

Capacitors for Use in Electronics



Capacitors

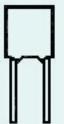
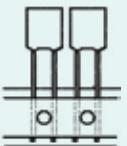
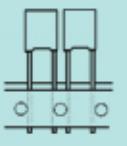
 **Iskra**[®]
Iskra MIS

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Type	Version	Pitch (mm)	Dielectric	Capacitance range	Rated voltage	Page
KFU1910		10; 15; 22,5; 27,5	Polyester film (KT)	0,022 µF — 1 µF 0,015 µF — 0,47 µF 4700 pF — 0,33 µF 1000 pF — 0,22 µF 1000 pF — 0,068 µF	100 V DC 250 V DC 400 V DC 630 V DC 1000 V DC	14
KEU1940		5	Metallized polyester film (MKT)	2,2 µF — 4,7 µF 0,1 µF — 1,5 µF 1000 pF — 1 µF 6800 pF — 0,22 µF 1000 pF — 0,068 µF	50 V DC 63 V DC 100 V DC 250 V DC 400 V DC	17
KEU1940 taped		5	Metallized polyester film (MKT)	2,2 µF — 4,7 µF 0,1 µF — 1,5 µF 1000 pF — 1 µF 6800 pF — 0,22 µF 1000 pF — 0,068 µF	50 V DC 63 V DC 100 V DC 250 V DC 400 V DC	17
KEU1930		7,5	Metallized polyester film (MKT)	0,068 µF — 1 µF 0,033 µF — 0,33 µF 0,01 µF — 0,15 µF 4700 pF — 0,033 µF 1000 pF — 0,015 µF	63 V DC 100 V DC 250 V DC 400 V DC 630 V DC	20
KEU1930 taped		7,5	Metallized polyester film (MKT)	0,068 µF — 1 µF 0,033 µF — 0,33 µF 0,01 µF — 0,15 µF 4700 pF — 0,033 µF 1000 pF — 0,015 µF	63 V DC 100 V DC 250 V DC 400 V DC 630 V DC	20
KEU1910		10; 15; 22,5; 27,5	Metallized polyester film (MKT)	0,22 µF — 22 µF 0,068 µF — 10 µF 0,033 µF — 10 µF 0,01 µF — 4,7 µF 4700 pF — 1,5 µF 1000 pF — 0,68 µF	63 V DC 100 V DC 250 V DC 400 V DC 630 V DC 1000 V DC	22
KEU1012		axial leads	Metallized polyester film (MKT)	0,15 µF — 10 µF 0,068 µF — 10 µF 0,047 µF — 10 µF 0,01 µF — 3,3 µF 1000 pF — 1 µF 1000 pF — 0,47 µF	63 V DC 100 V DC 250 V DC 400 V DC 630 V DC 1000 V DC	25
KLI1910		7,5; 10; 15; 22,5; 27,5	Polypropylene film (KP)	6800 pF — 0,15 µF 3300 pF — 0,1 µF 2200 pF — 0,047 µF 1000 pF — 0,047 µF 100 pF — 0,22 µF 1000 pF — 0,22 µF 1000 pF — 0,1 µF 1000 pF — 0,047 µF	100 V DC 160 V DC 250 V DC 400 V DC 630 V DC 1000 V DC 1600 V DC 2000 V DC	28
KNI1910		7,5; 10; 15; 22,5	Metallized polypropylene film (MKP)	680 pF — 2,2 µF 680 pF — 1,8 µF 680 pF — 0,39 µF 3300 pF — 0,33 µF 1000 pF — 0,15 µF 1000 pF — 0,1 µF	250 V DC 400 V DC 630 V DC 1000 V DC 1600 V DC 2000 V DC	33
KNU1910		10; 15; 22,5; 27,5	Metallized polypropylene film (MKP)	0,022 µF — 6,8 µF 0,01 µF — 2,2 µF 4700 pF — 1 µF 0,01 µF — 1 µF 1000 pF — 0,33 µF	250 V DC 400 V DC 630 V DC 1000 V DC 1600 V DC	40

General technical data

ISKRA capacitors for use in electronics are made of dielectric materials as follow:
- polypropylene film
- polyester
(polyethyleneterephthalate).

Survey of specific properties of individual dielectrics and use:

Polyester (polyethyleneterephthalate) film

Dielectric constant (25 °C/1 kHz):

$\epsilon_r = 3,25$; ASTM D 150-65T

Dielectric loss (25 °C/60 Hz):

$\tan\delta \leq 20,10^{-4}$ C;
ASTM D 150-65T

Dielectric strength (25 °C/60 Hz):

295 kV/mm; ASTM D 149-64,
ASTM D 2305-67

Temperature coefficient of capacitance:

$TC \approx +500, 10^{-6}$ C/°C

Temperature range max.:

+ 125 °C

Water absorption (sink for 24 h):

0,8 % max.; ASTM D 570-63

Dielectric absorption:

0,2 to 0,8 %

Polyester capacitors are used mainly in electronic devices where special characteristics of electrical parameters are not required and where wider temperature range is required. Mainly they are used as conjuctive or block capacitors.

Polypropylene film

Dielectric constant (25 °C/1 kHz):

$\epsilon_r = 2,2$; ASTM D 150

Dielectric loss (25 °C/1 kHz):

$\tan\delta \leq 5,10^{-4}$ C; ASTM D 150

Dielectric strength (25 °C/1 kHz):

300 to 380 kV/mm; ASTM D 149

Temperature coefficient of capacitance:

(- 100 \leq TC \leq -300) $,10^{-6}/^{\circ}\text{C}$

Temperature range max.:

+ 100 °C

Water absorption:

< 0,05 %; ASTM D 202

Dielectric absorption:

0,03 %

Polypropylene capacitors are used mainly in electronic circuits, where following requirements appear:

- small dielectric losses
- high insulation resistance
- negative and defined temperature coefficient (temperature compensation at oscillating circles with ferrite coil)
- high pulse loading
- loading with AC voltage.

The E-ranges are put down in accordance to IEC-publ. 60063 and DIN 41426.

Required values from E-range are all values from table below, multiplied by positive or negative whole number power exponent of the number 10.

Designation of dielectric in type code of capacitors

Type code is composed by three letters and four figures:

K	X	X		Y	Y	Y	Y
↓	↓	↓		↓	↓	↓	↓
1	2	3		4	5	6	7

1st Letter, "K" means capacitor

2nd Letter tells the type of dielectric (special for metallized version)

3rd Letter tells the purpose of use

4th, 5th, 6th, 7th Figure describes construction and design of capacitor and leads

Survey of letter used for single kinds of dielectric:

F - polyester film

E - metallized polyester film

L - polypropylene film

N - metallized polypropylene film

Electrical characteristics

1. Rated capacitance

Rated capacitance C_R values are available according to E-ranges. Available E-ranges (E6, E12, E24, E48, E96, on request E192) are stated at type descriptions in catalogue. The values from range E6 are privileged.

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0,5 %
				100	100
				101	101
				102	102
				104	104
				105	105
				106	106
				107	107
				109	109
100				110	110
				111	111
				113	113
				114	114
				115	115
				117	117
				118	118
				120	120
100				121	121
				123	123
				124	124
				126	126
				127	127
				129	129
120				130	130
				132	132
				133	133
				135	135
				137	137
				138	138
120				140	140
				142	142
				143	143
				145	145

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0,5 %
				147	147
				149	149
				150	150
				152	152
				154	154
				156	156
				158	158
				160	160
150				162	162
				164	164
				165	165
				167	167
				169	169
				172	172
150				174	174
				176	176
				178	178
				180	180
				182	182
				184	184
180				187	187
				189	189
				191	191
				193	193
180				196	196
				198	198
				200	200
				203	203
200				205	205
				208	208
				210	210
200				213	213

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0,5 %
				215	215
				218	218
				221	221
				223	223
220				226	226
				229	229
				232	232
				234	234
220				237	237
				240	240
				243	243
				246	246
220				249	249
				252	252
				255	255
				258	258
220				261	261
				264	264
				267	267
				271	271
270				274	274
				277	277
				280	280
				284	284
270				287	287
				291	291
				294	294
				298	298
300				301	301
				305	305
				309	309
300				312	312

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %
				316	316
			316	320	320
				324	324
				328	328
			332	332	332
		330		336	336
				340	340
				344	344
330				348	348
			348	352	352
				357	357
				361	361
330				365	365
			365	370	370
				374	374
				379	379
330				383	383
			383	388	388
				392	392
				397	397
390				402	402
			402	407	407
				412	412
				417	417
390				422	422
			422	427	427
				432	432
				437	437
430				442	442
			442	448	448
				453	453
				459	459

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %
				464	464
				470	470
			464	475	475
				475	481
				487	487
				493	493
			487	499	499
				505	505
				511	511
				511	517
				523	523
				530	530
				536	536
				542	542
				549	549
				556	556
				562	562
				562	569
				576	576
				583	583
				590	590
				597	597
				604	604
				612	612
				619	619
				626	626
				634	634
				642	642
				649	649
				657	657
				665	665
				673	673

E6 ± 20 %	E12 ± 10 %	E24 ± 5 %	E48 ± 2 %	E96 ± 1 %	E192 ± 0.5 %
				681	681
				690	690
				698	698
				706	706
				715	715
				723	723
				732	732
				741	741
				750	750
				759	759
				768	768
				777	777
				787	787
				796	796
				806	806
				816	816
				825	825
				835	835
				845	845
				856	856
				866	866
				876	876
				887	887
				898	898
				909	909
				920	920
				931	931
				942	942
				953	953
				965	965
				976	976
				988	988

2. Tolerance of rated capacitance

Standard tolerances and belonging codes for marking tolerances of rated capacitances are as follow:

Tolerance	$\pm 20\%$	$\pm 10\%$	$\pm 5\%$	$(\pm 2,5\%)$	$\pm 2\%$	$(\pm 1,25\%)$	$\pm 1\%$	$\pm 0,5\%$
Code	M	K	J	(H)	G	(E)	F	D

The narrowest possible tolerance is $\pm 1\text{ pF}$ (Z).

Available tolerances of rated capacitances are stated at type descriptions in catalogue.

3. Temperature dependence of capacitance

Temperature coefficient TC is defined for temperature range $\vartheta_1 \dots \vartheta_2$ according to DIN 41380 as follows:

$$TC = -\frac{C_2 - C_1}{C_3 (\vartheta_2 - \vartheta_1)}$$

C_1 - capacitance at temperature ϑ_1

C_2 - capacitance at temperature ϑ_2

C_3 - capacitance at temperature $(25 \pm 10)^\circ\text{C}$

Temperature coefficient for single type of capacitors is given in $10^{-6}/^\circ\text{C}$.

4. Rated voltage U_R

The rated voltage U_R is the maximum direct voltage which may be applied continuously to the terminals of a capacitor at any temperature between the lower category temperature and the rated temperature.

5. Category voltage U_C

Category voltage U_C is the maximum direct voltage which may be applied to the terminals of a capacitor at its upper category temperature. Adequate reducing of voltage for temperature range between upper rated temperature and category temperature is given at single types of capacitors in catalogue.

At un-sinusoidal alternating voltage it is to be dismantled according to Fourier's analysis to sinusoidal voltages and calculated the power loss as a sum of single partial sinusoidal power losses. For carrying-out the Fourier's analysis the voltage-time diagram is needed.

The sum of temperatures because of self-heating and temperature of surroundings of capacitor may be equal or lower than permitted category temperature with considering the category voltage U_C .

6. Alternating voltage loading

Allowed alternating voltage loading for single types is limited to frequency 50 to 60 Hz. The sum of applied alternating voltage (amplitude) and direct voltage to the terminals of a capacitor must not exceed category voltage U_C . In general mica and plastic foil capacitors are not suitable for connection to network, except special versions of capacitors, which are suitable also for such purposes.

7. Allowed self-heating because of alternating voltage loading

If capacitors are loaded with alternating voltages of higher frequencies with sinusoidal or unsinusoidal shape of alternating voltage, than self-heating and pulse loading is to consider.

