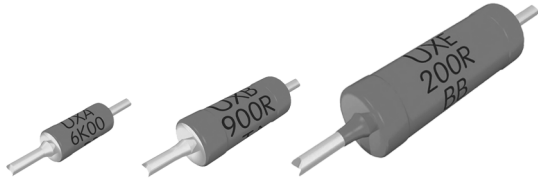




Ultra Precision Leaded Resistors



DESCRIPTION

UXA 0204, UXB 0207 and UXE 0414 ultra precision leaded thin film resistors combine the proven reliability of the professional products with an exceptional level of precision and stability. Therefore they are perfectly suited for applications in the fields of precision test and measuring equipment and particularly for the design of calibration references and standards.

FEATURES

- Superior thin film technology
- Exceptional low TC: ± 02 to ± 10 ppm/K
- Super tight tolerance: ± 0.01 to ± 0.25 %
- Exceptional overall stability: class 0.02
- Wide ultra precision range: 22Ω to $1 \text{ M}\Omega$

APPLICATIONS

- Precision test and measuring equipment
- Design of calibration references and standards.

METRIC SIZE

DIN:	0204	0207	0414
CECC:	A	B	D

TECHNICAL SPECIFICATIONS

DESCRIPTION	UXA 0204	UXB 0207	UXE 0414
CECC size	A	B	D
Resistance range	22Ω to $221 \text{ k}\Omega$	10Ω to $1 \text{ M}\Omega$	22Ω to $511 \text{ k}\Omega$
Resistance tolerance	± 0.25 %; ± 0.1 %; ± 0.05 %; ± 0.01 %		
Temperature coefficient	± 10 ppm/K; ± 05 ppm/K; ± 02 ppm/K		
Operation mode	precision	precision	precision
Climatic category (LCT/UCT/days)	20/125/56	20/125/56	20/125/56
Rated dissipation:			
P_{85}	0.05 W	0.125 W	0.25 W
P_{70}	0.1 W	0.25 W	0.5 W
Operating voltage, U_{max} AC/DC	200 V	250 V	300 V
Film temperature	125°C	125°C	125°C
Max. resistance change at P_{70} for resistance range, $\Delta R/R$ max., after: 2 000 h	100Ω to $100 \text{ k}\Omega$ ≤ 0.05 %	100Ω to $250 \text{ k}\Omega$ ≤ 0.05 %	100Ω to $100 \text{ k}\Omega$ ≤ 0.05 %
Max. resistance change at P_{85} for resistance range, $\Delta R/R$ max., after:			
1000 h	≤ 0.02 %	≤ 0.02 %	≤ 0.02 %
8000 h	≤ 0.04 %	≤ 0.04 %	≤ 0.04 %
225000 h	≤ 0.12 %	≤ 0.12 %	≤ 0.12 %
Specified lifetime	225000 h	225000 h	225000 h
Permissible voltage against ambient :			
1 minute	300 V	500 V	800 V
continuous	75 V	75 V	75 V
Failure rate	$\leq 0.7 \times 10^{-9}/\text{h}$	$\leq 0.3 \times 10^{-9}/\text{h}$	$\leq 0.1 \times 10^{-9}/\text{h}$

ORDERING INFORMATION - type description and ordering code

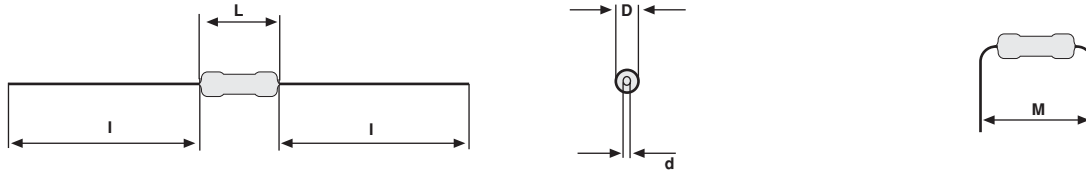
U	X	A	0204	-10	0.1 %	C1	47 K
FILM TYPE	PRODUCT CODE	SIZE CODE	DIN SIZE	TEMPERATURE COEFFICIENT	TOLERANCE	PACKAGING	RESISTANCE VALUE
U = Ultra precision	X = Leaded, tin alloy, axial ⁽¹⁾	A = 0204 B = 0207 E = 0414	0204 0207 0414	± 02 ppm/K ± 05 ppm/K ± 10 ppm/K	± 0.01 % ± 0.05 % ± 0.1 % ± 0.25 %	CU = 1000 units (cardboard box) C1 = 5000 units (cardboard box) R1 = 1000 units (reel pack) R2 = 2000 units (reel pack) RP = 5000 units (reel pack)	See Temperature coefficient and resistance range table

⁽¹⁾ 2 % Pb, in order to comply with demands of the U.S. Bellcore specification

Note: We recommend that the clear text ordering code is used to minimize the possibility of errors in order handling.



