performed for TCR smaller than 10 ppm/°C. Only accepted products are laid directly into the adhesive tapes in accordance with IEC 60286-3 or bulk case in accordance with IEC 60286-6.

The resistors are suitable for processing on automatic inserting assembly systems. They are suitable for automatic soldering using wave, reflow or vapor phase. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

The resistors are tested in accordance with **MIL-R-10509F** which refers to **MIL-STD-202** or **ECC 40401-803** which refers to **EN 140000 (IEC60115)** or **DIN44061**.

On request, resistors are available with established reliability in accordance with **CECC 40401 - 803** Version **E**.



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QUICK REFERENCE DATA

THUNDER TYPE		EE1/20	EE1/10	EE1/8	EE1/4	EE1/2
MIL-R-10509F TYPE		RN50	RN55	RN60	RN65	RN70
DIN-44061 TYPE		0204	0207	0414	0617	0719
VISHAY TYPE		PTF51	PTF56	PTF65		
PRP TYPE		PR1/20B	PR1/10	PR1/8	PR1/4A	PR1/4
AAC TYPE			SRN55	SRN60	SRN65	SRN70
TEPRO TYPE		RNF50	RNF55	RNF60	RNF65	
IRC/TT TYPE			CAR5	CAR6	CAR7	
WELWYN/TT TYPE			CAR5	CAR6	CAR7	
EBG TYPE		EE1/20	EE1/10	EE1/8	EE1/4	EE1/2
Resistance tolerance (%)		F(±1); D(±0.5); C(±0.25); B(±0.10); W(±0.05); P(±0.025)				
Temperature coefficient		C3(±25ppm/°C); C5(±15ppm/°C); C6(±10ppm/°C); C7(±5ppm/°C); C8(±3ppm/°C); C9(±2ppm/°C)				
Resistance range Resistance tolerance (%) Temperature coefficient (ppm/°C)	P; W; B; C; D; F C9; C8; C7; C6; C5	10 Ω to 100k Ω	10 Ω to 100k Ω	10 Ω to 100k Ω	10 Ω to 100k Ω	10 Ω to 100k Ω
	W; B; C; D; F C7; C6; C5; C3	10 Ω to 100k Ω	1 Ω to 300k Ω	1 Ω to 300k Ω	1 Ω to 300k Ω	1 Ω to 300k Ω
	B; C; D; F C5; C3	10 Ω to 1.5M Ω	1 Ω to 3M Ω	1 Ω to 3M Ω	1 Ω to 3M Ω	1 Ω to 3M Ω
Climatic category(LCT/UCT/days)		55/125/56				
Rated dissipation, P_{70}		0.125W	0.25W	0.50W	0.75W	1.0W
Rated dissipation, P_{125}		0.05W	0.10W	0.125W	0.25W	0.50W
Operating voltage U_{max}		200V	250V	300V	350V	400V
Short time over load voltage $2U_{max}$		400V	500V	600V	700V	800V
Stability		0.05%				
Operating Temperature range		-55°C to 125°C				
Endurance		20 Ω to 221k Ω	20 Ω to 1M Ω	20 Ω to 1M Ω	20 Ω to 1M Ω	20 Ω to 1M Ω
Max. resistance change at P_{70}						
$\Delta R/R_{max}$, after 1000h		≤0.05%	≤0.05%	≤0.05%	≤0.05%	≤0.05%
$\Delta R/R_{max}$, after 8000h		≤0.15%	≤0.15%	≤0.15%	≤0.15%	≤0.15%
Insulation voltage		>500V				
Insulation resistance		>1G Ω				
Noise		<0.05μV/V				
Failure rate		≤10 ⁻⁸ /h				
Dimension	±0.40(mm)	L=3.9, D=1.8	L=6.8, D=2.5	L=10, D=3.7	L=14.8, D=5.2	L=18.3, D=6.5
	±0.05(mm)	d=0.45	d=0.6	d=0.6	d=0.6	d=0.8
Outlines						

RESISTANCE RANGE CAN BE EXTENDED UNDER REQUEST.



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Test procedures and requirements

IEC	IEC	TEST	PROCEDURE	REQUIREMENTS		
60115-1	60068-2			PERMISSIBLE CHANGE ΔR/R		
CLAUSE	TEST			STABILITY CLASS		
	METHOD		TYPE	0.025%	0.050%	0.050%
			EE1/20	100Ω to 100kΩ	10Ω to <100Ω	>100 kΩ;<300kΩ
			EE1/10	100Ω to 221KΩ	10Ω to <100Ω	>221 kΩ;<470kΩ
			EE1/8	100Ω to 221kΩ	10Ω to <100Ω	>221 kΩ;<470kΩ
			EE1.4	100Ω to 221KΩ	10Ω to <100Ω	>221 kΩ;<470kΩ
			EE1/2	100Ω to 221KΩ	10Ω to <100Ω	>221 kΩ;<470kΩ
4.5	—	tolerance	-	±0.02%; ±0.05%; ±0.10%; ±0.25%; ±0.50%; ±1.0%		
4.8	—	temperature coefficient	take at 25/85/25°C; 25/-25/25°C and 25/125/25°C is available under request	±5ppm/°C; ±10ppm/°C; ±15ppm/°C; ±25ppm/°C		
4.13	—	short time overload;	room temperature; U=2.5×√P ₇₀ ×R ≤ 2U _{max} ; 5s	±0.025%+0.05Ω	±0.025%+0.05Ω	±0.025%+0.05Ω
				no visible damage		
4.17.2	58 (Td)	solderability	solder bath method; 215°C; 3s	good tinning ≥95% covered; no visible damage		
4.18.2	58 (Td)	resistance to soldering heat	solder bath method; 260 ±5°C; 5±1s	±0.025%+0.05Ω	±0.05%+0.05Ω	±0.025%+0.05Ω
				no visible damage		
4.19	14 (Na)	rapid change of temperature	30 min. at -55°C; 30 min at +155°C; 5 cycles	±0.025%+0.05Ω	±0.05%+0.05Ω	±0.025%+0.05Ω
				no visible damage		
4.22	6(B4)	vibration	6h 10 to 2000Hz 1.5mm or 196 m/s	±0.025%+0.05Ω	±0.025%+0.05Ω	±0.025%+0.05Ω
4.23		climatic sequence;				
4.23.2	2(Ba)	dry heat	UCT; 16 h			
4.23.3	30(Db)	damp heat, cyclic	55°C;24h; ≥90% RH 1 cycle;			
4.23.4	1 (Aa)	cold	LCT; 2 h			
4.23.5	13 (M)	low air pressure	8.5 kPa 25±10°C 2h;			
4.23.6	30(Db)	damp heat cyclic	55°C;24h; ≥90% RH ; 5 cycles LCT=-55°C; UCT=125°C	±0.05%+0.05Ω	±0.05%+0.05Ω	±0.05%+0.05Ω
				no visible damage	no visible damage	no visible damage
4.24	3(Ca)	damp heat, steady state	40±2°C;56 days 93 +2/-3% RH	±0.05%+0.05Ω	±0.05%+0.05Ω	±0.05%+0.05Ω
4.25.1	—	endurance: standard operation mode	U=√P ₇₀ ×R ≤ U _{max} ; 1.5 h on; 0.5h off; 70°C; 1000 h	±0.05%+0.05Ω	±0.05%+0.05Ω	±0.05%+0.05Ω
4.29	45 (XA)	component solvent resistance	isopropyl alcohol; +23°C; toothbrush method	marking legible; no visible damage		

Unless otherwise specified, all values are tested at : Temperature: 23°C to 25°C; Relative humidity: 45% to 60%