Self heating of capacitor ($\Delta\vartheta$) is in operating of capacitor conditioned by belonging power loss (P_i) and outer surface of capacitor (S), and is calculated by the following from:

$$\Delta\vartheta(K) = \frac{P_i (\text{mW})}{S(\text{cm}^2) \beta}$$

where the base for termoplastic case is used

$$\beta = 1 \left(\frac{\text{mW}}{\text{K} \cdot \text{cm}^2} \right)$$

Power loss of capacitor (P_i) at loading with sinusoidal voltage of higher frequencies is calculated as follows:

$$P_i = U_{ef}^2 \cdot 2 \pi \cdot f \cdot C \cdot \tan\delta(f)$$

where:

C = capacitance in F

U_{ef} = effective voltage in V

f = frequency in Hz

$\tan\delta(f)$ = loss factor at frequency f

P_i = power loss in W

8. Pulse loading

The capacitors charged with un-sinusoidal voltage pulses with quick rise (high du/dt) will be loaded with high current pulses. Because of overloading of internal contacts and connections in capacitor the current must be limited, The boundary current for single types of capacitors depend on:

- amplitude and shape of pulse
- rated voltage of capacitor
- capacitance
- geometrical shape of capacitor.

At the repeating pulses the current loading will be limited by self-heating, surrounding temperature and cooling.

The limit of allowed current loading is given with allowed voltage rise in time (du/dt) in V/ μs (volts per microsecond)

$$I_{max} = C_R \frac{du}{dt}$$

C_R = rated capacitance in μF
 du/dt = allowed pulse loading in V/ μs

At single types of capacitors the data of allowed pulse loading is valuable for unlimited number of pulses (charging and discharging of capacitors) up to rated voltage U_R . Minimum resistance in series with capacitor is then:

$$R = \frac{U_R}{C_R \cdot du/dt}$$

where:

U_R = rated voltage
of the capacitor in V

C_R = rated capacitance in μF

R = min. series resistance in Ohm

At the pulses of lower voltage than rated voltage the given values of allowed pulse loading are to multiply with the relation factor rated voltage/pulse voltage.

If the demanded pulse loading of the capacitor comply with the requests in certain case, the control is needed to be sure that power loss is not exceeded, resp. self-heating is in area of allowed pulse loading max. 15 °C. In critical cases the capacitor surface temperature is to measure and temperature fall of 5 °C inside capacitor is to consider.

9. Disipation factor $\tan\delta$

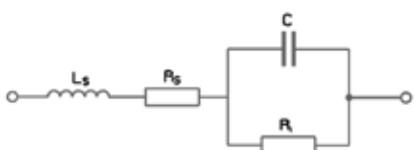
Every capacitor has beside desired capacitance also of her electrical properties, which are shown as constituent elements in following by connection:

L_s - serial inductance

R_s - serial resistnace

R_i - insulation resistance
(parallel resistance)

C - capacitance



The real capacitor has always incorrectnesses as serial inductance L_s and loss resistance R_s and R_i . The inductance can be reduced but not to zero. At certain frequency f_0 the capacitance and inductance reactances are equal:

$$\frac{1}{\omega_0 C} = \omega_0 L$$

where

$$\omega_0 = 2\pi f_0$$

At frequencys higher than f_0 (the resonant frequency) the inductive component prevail. The resistance R_s is the resistance of the capacitor's wires, transitional resistance of electrode contacting, the resistance of capacitor electrodes and polarisation losses in capacitor dielectric. Resistance R_i is insulating resistance depending on insulating properties of dielectric in capacitor.

Values R_s and R_i determine losses in capacitor and depend on temperature, frequency, voltage and capacitance and cause heating of capacitor. The resistance R_i is much bigger then the resistance R_s so we can change both resistances only with equivalent serial resistance of capacitor ESR.

The relation between equivalent serial resistance of capacitor ESR and his reactance $1/\omega C$ is dissipation factor of capacitor and is marked with $\tan\delta$.

$$\tan\delta = \text{ESR} \cdot \omega \cdot C$$

The values of dissipation factor ($\tan\delta$) are given at single types of capacitors in catalogue.

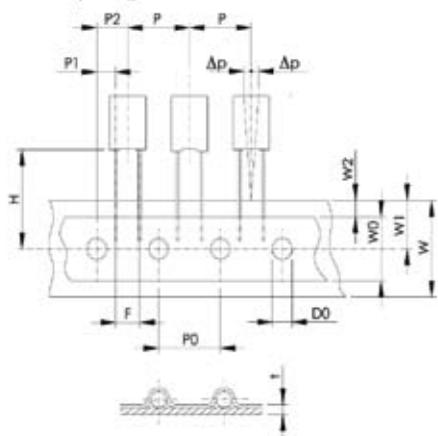
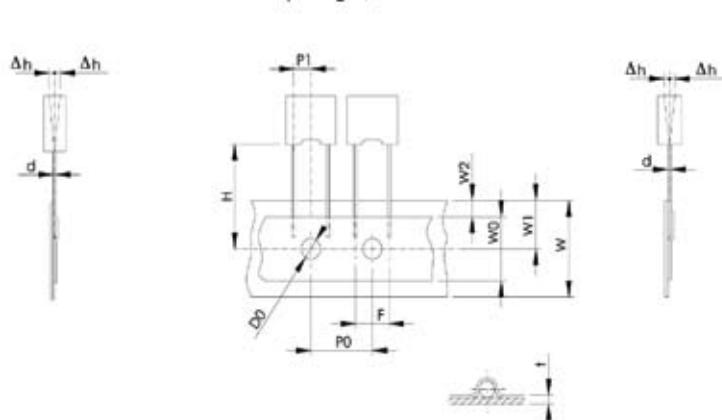
10. Insulation resistance R_i

Insulation resistance of capacitor is given as resistance R_i in $M\Omega$ or as time constant in seconds $R_i \cdot C_R = M\Omega \cdot \mu\text{F}$.

The insulation resistance is the relation between the applied direct voltage and the current, after precise determined time. The limited values for insulation resistance are given for testing time 60 sec. at 20 °C.

Test voltages in accordance to rated voltages are as follow:

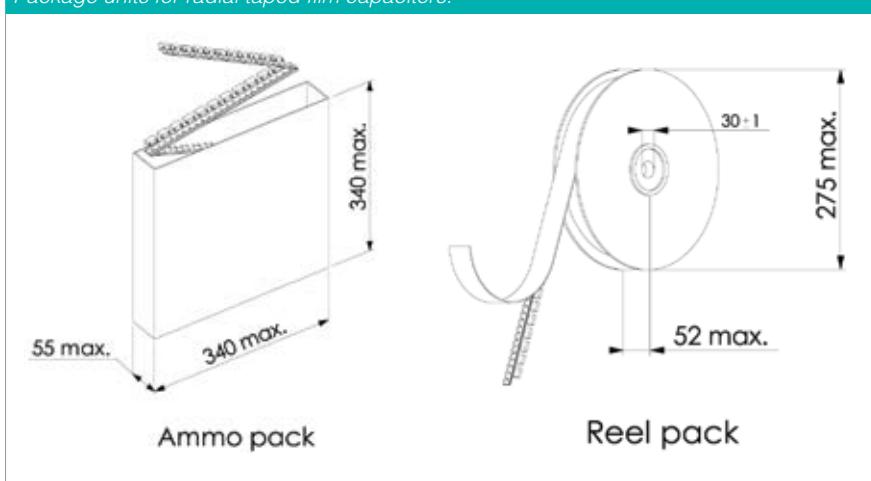
Rated voltage U_R	Test voltage
< 100 V	10 V
100 V ≤ U_R < 500 V	100 V
≥ 500 V	500 V

Lead spacing 5 mm**Lead spacing 7,5 mm**

Descriptions	Symbol	Dimensions (mm)		
		Lead spacing 5 mm	Lead spacing 7,5 mm	Tolerances
Carrier tape width	W	18	18	+ 1/-0,5
Hold-down tape width	W ₀	12	12	± 0,5
Hotel position	W ₁	9	9	± 0,5
Hold-down tape position	W ₂	3 max.	3 max.	
Feed hole diameter	D ₀	4	4	± 0,2
Pitch of component	P	127	12,7	± 1
Feed hole pitch	P ₀ *	12,7	12,7	± 0,3
Feed hole centre to lead	P ₁	3,85	3,75	± 0,7
Feed hole centre to component centre	P ₂	6,35	12,7	± 1,3
Height from feed hole centre to the component body	H	18,5	18,5	± 0,5
Component alignment	Δp	0	0	± 1,3
	Δh	0	0	± 2
Lead spacing	F	5	7,5	+ 0,6/-0,1
Lead wire diameter	d	0,5; 0,6	0,6	± 0,5
Total tape thickness	t	0,7	0,7	± 0,2

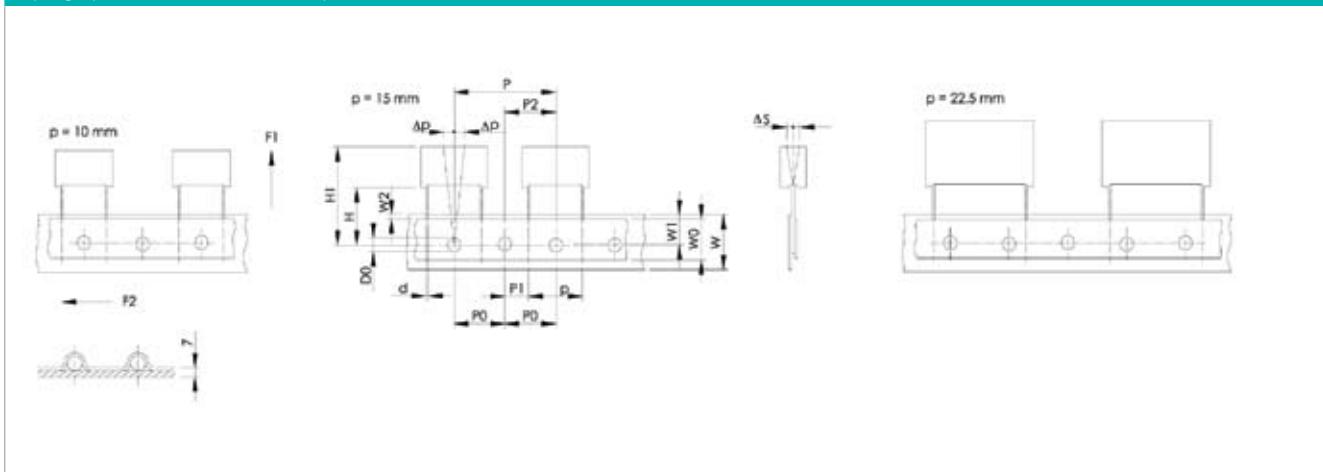
* Cumulative pitch error over any 20 pitches: max. ± 1mm

Package units for radial taped film capacitors:



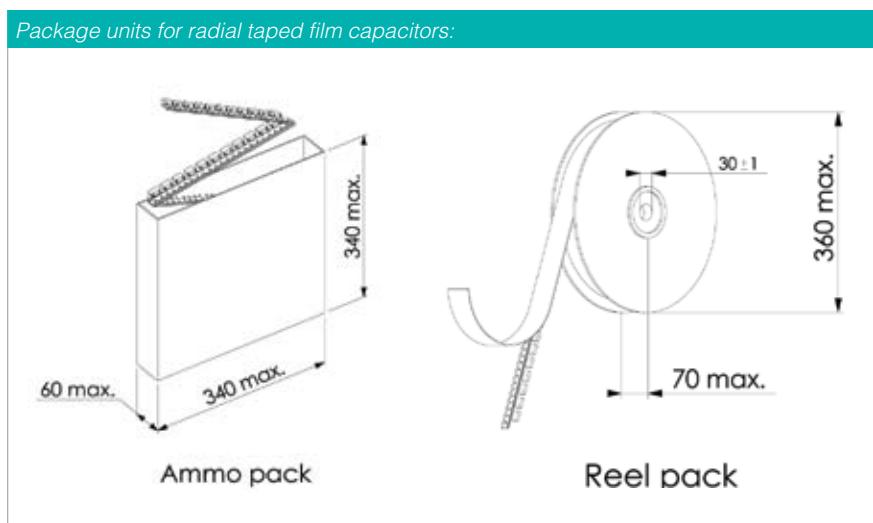
KEU1940 taped, KEU1930 taped

Capacitor thickness b (mm)	Ammo-pack (pcs/box)	Reel-pack (pcs/reel)
2,5	3100	1400
3,5	2250	1000
4	1900	850
4,5	1700	750
5	1550	700
6	1300	600