DIMENSIONS



DIMENSIONS - leaded resistor types, mass and relevant physical dimensions						
TYPE	D _{max} (mm)	L _{max} (mm)	d _{nom} (mm)	l _{min} (mm)	M _{min} (mm)	MASS (mg)
UXA 0204	1.6	3.6	0.5	29.0	5.0	125
UXB 0207	2.5	6.3	0.6	28.0	7.5	220
UXE 0414	4.0	11.9	0.8	31.0	15.0	750

SCRIPT MARKING - printed resistance value and letter coding for TC and tolerance				
RESISTANCE VALUE	TOL. (%)	LETTER CODE	TC (ppm/K)	LETTER CODE
Clear text code for value	± 0.25	C	± 10	B
	± 0.1	B	± 05	A
	± 0.05	A	± 02	T
	± 0.01	T	-	-

TEMPERATURE COEFFICIENT AND RESISTANCE RANGE				
DESCRIPTION		RESISTANCE VALUE ⁽¹⁾		
T.C.	TOLERANCE	UXA 0204	UXB 0207	UXE 0414
± 10 ppm/K ⁽²⁾	± 0.25 %	22 Ω to 221 kΩ	10 Ω to 1 MΩ	-
	± 0.1 %	43 Ω to 221 kΩ	10 Ω to 1 MΩ	22 Ω to 511 kΩ
	± 0.05 %	100 Ω to 180 kΩ	24 Ω to 301 kΩ	100 Ω to 301 kΩ
	± 0.01 %	200 Ω to 150 kΩ	24 Ω to 301 kΩ	-
± 05 ppm/K ⁽²⁾	± 0.25 %	47 Ω to 150 kΩ	10 Ω to 1 MΩ	-
	± 0.1 %	47 Ω to 150 kΩ	10 Ω to 1 MΩ	47 Ω to 301 kΩ
	± 0.05 %	100 Ω to 150 kΩ	24 Ω to 221 kΩ	100 Ω to 301 kΩ
	± 0.01 %	200 Ω to 150 kΩ	24 Ω to 221 kΩ	-
± 02 ppm/K ⁽³⁾	± 0.25 %	100 Ω to 100 kΩ	100 Ω to 150 kΩ	-
	± 0.1 %	100 Ω to 100 kΩ	100 Ω to 150 kΩ	-
	± 0.05 %	150 Ω to 100 kΩ	150 Ω to 150 kΩ	-
	± 0.01 %	200 Ω to 100 kΩ	200 Ω to 150 kΩ	-

Notes

- Resistance values to be selected from the E192 series, for other values please contact the factory.
- TC 10 and TC 05 are specified over the temperature range from - 20 °C to + 85 °C.
- TC 02 is specified over the temperature range from 0 °C to + 60 °C.



DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A homogeneous film of metal alloy is deposited on a high grade ceramic body (85 % Al₂O₃) and conditioned to achieve the desired temperature coefficient. Nickel plated steel termination caps are firmly pressed on the metallised rods. Special laser devices are used repeatedly to achieve the target value by slowly and smoothly cutting a helical groove in the resistive layer without damaging the ceramics. A further conditioning is applied in order to stabilise the trimming result. Connecting wires of electrolytic copper plated with tin alloy are welded to the termination caps. The resistors are covered by protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure tin on nickel plating. Script marking designates the resistance value plus coded TC and tolerance.

The result of the determined production is verified by an accelerated ageing (burn-in) and extensive testing procedure performed on 100 % of the individual resistors.

Only accepted products are stuck directly on the adhesive tapes in accordance with **IEC 60286-1**.