Descriptions	Symbol	Dimensions (mm)			
		Lead spacing 10 mm	Lead spacing 15 mm	Lead spacing 22,5 mm	Tolerances
Carrier tape width	W	18	18	18	+ 1/-0,5
Hold-down tape width	W ₀	12 or 6	12 or 6	12 or 6	± 0,5
Hotel position	W ₁	9	9	9	± 0,5
Hold-down tape position	W ₂	3	3	3	max
Feed hole diameter	D ₀	4	4	4	± 0,2
Pitch of component	P	25,4	25,4	38,1	± 1
Feed hole pitch	P ₀ *	12,7	12,7	12,7	± 0,2
Feed hole centre to lead	P ₁	7,7	5,2	7,8	± 0,7
Feed hole centre to component centre	P ₂	12,7	12,7	19,5	± 1,3
Height from feed hole centre to the component body	H	18,5	18,5	18,5	± 0,5
Component alignment	Δp	0	0	0	± 1,3
	ΔS	0	0	0	± 2
Lead spacing	p	10	15	22,5	+ 0,6/-0,1
Lead wire diameter	d	0,6	0,8	0,8	± 0,5
Total tape thickness	t	0,7	0,7	0,7	± 0,2
Extraction force for components	F ₁	5	5	5	min. (N)
Break force of the tape	F ₂	15	15	15	min. (N)
Component height	H ₁	31	34	39	max

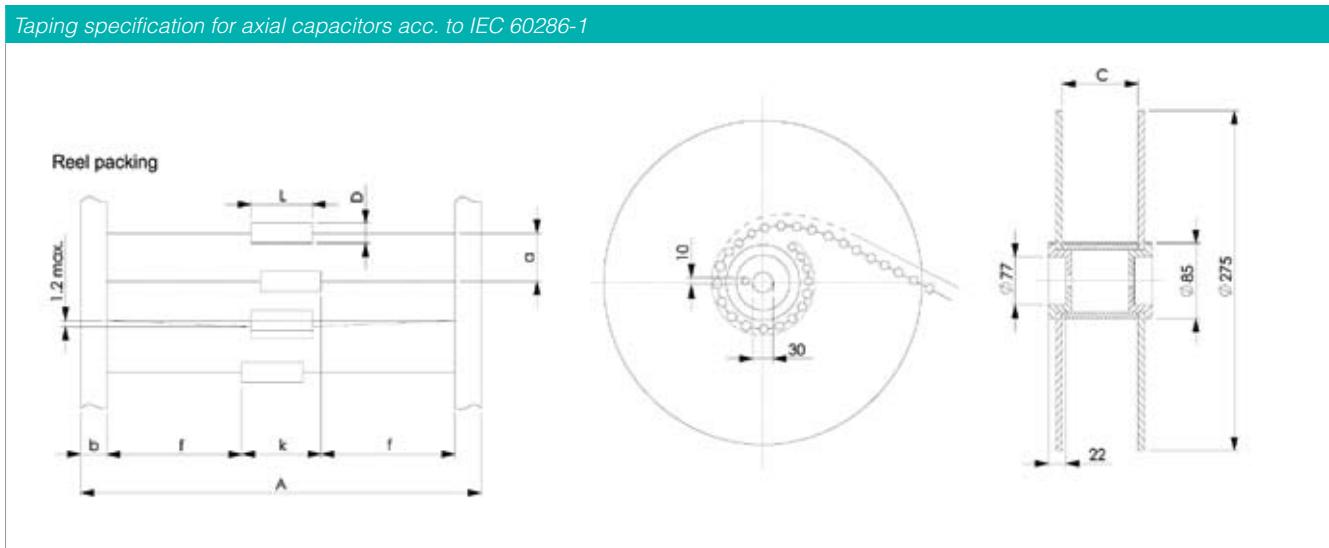
* Cumulative pitch error over any 20 pitches: max. ±1mm



Taped package units

Pitch (mm)	Capacitor thickness b (mm)	Ammo-pack (pcs/box)	Reel-pack (pcs/reel)
10	4; 4,3	900	900
	5	768	700
	6	648	550
15	5	768	600
	5,5	696	600
	6	648	500
	7	552	450
	7,5	504	400
	8,5	444	350
	9	420	350
22,5	6	424	350
	6,5	392	350
	7	368	300
	8,5	304	250
	10	256	200
	10,5	240	200

Taping specification for axial capacitors acc. to IEC 60286-1



Reel packing

Description	Symbol	Dimensions (mm)
Capacitor diameter	D	4,5 — 19,5
Body length of capacitor	L	11 — 33,5
Outer spacing of tapes	A	See table II
Inner reel width	C	See table II
Tape width	b	6 ± 1
Lead length from the capacitor body to the adhesive tape	f	≥ 20 mm
Body location (permissible lateral deviation)	k	L _{max} + 1,4
Component spacing	a	See table I
Permissible deviation over 10 spacing	Δa	See table I

Table I

D (mm)	a (mm)	Δa (mm)
≤ 5	5 ± 0,5	± 2
5,1 — 9,5	10 ± 0,5	± 2
9,6 — 14,7	15 ± 0,75	± 3
14,8 — 19,5	20 ± 1	± 4

Table II

L _{max} (mm) Body length	A (mm)	C (mm)
≤ 11	75 ± 2	77
14 — 21,5	85 ± 2	87
≥ 26,5	95 ± 2	97

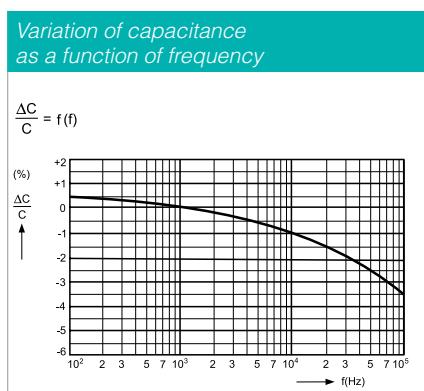
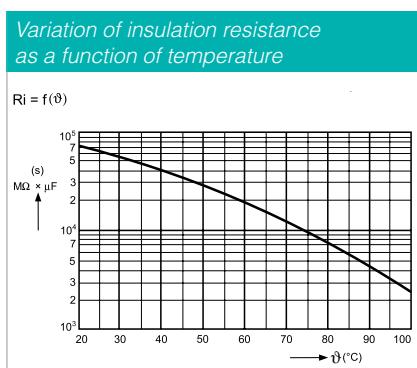
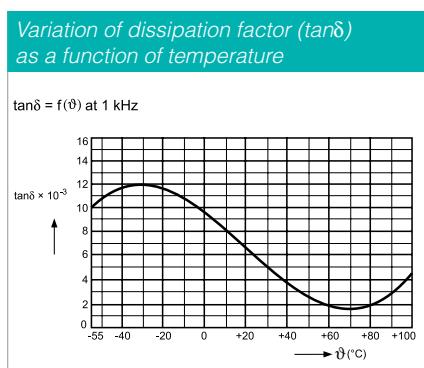
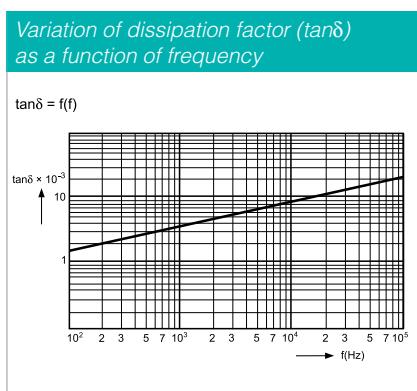
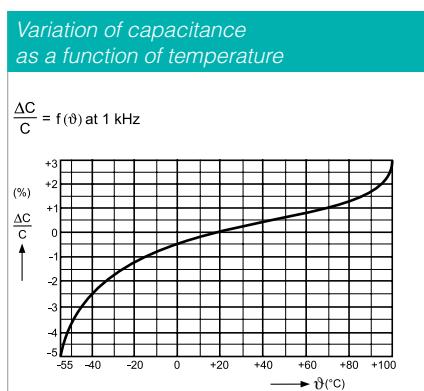
Capacitors

Type KFU

Polyester capacitors

As dielectric high quality polyester film is used, electrodes are of tin or aluminium foil. The winding is extended foil design, terminals are electrically welded to electrodes on frontal side. Such version is little inductive and because of good contacting suitable for pulse loading operation.

Typical electrical characteristics of polyester capacitors KFU



Capacitors

Type KFU1910 radial leads, pitch 10 mm to 27,5 mm

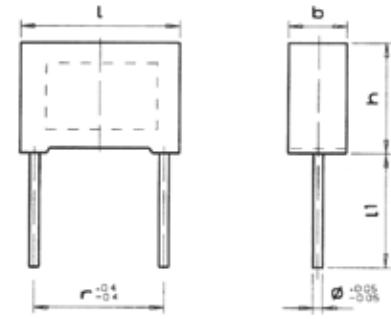
TECHNICAL DATA

General technical data

Dielectric:	polyester (polyethyleneterephthalate) film
Electrodes:	tin or aluminium foil
Winding:	non-inductive construction, flat shape
Leads:	tinned copper wire; standard lengths l_1 : $4^{\pm 0,5}$; 6^{-1} ; $25^{\pm 5}$. Other lead lengths on request.
Encapsulation:	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0
Marking:	Iskra symbol, capacitance, tolerance, rated voltage
Climatic category:	55/100/56, IEC 60068-1
Temperature range:	- 55 °C to + 100 °C
Complies with standards:	IEC 60384-11
<i>Electrical data</i>	
Capacitance range:	1000 pF to 1 μ F
Standard values of capacitance (C_R):	range E6
Capacitance tolerance:	$\pm 20\%$ (M), $\pm 10\%$ (K)
Rated voltage (U_R):	100 V DC, 250 V DC, 400 V DC, 630 V DC, 1000 V DC
Allowed alternative voltage up 60 Hz:	63 V AC, 100 V AC, 160 V AC, 200 V AC, 250 V AC
Category voltage (U_C):	to + 85 °C $U_C = U_R$; from + 85 °C to + 100 °C voltage U_R is lowered for 1,25 % per 1 °C
Test voltage:	$2 \times U_R$, 2 s
Dissipation factor ($\tan\delta$):	$\leq 60 \times 10^{-4}$ at 1 kHz at 20 °C
Insulation resistance (R_I):	$\geq 30\,000\, M\Omega$ for $C_R \leq 0,33\,\mu F$; $R_I \times C_R \geq 10\,000\, s$, for $C_R > 0,33\,\mu F$
Self inductance:	appr. 10 nH/cm length of capacitor and leads
Soldering on printed circuit boards:	temperature of soldering bath 265 °C max., soldering time 5 s max.
Pulse loading (du/dt):	1000 V/ μ s



Dimensions in mm



Diameter of leads:

Pitch r (mm)	Diameter of leads ϕ (mm)
10	0,6
15; 22,5; 27,5	0,8

Dimensional data: KFU1910

Capa- citance	Rated voltage U _R																			
	100 V DC				250 V DC				400 V DC				630 V DC				1000 V DC			
	I _{max.}	h _{max.}	b _{max.}	r	I _{max.}	h _{max.}	b _{max.}	r	I _{max.}	h _{max.}	b _{max.}	r	I _{max.}	h _{max.}	b _{max.}	r	I _{max.}	h _{max.}	b _{max.}	r
	(mm)				(mm)				(mm)				(mm)				(mm)			
1000 pF													13	9,5	4,3	10	18	11	5,5	15
1500 pF													13	9,5	4,3	10	18	11	5,5	15
2200 pF													13	9,5	4,3	10	18	11	5,5	15
3300 pF													13	9,5	4,3	10	18	13	7	15
4700 pF									13	9,5	4,3	10	13	10,5	5	10	18	13	7	15
6800 pF									13	9,5	4,3	10	13	11,5	6	10	18	14,5	9	15
0,01 µF									13	10,5	5	10	13	11,5	6	10	18	14,5	9	15
0,015 µF					13	10,5	5	10	13	11,5	6	10	18	13	7	15	27	16,5	7	22,5
0,022 µF	13	9,5	4,3	10	13	10,5	5	10	18	11	5,5	15	18	13	7	15	27	18,5	8,5	22,5
0,033 µF	13	10,5	5	10	18	11	5,5	15	18	13	7	15	18	14,5	9	15	27	19	10,5	22,5
0,047 µF	13	11,5	6	10	18	11	5,5	15	18	14,5	9	15	27	15	6,5	22,5	32	20	11	27,5
0,068 µF	18	11	5,5	15	18	13	7	15	27	15	6,5	22,5	27	18,5	8,5	22,5	32	22,5	13	27,5
0,1 µF	18	13	7	15	18	14,5	9	15	27	18,5	8,5	22,5	27	19	10,5	22,5				
0,15 µF	18	14,5	9	15	27	16,5	7	22,5	27	19	10,5	22,5	32	20	11	27,5				
0,22 µF	18	14,5	9	15	27	18,5	8,5	22,5	32	20	11	27,5	32	22,5	13	27,5				
0,33 µF	27	18,5	8,5	22,5	32	20	11	27,5	32	22,5	13	27,5								
0,47 µF	27	19	10,5	22,5	32	22,5	13	27,5												
0,68 µF	32	20	11	27,5																
0,82 µF	32	20	11	27,5																
1 µF	32	22,5	13	27,5																

Capacitors

Type KEU

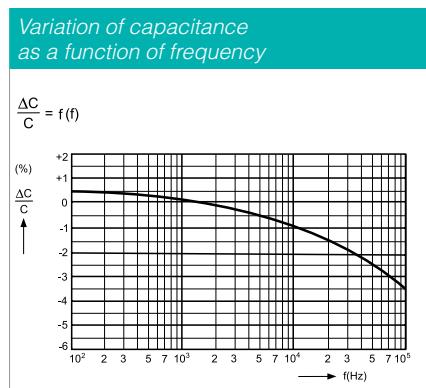
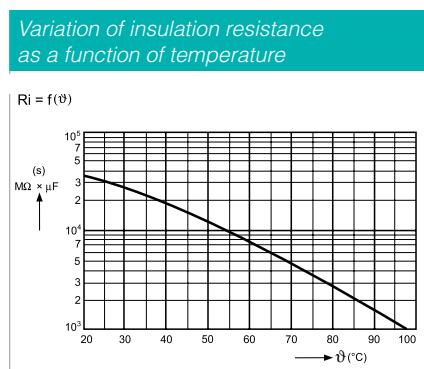
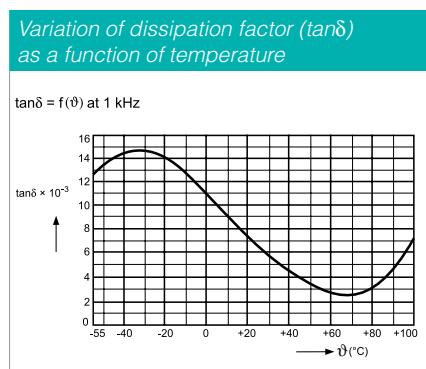
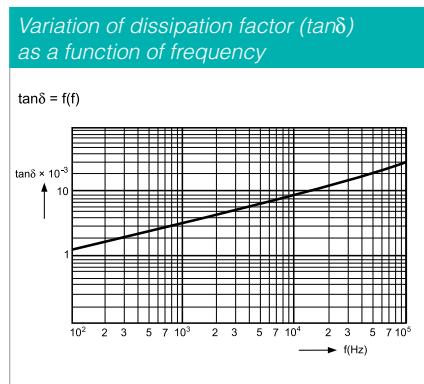
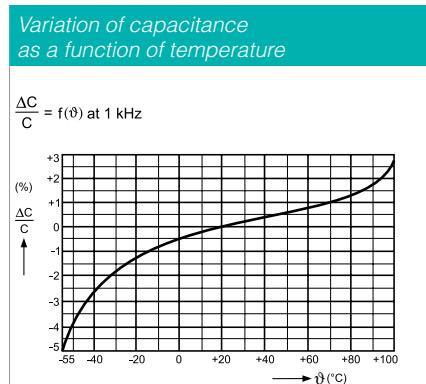
Metallized polyester capacitors

As a dielectric high quality polyester film with good electrical properties is used. Electrodes of capacitor are vacuum metallized aluminium. The thickness of aluminium is approximately $0.01 \mu\text{F}$ to $0.04 \mu\text{F}$, so the capacitor is self-regenerative after breakdown. The weak point in dielectric because of un-homogeneous material in some microseconds regenerate with energy of current bow of charged capacitor. In this process

metallized layer of aluminium in the area of weak point without any damage of dielectric burns out. The weak point is blameless insulated. So metallized capacitor withstands breakdowns without a permanent short circuit with considering self healing resp. regeneration. The majority of weak points are cleared during the high voltage burning-out in the manufacturing process.

Contact surface is made by spraying the parts of metal contact material. Leads are electrically welded on contact surface. The technology and control system in production assure high liability of capacitors also in use on low voltages and high frequencies. In the case of pulse loading or loading the capacitor with alternative voltage of high gradient of growth is to consider allowed pulse loading du/dt resp. maximal allowed current.

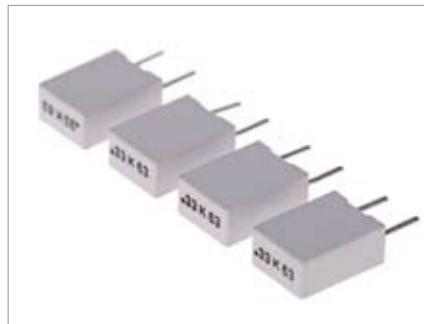
Typical electrical characteristics of metallized polyester capacitors KEU



Capacitors

Type KEU1940
Type KEU1940 taped

radial leads, pitch 5 mm

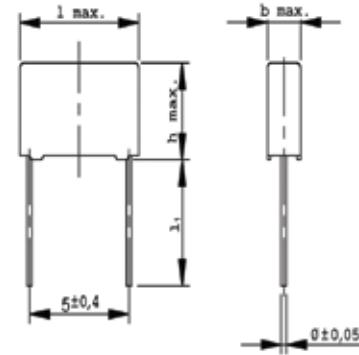


TECHNICAL DATA

General technical data

Dielectric:	polyester (polyethylene terephthalate) film
Electrodes:	vacuum metallized aluminum on dielectric
Winding:	non-inductive construction, flat shape
Leads:	tinned copper wire; standard lengths l_1 : $4^{+0,5}$; 6^{-1} ; 16^{+2-1} . Other lead lengths on request.
Encapsulation:	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0, resistant to wash in halogenated solvents
Marking:	capacitance, tolerance, rated voltage
Climatic category:	55/105/56, IEC 60068-1
Temperature range:	- 55 °C to + 105 °C
Complies with standards:	IEC 60384-2
Taping according to:	IEC 60286-2

Dimensions in mm



Diameter of leads:

b _{max} (mm)	Diameter of lead ϕ (mm)
≤ 6,1	0,5
> 6,1	0,6

Typical application:

Blocking, coupling, decoupling, by-passing, timing, oscillator circuits

TECHNICAL DATA

Electrical data

Capacitance range:	1000 pF to 4,7 µF
Standard values of capacitance (C_R):	range E6
Capacitance tolerance:	$\pm 20\%$ (M), $\pm 10\%$ (K) and $\pm 5\%$ (J)
Rated voltage (U_R):	50 V DC, 63 V DC, 100 V DC, 250 V DC, 400 V DC
Allowed alternative voltage up 60 Hz:	30 V AC, 40 V AC, 63 V AC, 160 V AC (140 V AC), 200 V AC (160 V AC)
Category voltage (U_C):	up to $+85^\circ\text{C}$ $U_C = U_R$; from $+85^\circ\text{C}$ to $+105^\circ\text{C}$ voltage U_R is lowered for 1,25 % per 1 $^\circ\text{C}$
Test voltage:	$1,4 \times U_R$, 2 s
Dissipation factor ($\tan\delta$):	$\leq 80 \times 10^{-4}$ at 1 kHz and 20°C

Insulation resistance (R_i)
at 20°C :

Rated capacitance C_R (μF)	Min. R_i or $R_i \times C_R$ between terminals	
	$U_R \leq 100$ V DC	$U_R > 100$ V DC
$\leq 0,33$	15 000 MΩ	30 000 MΩ
$> 0,33 (> 1)$	5 000 s (1000 s)	30 000 MΩ

Self inductance:
1 nH/mm length of capacitor
and leads

Soldering on printed
circuit boards:
temperature of soldering bath
 275°C max., soldering time 4 s max.

Pulse loading (dU/dt):
100 V/µs for $U_R = 50$ V DC
and $C_r = 0,22$ µF
25 V/µs for $U_R = 50$ V DC
and $C_r > 0,22$ µF
160 V/µs for $U_R = 63$ V DC
200 V/µs for $U_R = 100$ V DC
250 V/µs for $U_R = 250$ V DC
130 V/µs for $U_R = 250$ V DC
(alternative dimensions)
400 V/µs for $U_R = 400$ V DC
200 V/µs for $U_R = 400$ V DC
(alternative dimensions)

Dimensional data: KEU1940

Capacitance (μF)	Rated voltage U_R											
	50 V DC/30 V AC			63 V DC/40 V AC			100 V DC/63 V AC			250 V DC/160 V AC		
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$
	(mm)			(mm)			(mm)			(mm)		
0,001							7,4	6,6	2,6			
0,0015							7,4	6,6	2,6			
0,0022							7,4	6,6	2,6			
0,0033							7,4	6,6	2,6			
0,0047							7,4	6,6	2,6			
0,0068							7,4	6,6	2,6	7,4	6,6	3,6
0,01							7,4	6,6	2,6	7,4	6,6	3,6
0,015							7,4	6,6	2,6	7,4	6,6	4,6
0,022							7,4	6,6	2,6	7,4	7,6	4,6
0,033							7,4	6,6	2,6	7,4	7,6	5,1
0,047							7,4	6,6	2,6	7,5	9,6	6,1
0,068							7,4	6,6	2,6	7,5	9,6	
0,1			7,4	6,6	2,6		7,4	6,6	2,6	7,5	10,1	
0,15			7,4	6,6	2,6		7,4	7,6	3,6	7,5	11,1	
0,22			7,4	6,6	2,6		7,4	7,6	3,6			
0,33			7,4	7,6	3,6		7,5	9,6	4,6			
0,47			7,4	7,6	3,6		7,5	9,6	4,6			
0,68			7,5	9,6	4,6		7,5	10,1	5,1			
1			7,5	10,1	5,1		7,5	11,1	6,1			
1,5			7,5	11,1	6,1							
2,2	7,5	11,1	6,1									
3,3	7,5	13,1	7,3									
4,7	7,5	13,1	7,3									

Alternative dimensions

Capacitance (μF)	250 V DC/140 V AC			400 V DC/160 V AC		
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$
	(mm)			(mm)		
0,0068				7,4	6,6	2,6
0,01						
0,015				7,4	7,6	3,6
0,022	7,4	6,6	2,6			
0,033				7,5	9,6	4,6
0,047	7,4	7,6	3,6	7,5	10,1	5,1
0,068	7,4	7,6	3,6	7,5	11,1	6,1
0,1	7,5	9,6	4,6			
0,15	7,5	10,1	5,1			
0,22	7,5	11,1	6,1			

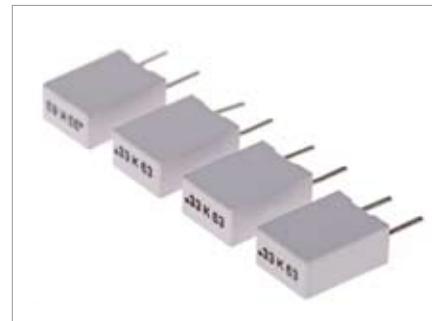
Taped version details data see page 10

Capacitors

Type KEU1930

Type KEU1930 taped

radial leads, pitch 7,5 mm

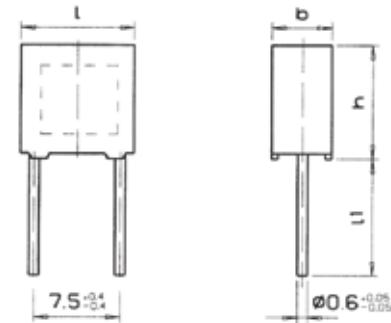


TECHNICAL DATA

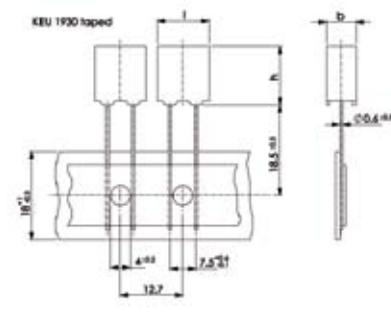
General technical data

Dielectric:	polyester (polyethylene terephthalate) film
Electrodes:	vacuum metallized aluminum on dielectric
Winding:	non-inductive flat shape
Leads:	tinned copper wire; standard lengths l_1 : $4^{\pm 0,5}$, 6^{-1} ; $25^{\pm 5}$. Other lead lengths on request.
Encapsulation:	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0
Marking:	capacitance, tolerance, rated voltage
Climatic category:	55/100/56, IEC 60068-1
Temperature range:	- 55 °C to + 100 °C
Complies with standards:	IEC 60384-2