ASSEMBLY

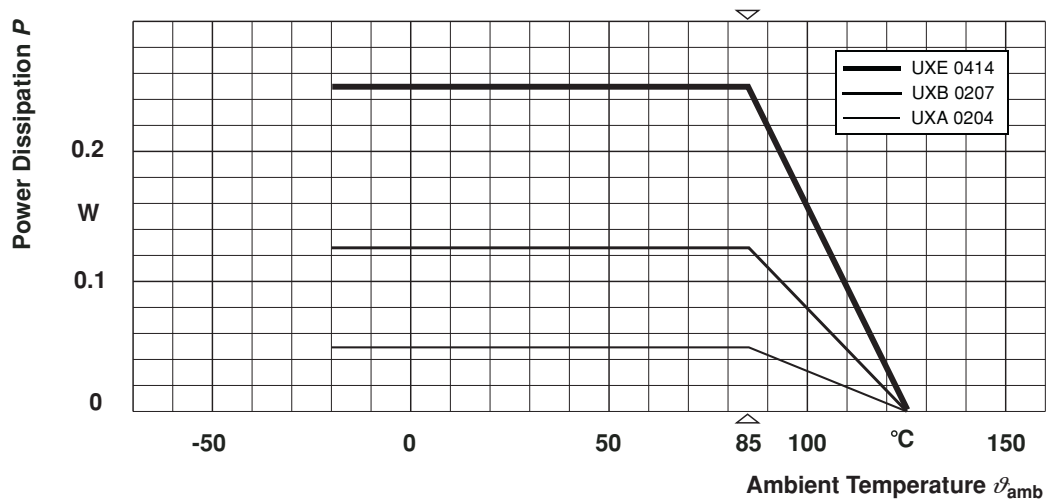
The resistors are suitable for processing on automatic insertion equipment and cutting and bending machines. Excellent solderability is proven, even after extended storage. They are suitable for automatic soldering using wave or dipping. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions.

APPROVALS

Where applicable, the resistors are tested in accordance with **CECC 40101-806** which refers to **EN 60115-1** and **EN 140100**.

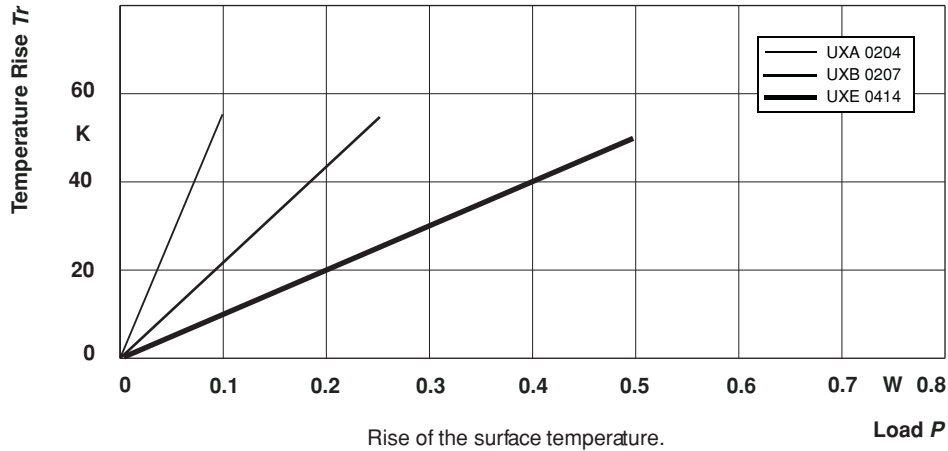
Vishay BEYSCHLAG has achieved "**Approval of Manufacturer**" in accordance with **EN 100114-1**

FUNCTIONAL DESCRIPTION

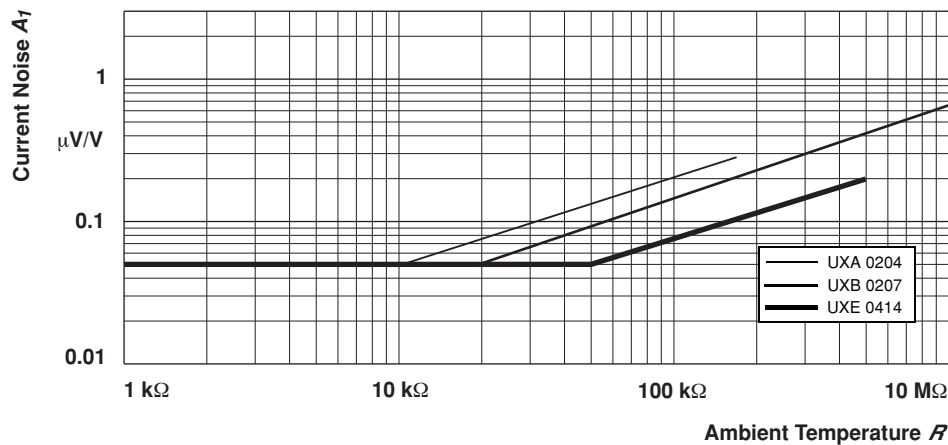


Specification of TC 02 is valid from 0 °C to 60 °C.

Derating - Precision Operation



Temperature Rise



Current Noise A_1 In Accordance With IEC 60 195

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the following specifications:

EN 140000 / IEC 60115-1, Generic specification (includes tests)

EN 140100 / IEC 60115-2, Sectional specification (includes schedule for qualification approval)

CECC 40101-806, Detail specification (includes schedule for conformance inspection)

Most of the components are approved in accordance with the European CECC-system, where applicable. The Test Procedures and Requirements table contains only the most important tests. For the full test schedule refer to the documents listed above. The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5202.

The tests are carried out in accordance with IEC 60 068 and under standard atmospheric conditions in accordance with

IEC 60068-1, 5.3. Climatic category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days) is valid.

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar).

For testing the components are mounted on a test board in accordance with IEC 60115-1, 4.31 unless otherwise specified.

In the Test Procedures and Requirements table only the tests and requirements are listed with reference to the relevant clauses of IEC 60115-1 and IEC 60068-2; a short description of the test procedure is also given.



UXA 0204, UXB 0207, UXE 0414 - Ultra Precision

Ultra Precision Leaded Resistors

Vishay Beyschlag

TEST PROCEDURES AND REQUIREMENTS						
IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
			Stability for product types:			
			UXA 0204	100 Ω to 100 k Ω	22 Ω to < 100 Ω ; > 100 k Ω to 221 k Ω	–
			UXB 0207	100 Ω to 250 k Ω	40.2 Ω to < 100 Ω ; > 250 k Ω to 301 k Ω	10 Ω to < 40.2 Ω ; > 301 k Ω to 1 M Ω
			UXE 0414	100 Ω to 100 k Ω	22 Ω to < 100 Ω ; > 100 k Ω to 511 k Ω	–
4.5	–	resistance			$\pm 0.25\%$; $\pm 0.1\%$; $\pm 0.05\%$; $\pm 0.01\%$	
4.8.4.2	–	temperature coefficient	at 20 / LCT / 20 °C and 20 / UCT / 20 °C		± 10 ppm/K; ± 05 ppm/K; ± 02 ppm/K	
4.25.1	–	endurance	room temperature; $U = \sqrt{P_{70} \times R}$ or $U = U_{max}$; 1.5 h on; 0.5 h off			
			70 °C; 2000 h	$\pm (0.05\% + 0.01 \Omega)$	$\pm (0.05\% + 0.01 \Omega)$	$\pm (0.05\% + 0.01 \Omega)$
			85 °C; 1000 h	$\pm (0.02\% + 0.01 \Omega)$	$\pm (0.03\% + 0.01 \Omega)$	$\pm (0.04\% + 0.01 \Omega)$
			85 °C; 8000 h	$\pm (0.04\% + 0.01 \Omega)$	$\pm (0.06\% + 0.01 \Omega)$	$\pm (0.08\% + 0.01 \Omega)$
4.25.3	–	endurance at upper category temperature	125 °C; 1000 h	$\pm (0.04\% + 0.01 \Omega)$	$\pm (0.06\% + 0.01 \Omega)$	$\pm (0.08\% + 0.01 \Omega)$
4.24	78 (Cab)	damp heat, steady state	(40 \pm 2) °C; 56 days; (93 \pm 3) % RH	$\pm (0.04\% + 0.01 \Omega)$	$\pm (0.05\% + 0.01 \Omega)$	$\pm (0.06\% + 0.01 \Omega)$
4.23		climatic sequence:				
4.23.2	2 (Ba)	dry heat	125 °C; 16 h			
4.23.3	30 (Db)	damp heat, cyclic	55 °C; 24 h; 90 to 100 % RH; 1 cycle			
4.23.4	1 (Aa)	cold	–55 °C; 2 h			
4.23.5	13 (M)	low air	8.5 kPa; 2 h;			
4.23.6	30 (Db)	pressure damp heat, cyclic	15 to 35 °C 55 °C; 5 days; 95 to 100 % RH; 5 cycles	$\pm (0.04\% + 0.01 \Omega)$ no visible damage	$\pm (0.05\% + 0.01 \Omega)$ no visible damage	$\pm (0.06\% + 0.01 \Omega)$ no visible damage