KEU 1930 (dimensions in mm)



KEU 1930 taped (dimensions in mm)



Electrical data

Capacitance range:	1000 pF to 1 µF
Standard values of capacitance (C_R):	range E6
Capacitance tolerance:	± 20 % (M), ± 10 % (K), and ± 5 % (J) on special request
Rated voltage (U_R):	63 V DC, 100 V DC, 250 V DC, 400 V DC, 630 V DC
Allowed alternative voltage up to 60 Hz:	40 V AC, 63 V AC, 160 V AC, 200 V AC, 220 V AC
Category voltage (U_C):	to + 85 °C $U_C = U_R$; from + 85 °C to + 100 °C voltage U_R is lowered for 1,25 % per 1 °C
Test voltage:	$1,6 \times U_R$, 2 s
Dissipation factor ($\tan\delta$):	$\leq 100 \times 10^{-4}$ at 1 kHz and 20 °C
Self inductance	$\leq 10 \text{ nH}$ at leads length 2 mm
Soldering on printed circuit board:	temperature of soldering bath 270 °C max., soldering time 5 s max.
Pulse loading (dU/dt):	10 V/µs for $U_R = 63$ V DC 15 V/µs for $U_R = 100$ V DC 30 V/µs for $U_R = 250$ V DC 50 V/µs for $U_R = 400$ V DC 70 V/µs for $U_R = 630$ V DC

Insulation resistance (R_i) at 20 °C:

Rated capacitance C_R (μF)	Min. R_i or $R_i \times C_R$ between terminals	
	$U_R > 100 \text{ V DC}$	$U_R \leq 100 \text{ V DC}$
$\leq 0,33$	7500 MΩ	3750 MΩ
$> 0,33$	2500 s	1250 s

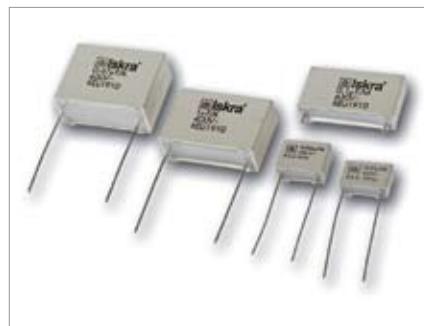
Dimensional data: KEU1930

Capa- citance (μF)	Rated voltage U_R														
	63 V DC			100 V DC			250 V DC			400 V DC			630 V DC		
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$
	(mm)			(mm)			(mm)			(mm)			(mm)		
0,001													10,5	6,5	3,5
0,0015													10,5	6,5	3,5
0,0022													10,5	6,5	3,5
0,0033													10,5	6,5	3,5
0,0047										10,5	6,5	3,5	70,5	9	4
0,0068										10,5	6,5	3,5	10,5	9	4
0,01							10,5	6,5	3,5	10,5	9	4	10,5	11	5
0,015							10,5	6,5	3,5	10,5	9	4	10,5	12	6
0,022							10,5	9	4	10,5	11	5			
0,033				10,5	6,5	3,5	10,5	9	4	10,5	12	6			
0,047				10,5	6,5	3,5	10,5	9	4						
0,068	10,5	6,5	3,5	10,5	9	4	10,5	11	5						
0,1	10,5	6,5	3,5	10,5	9	4	10,5	11	5						
0,15	10,5	6,5	3,5	10,5	9	4	10,5	12	6						
0,22	10,5	9	4	10,5	11	5									
0,33	10,5	9	4	10,5	12	6									
0,47	10,5	11	5												
0,68	10,5	11	5												
1	10,5	12	6												

Taped version details data see page 10

Capacitors

Type KEU1910	radial leads, pitch 10 mm to 27,5 mm
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TECHNICAL DATA

General technical data

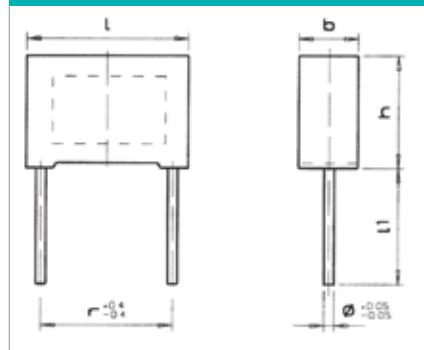
Dielectric:	polyester (polyethylene terephthalate) film
Electrodes:	vacuum metallized aluminum on dielectric
Winding:	non-inductive flat shape
Leads:	tinned copper wire; standard lengths l_1 : $4^{\pm 0,5}$, 6^{-1} ; $25^{\pm 5}$. Other lead lengths on request.
Encapsulation:	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0
Marking:	Iskra symbol, capacitance, tolerance, rated voltage
Climatic category:	55/100/56, IEC 60068-1
Temperature range:	- 55 °C to + 100 °C
Complies with standards:	IEC 60384-2

Electrical data

Capacitance range:	1000 pF to 22 μ F
Standard values of capacitance (C_R):	range E6
Capacitance tolerance:	$\pm 20\%$ (M), $\pm 10\%$ (K), and $\pm 5\%$ (J) on special request
Rated voltage (U_R):	63 V DC, 100 V DC, 250 V DC, 400 V DC, 630 V DC, 1000 V DC
Allowed alternative voltage up to 60 Hz:	40 V AC, 63 V AC, 160 V AC, 200 V AC, 220 V AC, 250 V AC
Category voltage (U_C):	up to + 85 °C $U_C = U_R$; from + 85 °C to + 100 °C voltage U_R is lowered for 1,25 % per 1 °C
Test voltage:	$1,6 \times U_R$, 2 s
Dissipation factor ($\tan\delta$):	$\leq 80 \times 10^{-4}$ at 1 kHz and 20 °C
Self inductance	10 nH/cm length of capacitor and leads
Soldering on printed circuit board:	temperature of soldering bath 270 °C max., soldering time 5 s max.
Insulation resistance (R_i) at 20 °C:	

Rated capacitance C_R (μ F)	Min. R_i or $R_i \times C_R$ between terminals	
	$U_R > 100$ V DC	$U_R \leq 100$ V DC
$\leq 0,33$	30000 M Ω	15000 M Ω
$> 0,33$	10000 s	5000 s

KEU1910 (dimensions in mm)



Diameter of leads:

Pitch r (mm)	Diameter of lead ϕ (mm)
10	0,6
15; 22,5; 27,5	0,8

Pulse loading (du/dt):

U_R (V DC)	Pitch r (mm)			
	10	15	22,5	27,5
Allowed pulse loading (V/ μ s)				
63	9	6	3	2,5
100	12	8	5	4
250	22	14	9	7
400	35	20	12	10
630	45	32	17	13
1000	90	45	26	20

Dimensional data: KEU1910

Capa- citance (µF)	Rated voltage U _R																														
	63 V DC				100 V DC				250 V DC				400 V DC				630 V DC				1000 V DC										
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r							
	(mm)				(mm)				(mm)				(mm)				(mm)				(mm)										
0,001																					13	9	4	10							
0,0015																					13	9	4	10							
0,0022																					13	9	4	10							
0,0033																					13	9	4	10							
0,0047																				13	9	4	10	13	9	4	10				
0,0068																				13	9	4	10	13	10,5	5	10				
0,01																	13	9	4	10	13	9	4	10	13	11,5	6	10			
0,015																	13	9	4	10	13	9	4	10							
0,022																	13	9	4	10	13	10,5	5	10							
0,033									13	9	4	10	13	9	4	10	13	11,5	6	10											
0,047									13	9	4	10	13	9	4	10															
0,068					13	9	4	10	13	9	4	10	13	10,5	5	10															
0,1					13	9	4	10	13	9	4	10	13	11,5	6	10															
0,15					13	9	4	10	13	9,5	4,3	10																			
0,22	13	9	4	10	13	10,5	5	10	13	10,5	5	10																			
0,33	13	9	4	10	13	11,5	6	10																							
0,47	13	9	4	10																											
0,68	13	9,5	4,3	10																											
1	13	10,5	5	10																	18	11	5	15							
1,5	13	11,5	6	10																	18	11	5	15							
0,01																					18	11	5,5	15							
0,015																					18	11	5	15							
0,022																					18	11	5,5	15							
0,033																				18	11	5	15	18	13	7	15				
0,047																	18	11	5	15	18	11	5	15	18	14,5	8,5	15			
0,068																	18	11	5	15	18	12	6	15	18	16,5	8,5	15			
0,1									18	11	5	15	18	11	5	15	18	13	7	15											
0,15									18	11	5	15	18	11	5	15	18	14,5	8,5	15											
0,22									18	11	5	15	18	12	6	15	18	18,5	9	15											
0,33					18	11	5	15	18	11	5	15	18	13	7	15															
0,47					18	11	5	15	18	12	6	15	18	14,5	8,5	15															
0,68	18	11	5	15	18	12	6	15	18	13	7	15																			
1	18	11	5	15	18	13,5	7,5	15	18	14,5	8,5	15																			
1,5	18	11	5	15	18	16,5	8,5	15																							
2,2	18	12	6	15																											
3,3	18	13	7	15																											
4,7	18	14,5	8,5	15																											

Taped version details data see page 10

Dimensional data: KEU1910

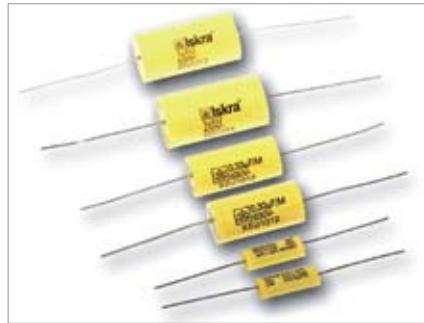
Capacitance (μF)	Rated voltage U_R																							
	63 V DC				100 V DC				250 V DC				400 V DC				630 V DC				1000 V DC			
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r
	(mm)				(mm)				(mm)				(mm)				(mm)				(mm)			
0,033																					26,5	15	6	22,5
0,047																					26,5	15	6	22,5
0,068																					26,5	15	6	22,5
0,1																	26,5	15	6	22,5	26,5	16,5	8,5	22,5
0,15																	26,5	15	6	22,5	26,5	18,5	10	22,5
0,22													26,5	15	6	22,5	26,5	16	7	22,5				
0,33													26,5	15	6	22,5	26,5	18,5	9	22,5				
0,47									26,5	15	6	22,5	26,5	15	6	22,5	26,5	20,5	11	22,5				
0,68									26,5	15	6	22,5	26,5	16	7	22,5								
1									26,5	15	6	22,5	26,5	18,5	9	22,5								
1,5					26,5	16	7	22,5	26,5	16	7	22,5	26,5	20,5	11	22,5								
2,2					26,5	16,5	8,5	22,5	26,5	18,5	9	22,5												
3,3	26,5	15	6	22,5	26,5	18,5	10	22,5	26,5	20,5	11	22,5												
4,7	26,5	15	6	22,5																				
6,8	26,5	16	7	22,5																				
10	26,5	17	8,5	22,5																				
15	26,5	20,5	11	22,5																				
0,15																					32	17	9	27,5
0,22																					32	19	10	27,5
0,33																	32	17	9	27,5	32	22	13	27,5
0,47																	32	19	10	27,5	32	24,5	15	27,5
0,68													32	17	9	27,5	32	21	12	27,5	32	28	18	27,5
1													32	17	9	27,5	32	23,5	14	27,5				
1,5									32	17	9	27,5	32	19	10	27,5	32	26,5	17	27,5				
2,2									32	17	9	27,5	32	21	12	27,5								
3,3									32	19	10	27,5	32	24,5	15	27,5								
4,7					32	20	11	27,5	32	21	12	27,5	32	28	18	27,5								
6,8					32	22	13	27,5	32	24,5	15	27,5												
10	32	17	9	27,5	32	28,5	15	27,5	32	28	18	27,5												
15	32	20	11	27,5																				

Taped version details data see page 11

Capacitors

Type KEU1012

axial leads



TECHNICAL DATA

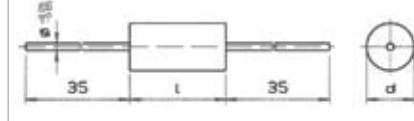
General technical data

Dielectric:	polyester (polyethylene terephthalate) film
Electrodes:	vacuum metallized aluminum on dielectric
Winding:	non-inductive construction, cylindric shape
Leads:	tinned copper wire
Encapsulation:	polyester film, ends sealed with epoxy resin
Marking:	capacitance, tolerance, rated voltage (at larger dimensions also Iskra symbol, type designation)
Climatic category:	55/100/21, IEC 60068-1
Temperature range:	- 55 °C to + 100 °C
Complies with standards:	IEC 60384-2

Electrical data

Capacitance range:	1000 pF to 10 µF
Standard values of capacitance (C_R):	range E6
Capacitance tolerance:	± 20 % (M), ± 10 % (K), and ± 5 % (J) on special request
Rated voltage (U_R):	63 V DC, 100 V DC, 250 V DC, 400 V DC, 630 V DC, 1000 V DC
Allowed alternative voltage up to 60 Hz:	440 V AC, 63 V AC, 160 V AC, 200 V AC, 220 V AC, 250 V AC
Category voltage (U_C):	up to + 85 °C $U_C = U_R$; from + 85 °C to + 100 °C voltage U_R is lowered for 1,25 % per 1 °C
Test voltage:	1,6 x U_R , 2 s
Dissipation factor ($\tan\delta$):	≤ 80 x 10 ⁻⁴ at 1 kHz and 20 °C
Self inductance	10 nH/cm length of capacitor and leads
Soldering on printed circuit board:	temperature of soldering bath 270 °C max., soldering time 5 s max.
Insulation resistance (R_i) at 20 °C:	

KEU1012 (dimensions in mm)



Diameter of leads:

Capacitor lenght l_{max} (mm)	Diameter of leads ϕ (mm)
11; 14; 19	0,6
26,5; 31,5	0,8

Pulse loading (du/dt):

U_R (V DC)	I _{max} (mm)				
	11	14	19	26,5	31,5
	Allowed pulse loading (V/µs)				
63	12	9	6	3	2,5
100	18	12	8	5	4
250	32	22	14	9	7
400	55	35	20	12	10
630	70	45	32	17	13
1000	-	90	45	26	20

Rated capacitance C_R (µF)	Min. R_i or $R_i \times C_R$ between terminals	
	$U_R > 100$ V DC	$U_R \leq 100$ V DC
≤ 0,33	30000 MΩ	15000 MΩ
> 0,33	10000 s	5000 s

Dimensional data: KEU1012

Capa- citance (μ F)	Rated voltage U_R											
	63 V DC		100 V DC		250 V DC		400 V DC		630 V DC		1000 V DC	
	$d_{max.}$	$l_{max.}$	$d_{max.}$	$l_{max.}$	$d_{max.}$	$l_{max.}$	$d_{max.}$	$l_{max.}$	$d_{max.}$	$l_{max.}$	$d_{max.}$	$l_{max.}$
	(mm)		(mm)		(mm)		(mm)		(mm)		(mm)	
0,001									5	11	5	14
0,0015									5	11	5	14
0,0022									5	11	5	14
0,0033									5	11	5,5	14
0,0047									5	11	6	14
0,0068									5,5	11	7	14
0,01							5	11	5	14	6	19
0,015							5	11	5,5	14	6,5	19
0,022							5	11	6,5	14	7,5	19
0,033							5,5	11	6	19	8,5	19
0,047					5	11	5,5	14	6,5	19	10	19
0,068			5	11	5,5	11	6	14	7,5	19	9	26,5
0,1			5	11	5,5	14	7	14	9	19	10,5	26,5
0,15	5	11	5	11	6	14	6,5	19	8,5	26,5	11,5	31,5
0,22	5	11	6	11	7	14	7,5	19	10	26,5	13,5	31,5
0,33	5,5	11	6	14	6,5	19	9	19	12	26,5	16	31,5
0,47	6	14	6,5	14	7,5	19	8,5	26,5	12,5	31,5	18,5	31,5
0,68	6	14	7,5	14	8,5	19	10	26,5	14,5	31,5		
1	7	14	7	19	8,5	26,5	10,5	31,5	17,5	31,5		
1,5	6,5	19	8,5	19	10	26,5	12,5	31,5				
2,2	7,5	19	9,5	19	11	31,5	15	31,5				
3,3	9	19	9,5	26,5	13	31,5	18	31,5				
4,7	9	26,5	11	26,5	15	31,5						
6,8	10	26,5	12	31,5	18	31,5						
10	10,5	31,5	14	31,5	21	31,5						

Taped version details data see page 12

Capacitors

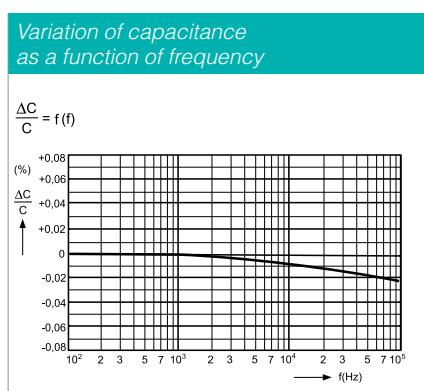
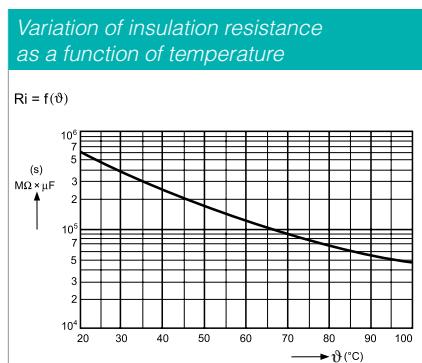
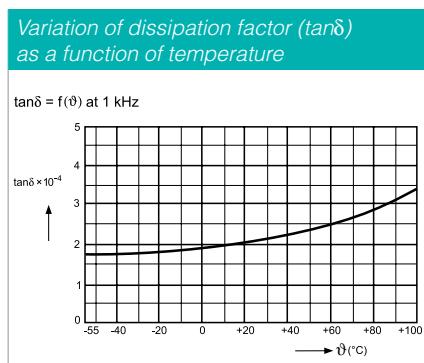
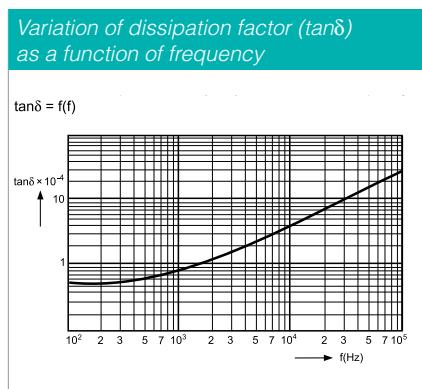
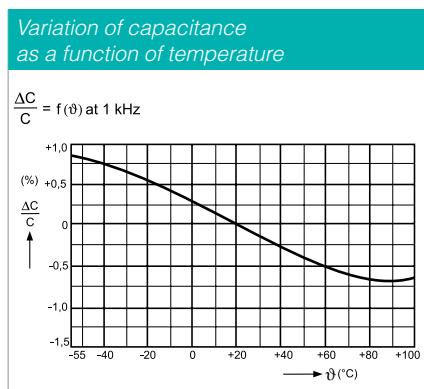
Type KLI

Polypropylene capacitors

As a dielectric a high quality polypropylene film with excellent electrical properties is used. The electrodes are of aluminium foil and vacuum evaporated metal on polypropylene film for internal serial connection. Winding is extended foil design

and enables contacting of leads on aluminium electrodes for high currents. Capacitors are suitable for operating in pulse circuits (for instance in TV sets in thyristor or transistor deflection steps) where high pulse loading appear.

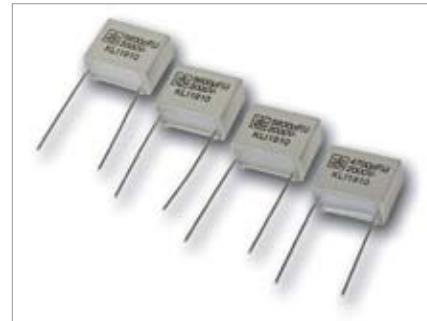
Typical electrical characteristics of polypropylene polyester capacitors KLI



Capacitors

Type KLI1910

radial leads, pitch 7,5 mm to 27,5 mm



TECHNICAL DATA

General technical data

Dielectric:

polypropylene film

Electrodes:

metal foil; metal foil and metallized polypropylene film (internal series connection for $U_R \geq 630V$ DC and $r \geq 15mm$)

Winding:

non-inductive construction,
flat shape

Leads:

tinned copper wire, standard
lengths $l_1: 4^{\pm 0,5}, 6^{-1}; 25^{\pm 5}$.
Other lead lengths on request.

Encapsulation:

flame-retardant plastic case with
flame-retardant epoxy resin seal,
UL 94 V-0

Marking:

Iskra symbol, capacitance,
tolerance, rated voltage,
type designation

Climatic category:

55/100/56 IEC 60068-1

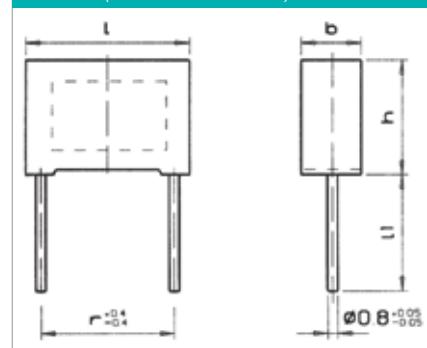
Temperature range:

- 55 °C to + 100 °C

Complies with standards:

IEC 60384-13; IEC 60384-16

KLI1910 (dimensions in mm)



Diameter of leads:

Pitch r (mm)	Diameter of leads ϕ (mm)
7,5; 10	0,6
15; 22,5; 27,5	0,8

Typical application:

Switching circuits in electronic ballast; applications with high voltage and very high current.

Pulse loading (du/dt):

U_R (V DC)	Pitch r (mm)				
	7,5	10	15	22,5	27,5
Allowed pulse loading (V/ μ s)					
100	9000	4500	2200	-	-
160	11000	5500	2700	-	-
250	18000	9300	4500	-	-
400	25000	13000	6100	-	-
630	31000	16000	8000	3500	2700
1000	-	-	10900	4700	3600
1600	-	-	16400	8200	6100
2000	-	-	20500	10200	7700

Electrical data

Capacitance range:

100 pF to 0,22 μ F

Standard values
of capacitance (C_R):

range E6 and E12

Capacitance tolerance:

$\pm 20\%$ (M), $\pm 10\%$ (K),
and $\pm 5\%$ (J)

Rated voltage (U_R):

100 V DC, 160 V DC, 250 V DC,
400 V DC, 630 V DC, 1000 V DC,
1600 V DC, 2000 V DC

Allowed alternative voltage
up to 60 Hz:

63 V AC, 90 V AC, 125 V AC,
160 V AC, 200 V AC (for 630 V DC,
 $r \leq 10$ mm), 300 V AC, 400 V AC,
500 V AC, 600 V AC

Category voltage (U_C):

up to + 85 °C $U_C = U_R$;
from + 85 °C to + 100 °C voltage
 U_R is lowered for 1,25 % per 1 °C

Test voltage:

2 x U_R (for $U_R \leq 630$ V), 2s;
1,6 x U_R (for $U_R \geq 630$ V and
 $r \geq 15$ mm), 2s

Dissipation factor ($\tan\delta$):

$\leq 5 \times 10^{-4}$ at 1 kHz and 20 °C
 $\leq 6 \times 10^{-4}$ at 10 kHz and 20 °C
 $\leq 10 \times 10^{-4}$ at 100 kHz and 20 °C
for $C_R \leq 0,1 \mu$ F.

Insulation resistance (R_i)
at 20 °C:

≥ 100000 M Ω

Soldering on printed
circuit board:

temperature of soldering bath
270 °C max., soldering time 5 s max.