TEST PROCEDURES AND REQUIREMENTS - continued						
IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R/R$)		
			Stability for product types:			
			UXA 0204	100 Ω to 100 k Ω	22 Ω to < 100 Ω ; > 100 k Ω to 221 k Ω	–
			UXB 0207	100 Ω to 250 k Ω	40.2 Ω to < 100 Ω ; > 250 k Ω to 301 k Ω	10 Ω to < 40.2 Ω ; > 301 k Ω to 1 M Ω
			UXE 0414	100 Ω to 100 k Ω	22 Ω to < 100 Ω ; > 100 k Ω to 511 k Ω	–
4.13	–	short time overload	room temperature; $U = 2.5 \times \sqrt{P_{70} \times R}$ or $U = 2 \times U_{max}; 5 \text{ s}$	$\pm (0.01 \% + 0.01 \Omega)$ no visible damage	$\pm (0.01 \% + 0.01 \Omega)$ no visible damage	$\pm (0.02 \% + 0.01 \Omega)$ no visible damage
4.19	14 (Na)	rapid change of temperature	30 minutes at LCT and 30 minutes at UCT; 5 cycles	$\pm (0.01 \% + 0.01 \Omega)$ no visible damage	$\pm (0.01 \% + 0.01 \Omega)$ no visible damage	$\pm (0.02 \% + 0.01 \Omega)$ no visible damage
4.29	45 (XA)	component solvent resistance	isopropyl alcohol + 23 °C; toothbrush method	marking legible; no visible damage		
4.18.2	20 (Tb)	resistance to soldering heat	unmounted components; (260 \pm 5) °C; (10 \pm 1) s	$\pm (0.01 \% + 0.01 \Omega)$ no visible damage	$\pm (0.01 \% + 0.01 \Omega)$ no visible damage	$\pm (0.02 \% + 0.01 \Omega)$ no visible damage
4.17	20 (Ta)	solderability	+ 235 °C; 2 s solder bath method	good tinning (≥ 95 % coverage, no visible damage)		
4.22	6 (B4)	vibration	6 h; 10 to 2 000 Hz 1.5 mm or 196 m/s ²	$\pm (0.01 \% + 0.01 \Omega)$	$\pm (0.01 \% + 0.01 \Omega)$	$\pm (0.02 \% + 0.01 \Omega)$
4.16	21 (Ua ₁) 21 (Ub) 21 (Uc)	robustness of terminations	tensile, bending and torsion	$\pm (0.01 \% + 0.01 \Omega)$	$\pm (0.01 \% + 0.01 \Omega)$	$\pm (0.02 \% + 0.01 \Omega)$
4.7	–	voltage proof	$U_{rms} = 100 \text{ V}; 60 \text{ s}$	no flashover or breakdown		



UXA 0204, UXB 0207, UXE 0414 - Ultra Precision

Ultra Precision Leaded Resistors

Vishay Beyschlag

ORDERING INFORMATION

Components may be ordered by using either a simple clear text ordering code, see "Type Description and Ordering Code" or Vishay BCcomponents' unique 12NC.

Numeric Ordering Code (12NC)

- The resistors have a 12-digit ordering code starting with 2312.
- The subsequent 4 digits indicate the resistor type, specification and packaging; see the 12NC Ordering code table.
- The remaining 4 digits indicate the resistance value:
 - The first 3 digits indicate the resistance value.
 - The last digit indicates the resistance decade in accordance with the 12NC Indicating Resistance Decade table.

Last Digit of 12NC Indicating Resistance Decade

RESISTANCE DECADE	LAST DIGIT
10 Ω to 99.9 Ω	9
100 Ω to 999 Ω	1
1 kΩ to 9.99 kΩ	2
10 kΩ to 99.9 kΩ	3
100 kΩ to 999 kΩ	4

Ordering Example

The ordering code of a UXA 0204 resistor, value 47 kΩ and TC 10 with ± 0.1 % tolerance, supplied on bandolier in a box of 1000 units is: 2312 662 34703.

12NC ORDERING CODE - resistor type and packaging							
DESCRIPTION			ORDERING CODE 2312				
			BANDOLIER IN BOX	BANDOLIER IN BOX	BANDOLIER ON REEL	BANDOLIER ON REEL	BANDOLIER ON REEL
TYPE	T.C.	TOL.	CU 100 units	C1 1000 units	R1 1000 units	R2 2000 units	RP 5000 units
UXA 0204	± 10 ppm/K	± 0.25 %	562 2....	662 2....	462 2....	–	–
		± 0.1 %	562 3....	662 3....	462 3....	–	–
		± 0.05 %	562 4....	662 4....	462 4....	–	–
		± 0.01 %	562 7....	662 7....	462 7....	–	–
		note 1	562 91...	662 91...	462 91...	–	–
	± 05 ppm/K	± 0.25 %	563 2....	663 2....	463 2....	–	–
		± 0.1 %	563 3....	663 3....	463 3....	–	–
		± 0.05 %	563 4....	663 4....	463 4....	–	–
		± 0.01 %	563 7....	663 7....	463 7....	–	–
		note 1	563 91...	663 91...	463 91...	–	–
	± 02 ppm/K	± 0.25 %	564 2....	664 2....	464 2....	–	–
		± 0.1 %	564 3....	664 3....	464 3....	–	–
		± 0.05 %	564 4....	664 4....	464 4....	–	–
		± 0.01 %	564 7....	664 7....	464 7....	–	–
		note 1	564 91...	664 91...	464 91...	–	–



12NC ORDERING CODE - resistor type and packaging - continued							
DESCRIPTION			ORDERING CODE 2312				
			BANDOLIER IN BOX	BANDOLIER IN BOX	BANDOLIER ON REEL	BANDOLIER ON REEL	BANDOLIER ON REEL
TYPE	T.C.	TOL.	CU 100 units	C1 1000 units	R1 1000 units	R2 2000 units	RP 5000 units
UXB 0207	± 10 ppm/K	± 0.25 %	572 2....	672 2....	472 2....	-	577 2....
		± 0.1 %	572 3....	672 3....	472 3....	-	577 3....
		± 0.05 %	572 4....	672 4....	472 4....	-	577 4....
		± 0.01 %	572 7....	672 7....	472 7....	-	577 7....
		note 1	572 91...	672 91...	472 91...	-	577 91...
	± 05 ppm/K	± 0.25 %	573 2....	673 2....	473 2....	-	578 2....
		± 0.1 %	573 3....	673 3....	473 3....	-	578 3....
		± 0.05 %	573 4....	673 4....	473 4....	-	578 4....
		± 0.01 %	573 7....	673 7....	473 7....	-	578 7....
		note 1	573 91...	673 91....	473 91...	-	578 91...
	± 02 ppm/K	± 0.25 %	574 2....	674 2....	474 2....	-	579 2....
		± 0.1 %	574 3....	674 3....	474 3....	-	579 3....
		± 0.05 %	574 4....	674 4....	474 4....	-	579 4....
		± 0.01 %	574 7....	674 7....	474 7....	-	579 7....
		note 1	574 91...	674 91...	474 91...	-	579 91...
UXE 0414	± 10 ppm/K	± 0.1 %	592 3....	692 3....	-	597 3....	-
		± 0.05 %	592 4....	692 4....	-	597 4....	-
		note 1	592 91...	692 91...	-	597 91...	-
	± 05 ppm/K	± 0.1 %	593 3....	693 3....	-	598 3....	-
		± 0.05 %	593 4....	693 4....	-	598 4....	-
		note 1	593 91...	693 91...	-	598 91...	-

Note

1. Readable 12NC coding of resistance values is restricted to values with three significant digits. For resistance values with more than three significant digits, a non readable sequential number will be issued by the factory for each requested combination of resistance value and tolerance.