Dimensional data - r7,5 mm: KLI1910

Capa- citance (μ F)	Rated voltage U_R																			
	100 V DC/63 V AC				160 V DC/90V AC				250 V DC/125V AC				400 V DC/160V AC				630V DC/200V AC			
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r
(mm)				(mm)				(mm)				(mm)				(mm)				
0,0001																	10,5	9	4	7,5
0,00015																	10,5	9	4	7,5
0,00022																	10,5	9	4	7,5
0,00033																	10,5	9	4	7,5
0,00047																	10,5	9	4	7,5
0,00068																	10,5	9	4	7,5
0,001																10,5	9	4	7,5	
0,0015																10,5	9	4	7,5	
0,0022									10,5	9	4	7,5	10,5	11	5	7,5	10,5	12	6	7,5
0,0033					10,5	9	4	7,5	10,5	9	4	7,5	10,5	12	6	7,5				
0,0047					10,5	9	4	7,5	10,5	11	5	7,5								
0,0068	10,5	9	4	7,5	10,5	9	4	7,5	10,5	12	6	7,5								
0,01	10,5	9	4	7,5	10,5	11	5	7,5												
0,015	10,5	11	5	7,5	10,5	12	6	7,5												
0,022	10,5	12	6	7,5																

Taped version details data see page 10

Dimensional data - r10 mm: KLI1910

Capa- citance (μ F)	Rated voltage U_R																			
	100 V DC/63 V AC				160 V DC/90V AC				250 V DC/125V AC				400 V DC/160V AC				630V DC/200V AC			
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r
(mm)				(mm)				(mm)				(mm)				(mm)				
0,0015																	13	9	4	10
0,0022																13	9	4	10	
0,0033									13	9	4	10	13	10,5	5	10	13	11,5	6	10
0,0047									13	9	4	10	13	10,5	5	10	13	12	6	10
0,0068					13	9	4	10	13	10,5	5	10	13	11,5	6	10				
0,01					13	9	4	10	13	11,5	6	10								
0,015	13	9	4	10	13	10,5	5	10												
0,022	13	10,5	5	10	13	11,5	6	10												
0,033	13	11,5	6	10																

Taped version details data see page 11

Dimensional data - r15 mm: KLI1910

Capacitance (μF)	Rated voltage U_R															
	100 V AC/63 V AC				160 V DC/90V AC				250 V DC/125V AC				400 V DC/160V AC			
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r
(mm)				(mm)				(mm)				(mm)				
0,01													18	11	5	15
0,015									18	11	5	15	18	12	6	15
0,022									18	11	5,5	15	18	13,5	7,5	15
0,033					18	11	5	15	18	12	7	15	18	16,5	8,5	15
0,047	18	11	5	15	18	11	5,5	15	18	13,5	7,5	15	18	18,5	9	15
0,068	18	12	6	15	18	12	7	15								
0,1	18	12	7	15	18	13,5	7,5	15								
0,15	18	14,5	8,5	15												

Taped version details data see page 11

Dimensional data - r15 mm - Internal series connection: KLI1910

Capacitance (μF)	Rated voltage U_R															
	630 V DC/300 V AC				1000V DC/400V AC				1600 V DC/500V AC				2000 V DC/600V AC			
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r
(mm)				(mm)				(mm)				(mm)				
0,001					18	11	5	15	18	11	5	15	18	11	5	15
0,0012					18	11	5	15	18	11	5	15	18	11	5	15
0,0015					18	11	5	15	18	11	5	15	18	11	5	15
0,0018					18	11	5	15	18	11	5	15	18	11	5	15
0,0022					18	11	5	15	18	11	5	15	18	11	5,5	15
0,0027					18	11	5	15	18	11	5	15	18	12	6	15
0,0033	18	11	5	15	18	11	5	15	18	11	5,5	15	18	13	7	15
0,0039	18	11	5	15	18	11	5	15	18	12	6	15	18	13	7	15
0,0047	18	11	5	15	18	11	5	15	18	13	7	15	18	14,5	8,5	15
0,0056	18	11	5	15	18	11	5	15	18	13	7	15	18	14,5	8,5	15
0,0068	18	11	5	15	18	11	5,5	15	18	13,5	7,5	15				
0,0082	18	11	5	15	18	12	6	15	18	14,5	8,5	15				
0,01	18	11	5,5	15	18	13	7	15								
0,012	18	12	6	15	18	13,5	7,5	15								
0,015	18	13	7	15	18	14,5	8,5	15								
0,018	18	13	7	15	18	16,5	8,5	15								
0,022	18	14,5	8,5	15												
0,027	18	16,5	8,5	15												

Taped version details data see page 11

Dimensional data - r22,5 mm - Internal series connection: KLI1910

Capa- citance (μ F)	Rated voltage U_R															
	630 V DC/300 V AC				1000V DC/400V AC				1600 V DC/500V AC				2000 V DC/600V AC			
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r
(mm)				(mm)				(mm)				(mm)				
0,0068													26,5	15	6	22,5
0,0082													26,5	16	7	22,5
0,01									26,5	15	6	22,5	26,5	16,5	7,5	22,5
0,012									26,5	16	7	22,5	26,5	17	8,5	22,5
0,015									26,5	16,5	7,5	22,5	26,5	18,5	9	22,5
0,018									26,5	17	8,5	22,5	26,5	20,5	11	22,5
0,022					26,5	15	6	22,5	26,5	18,5	9	22,5				
0,027					26,5	16	7	22,5	26,5	20,5	11	22,5				
0,033	26,5	15	6	22,5	26,5	16	7	22,5								
0,039	26,5	15	6	22,5	26,5	17	8,5	22,5								
0,047	26,5	16	7	22,5	26,5	18,5	9	22,5								
0,056	26,5	16,5	7,5	22,5	26,5	18,5	10	22,5								
0,068	26,5	17	8,5	22,5	26,5	20,5	11	22,5								
0,082	26,5	18,5	9	22,5												
0,1	26,5	20,5	11	22,5												

Taped version details data see page 11

Dimensional data - r27,5 mm - Internal series connection: KLI1910

Capa- citance (μ F)	Rated voltage U_R															
	630 V DC/300 V AC				1000V DC/400V AC				1600 V DC/500V AC				2000 V DC/600V AC			
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r
(mm)				(mm)				(mm)				(mm)				
0,022													32	19	10	27,5
0,027													32	20	11	27,5
0,033									32	19	10	27,5	32	21	12	27,5
0,039									32	20	11	27,5	32	23,5	14	27,5
0,047									32	21	12	27,5	32	24,5	15	27,5
0,056									32	23,5	14	27,5				
0,068									32	24,5	15	27,5				
0,082					32	19	10	27,5	32	26,5	17	27,5				
0,1					32	21	12	27,5	32	28	18	27,5				
0,12	32	19	10	27,5	32	21	12	27,5								
0,15	32	20	11	27,5	32	23,5	14	27,5								
0,18	32	21	12	27,5	32	26,5	17	27,5								
0,22	32	23,5	14	27,5	32	26,5	17	27,5								

Capacitors

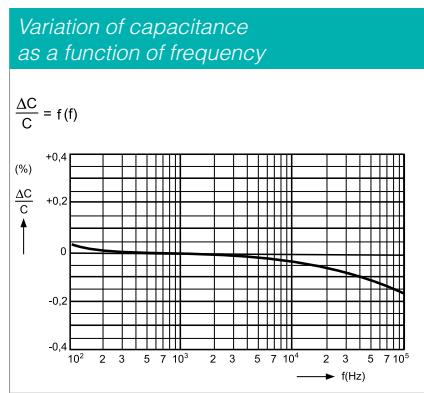
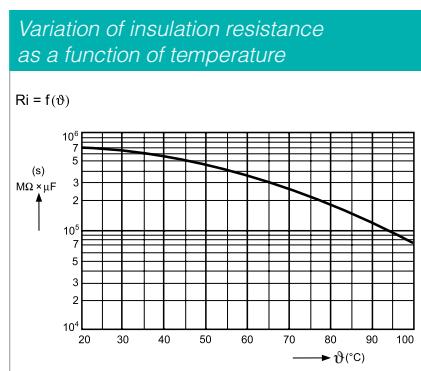
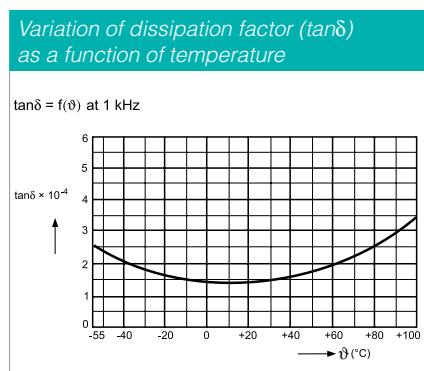
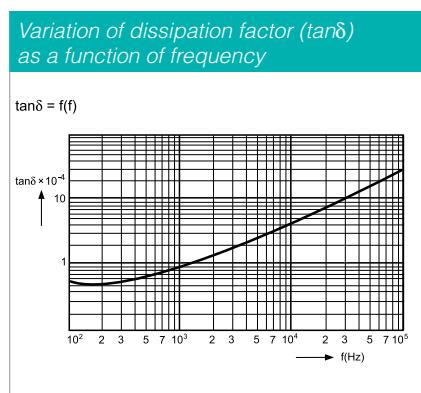
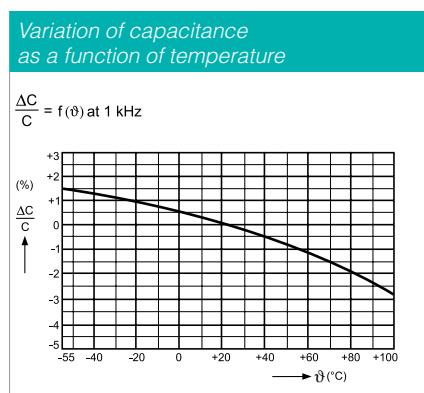
Type KNI

Metallized polypropylene capacitors

As a dielectric a high quality polypropylene film of excellent electrical properties is used. Electrodes of capacitors are of double sides vacuum metallized aluminium on polyester film. Winding is cylindrical extended foil design. Such construction enables very good contacting and is able to translate higher currents.

The capacitor has the property to regenerate after break-down. Capacitors are suitable for use in high pulse loading (for instance in TV sets for "S" correction) because of self regenerative properties and low loss angle, where common types of metallized capacitors do not comply the requirements.

Typical electrical characteristics of metallized polypropylene capacitors KNI



Capacitors

Type KNI1910

radial leads, pitch 7,5 mm to 27,5 mm

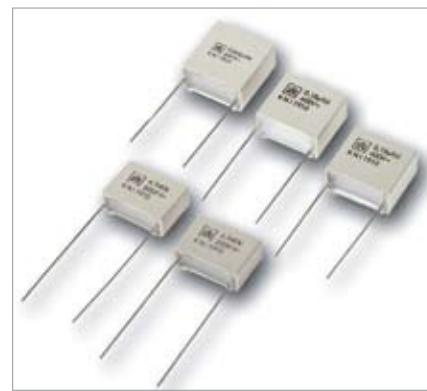
TECHNICAL DATA

General technical data

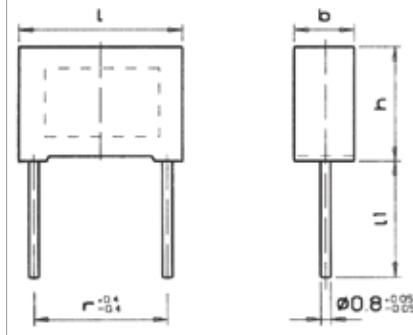
Dielectric:	polypropylene film
Electrodes:	double-sided metallized polyester film and metallized polypropylene film (internal series connection for for $U_R \geq 630V$ DC and $r \geq 15mm$)
Winding:	non-inductive construction, flat shape
Leads:	tinned copper wire, standard lengths $l_1: 4^{+0,5}; 6^{-1}; 25^{\pm 5}$. Other lead lengths on request.
Encapsulation:	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0
Marking:	Iskra symbol, capacitance, tolerance, rated voltage, type designation
Climatic category:	55/100/56 IEC 60068-1
Temperature range:	- 55 °C to + 100 °C
Complies with standards:	IEC 60384-16; IEC 60384-17

Electrical data

Capacitance range:	680 pF to 2,2 µF
Standard values of capacitance (C_R):	range E12
Capacitance tolerance:	± 20 % (M), ± 10 % (K), and ± 5 % (J)
Rated voltage (U_R):	250 V DC, 400 V DC, 630 V DC, 1000 V DC, 1600 V DC, 2000 V DC
Allowed alternative voltage up to 60 Hz:	180 V AC, 250 V AC, 300 V AC, 400 V AC, 500V AC, 630 V AC, 650 V AC
Category voltage (U_C):	up to + 85 °C $U_C = U_R$; from + 85 °C to + 100 °C voltage U_R is lowered for 1,25 % per 1 °C
Test voltage:	$1,6 \times U_R$, 2 s
Insulation resistance (R_i):	$\geq 100000 M\Omega$ at 20 °C for $C_R \leq 0,33 \mu F$ $R_i \times C_R \geq 30000$ s at 20 °C for $C_R > 0,33 \mu F$
Soldering on printed circuit boards:	temperature of soldering bath 270 °C max., soldering time 5 s max.
Dissipation factor ($\tan\delta$):	$\leq 3 \times 10^{-4}$ at 1 kHz and 20 °C, $\leq 6 \times 10^{-4}$ at 10 kHz and 20 °C for $C_R \leq 1 \mu F$ $\leq 15 \times 10^{-4}$ at 100 kHz and 20 °C for $C_R \leq 0,1 \mu F$.



KNI1910 (dimensions in mm)



Diameter of leads:

Pitch (mm)	Diameter of leads Ø (mm)
7,5; 10	0,6
15; 22,5; 27,5	0,8

Typical application:

Deflection circuits in TV-sets;
protection circuits in SMPS
(switch mode power supplies) and
in electronic ballast; applications
with high voltage and current.

Pulse loading (du/dt):

U_R (V DC)	Pitch r (mm)				
	7,5	10	15	22,5	27,5
Allowed pulse loading (V/µs)					
250	1500	1100	750	450	300
400	1800	1600	1000	600	500
630	2800	1800	2500	1500	1000
1000	-	-	3200	2000	1200
1600	-	-	4500	2500	1800
2000	-	-	7000	3200	2200

Dimensional data - r7,5 mm: KNI1910

Capacitance (μF)	Rated voltage U_R											
	250V DC/180V AC				400V DC/250V AC				630V DC/300V AC			
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r
	(mm)				(mm)				(mm)			
0,00068	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,00082	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,001	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0012	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0015	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0018	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0022	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0027	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0033	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0039	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0047	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0056	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0068	10,5	8	4	7,5	10,5	8	4	7,5	10,5	8	4	7,5
0,0082	10,5	8	4	7,5	10,5	8	4	7,5	10,5	9	4	7,5
0,01	10,5	8	4	7,5	10,5	8	4	7,5	10,5	10	5	7,5
0,012	10,5	8	4	7,5	10,5	8	4	7,5	10,5	10	5	7,5
0,015	10,5	8	4	7,5	10,5	9	4	7,5	10,5	11	5	7,5
0,018	10,5	8	4	7,5	10,5	9	4	7,5	10,5	11	5,5	7,5
0,022	10,5	9	4	7,5	10,5	10	5	7,5	10,5	12	6	7,5
0,027	10,5	10	5	7,5	10,5	11	5	7,5				
0,033	10,5	10	5	7,5	10,5	11	5,5	7,5				
0,039	10,5	11	5	7,5	10,5	12	6	7,5				
0,047	10,5	12	6	7,5								
0,056	10,5	12	6	7,5								

Dimensional data - r10 mm: KNI1910

Capa- citance (μ F)	Rated voltage U_R											
	250V DC/180V AC				400V DC/250V AC				630V DC/300V AC			
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r
(mm)				(mm)				(mm)				
0,001									13	9	4	10
0,0012									13	9	4	10
0,0015									13	9	4	10
0,0018									13	9	4	10
0,0022									13	9	4	10
0,0027									13	9	4	10
0,0033									13	9	4	10
0,0039									13	9	4	10
0,0047									13	9	4	10
0,0056									13	9	4	10
0,0068									13	9	4	10
0,0082									13	9	4	10
0,01	13	9	4	10	13	9	4	10	13	9	4	10
0,012	13	9	4	10	13	9	4	10	13	9	4	10
0,015	13	9	4	10	13	9	4	10	13	9	4	10
0,018	13	9	4	10	13	9	4	10	13	10,5	5	10
0,022	13	9	4	10	13	9,5	4,3	10	13	10,5	5	10
0,027	13	9	4	10	13	10,5	5	10	13	11,5	6	10
0,033	13	10,5	5	10	13	10,5	5	10	13	12	6	10
0,039	13	10,5	5	10	13	11,5	6	10	13	12	6	10
0,047	13	11,5	6	10	13	12	6	10				
0,056	13	11,5	6	10								
0,068	13	12	6	10								

Dimensional data - r15 mm: KNI1910

Capacitance (μF)	Rated voltage U_R																							
	250V DC/180V AC				400V DC/250V AC				630V DC/400V AC				1000V DC/500V AC				1600V DC/630V AC				2000V DC/650V AC			
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r				
	(mm)				(mm)				(mm)				(mm)				(mm)							
0,001																	18	11	5	15	18	11	5	15
0,0012																	18	11	5	15	18	11	5	15
0,0015																	18	11	5	15	18	11	5	15
0,0018																	18	11	5	15	18	11	5	15
0,0022																	18	11	5	15	18	11	5	15
0,0027																	18	11	5	15	18	11	5	15
0,0033													18	11	5	15	18	11	5	15	18	11	5,5	15
0,0039													18	11	5	15	18	11	5	15	18	12	6	15
0,0047													18	11	5	15	18	11	5,5	15	18	12	7	15
0,0056													18	11	5	15	18	12	6	15	18	13	7	15
0,0068													18	11	5	15	18	12	7	15	18	13,5	7,5	15
0,0082													18	11	5	15	18	13	7	15	18	14,5	8,5	15
0,01								18	11	5	15		18	11	5,5	15	18	13,5	7,5	15	18	16	9,5	15
0,012								18	11	5	15		18	12	6	15	18	14,5	8,5	15	18	18,5	9	15
0,015								18	12	6	15		18	12	7	15	18	16	9,5	15	18	18,5	11	15
0,018								18	12	7	15		18	13	7	15	18	18,5	9	15				
0,022								18	13	7	15		18	14,5	8,5	15	18	18,5	11	15				
0,027								18	13,5	7,5	15		18	16,5	8,5	15	18	20	12,5	15				
0,033					18	11	5	15	18	14,5	8,5	15	18	18,5	9	15								
0,039					18	11	5	15	18	16,5	8,5	15	18	18,5	11	15								
0,047	18	11	5	15	18	11	5	15	18	18,5	9	15												
0,056	18	11	5	15	18	11	5	15	18	18,5	11	15												
0,068	18	11	5	15	18	12	6	15	18	20	12,5	15												
0,082	18	11	5,5	15	18	12	6	15																
0,1	18	12	6	15	18	13	7	15																
0,12	18	12	7	15	18	13,5	7,5	15																
0,15	18	13,5	7,5	15	18	14,5	8,5	15																
0,18	18	14,5	8,5	15	18	16,5	8,5	15																
0,22	18	16,5	8,5	15	18	18,5	9	15																
0,27	18	18,5	9	15																				
0,33	18	18,5	11	15																				
0,39	18	20	12,5	15																				

Dimensional data - r22,5 mm: KNI1910

Capa- citance (μ F)	Rated voltage U_R																										
	250V DC/180V AC				400V DC/250V AC				630V DC/400V AC				1000V DC/500V AC				1600V DC/630V AC				2000V DC/650V AC						
	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r	$l_{max.}$	$h_{max.}$	$b_{max.}$	r			
(mm)				(mm)				(mm)				(mm)				(mm)				(mm)							
0,0033																						26,5	14	6	22,5		
0,0039																						26,5	14	6	22,5		
0,0047																						26,5	14	6	22,5		
0,0056																						26,5	14	6	22,5		
0,0068																						26,5	14	6	22,5		
0,0082																						26,5	14	6	22,5		
0,01																					26,5	14	6	22,5			
0,012																					26,5	14	6	22,5			
0,015																					26,5	15	6	22,5			
0,018																					26,5	15,5	7,5	22,5			
0,022																26,5	14	6	22,5	26,5	16,5	7,5	22,5	26,5	18,5	10	22,5
0,027																26,5	14	6	22,5	26,5	17	8,5	22,5	26,5	20,5	11	22,5
0,033									26,5	14	6	22,5	26,5	15	6	22,5	26,5	18,5	10	22,5	26,5	21,5	12,5	22,5			
0,039									26,5	15	6	22,5	26,5	16	7	22,5	26,5	20,5	11	22,5							
0,047									26,5	16	7	22,5	26,5	16,5	8,5	22,5	26,5	21,5	12,5	22,5							
0,056									26,5	16,5	7,5	22,5	26,5	17	8,5	22,5	26,5	21,5	12,5	22,5							
0,068									26,5	17	8,5	22,5	26,5	18,5	10	22,5											
0,082									26,5	18,5	9	22,5	26,5	20,5	11	22,5											
0,1									26,5	18,5	10	22,5	26,5	21,5	12,5	22,5											
0,12					26,5	14	6	22,5	26,5	20,5	11	22,5															
0,15					26,5	14	6	22,5	26,5	21,5	12,5	22,5															
0,18	26,5	14	6	22,5	26,5	15	6	22,5																			
0,22	26,5	15	6	22,5	26,5	16	7	22,5																			
0,27	26,5	16	7	22,5	26,5	16,5	8,5	22,5																			
0,33	26,5	16,5	8,5	22,5	26,5	18,5	9	22,5																			
0,39	26,5	17	8,5	22,5	26,5	18,5	10	22,5																			
0,47	26,5	18,5	9	22,5	26,5	20,5	11	22,5																			
0,56	26,5	18,5	10	22,5																							
0,68	26,5	20,5	11	22,5																							
0,82	26,5	21,5	12,5	22,5																							

Dimensional data - r 27,5 mm: KNI1910

Capacitance (μF)	Rated voltage U_R																											
	250V DC/180V AC				400V DC/250V AC				630V DC/400V AC				1000V DC/500V AC				1600V DC/630V AC				2000V DC/650V AC							
	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r	$l_{\max.}$	$h_{\max.}$	$b_{\max.}$	r				
	(mm)				(mm)				(mm)				(mm)				(mm)				(mm)							
0,022																						32	17	9	27,5			
0,027																						32	17	11	27,5			
0,033																		32	17	9	27,5	32	17	11	27,5			
0,039																		32	17	9	27,5	32	20	11	27,5			
0,047																		32	17	11	27,5	32	21	12	27,5			
0,056																		32	20	11	27,5	32	22	13	27,5			
0,068																32	17	9	27,5	32	21	12	27,5	32	24,5	15	27,5	
0,082																	32	17	11	27,5	32	22	13	27,5	32	26,5	17	27,5
0,1																	32	17	11	27,5	32	24,5	15	27,5	32	28	18	27,5
0,12																	32	20	11	27,5	32	26,5	17	27,5				
0,15										32	20	11	27,5	32	22	13	27,5	32	28	18	27,5							
0,18										32	21	12	27,5	32	23,5	14	27,5											
0,22										32	23,5	14	27,5	32	24,5	15	27,5											
0,27										32	24,5	15	27,5	32	26,5	17	27,5											
0,33										32	26,5	17	27,5	32	28	18	27,5											
0,39						32	17	9	27,5	32	28	18	27,5															
0,47						32	17	11	27,5																			
0,56	32	17	9	27,5	32	20	11	27,5																				
0,68	32	17	11	27,5	32	20	11	27,5																				
0,82	32	20	11	27,5	32	22	13	27,5																				
1	32	21	12	27,5	32	23,5	14	27,5																				
1,2	32	22	13	27,5	32	24,5	15	27,5																				
1,5	32	24,5	15	27,5	32	26,5	17	27,5																				
1,8	32	26,5	17	27,5	32	28	18	27,5																				
2,2	32	26,5	17	27,5																								

Capacitors

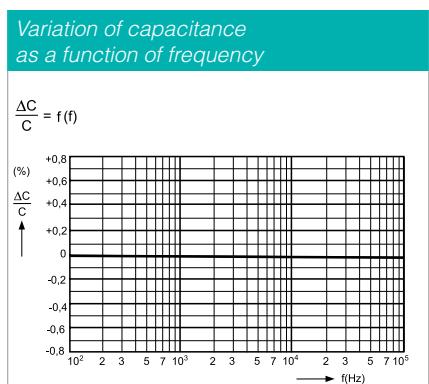
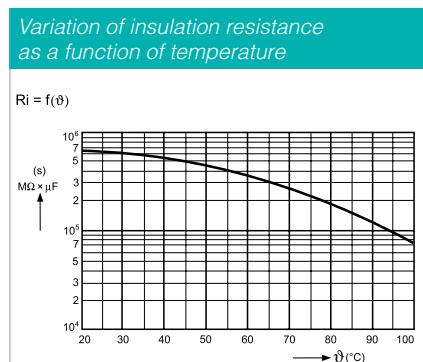
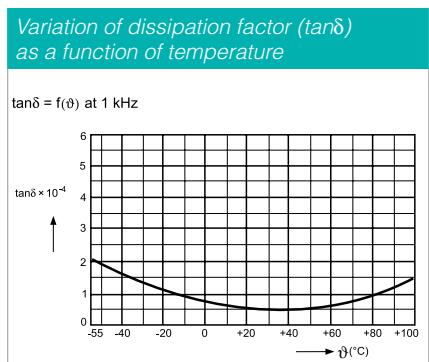
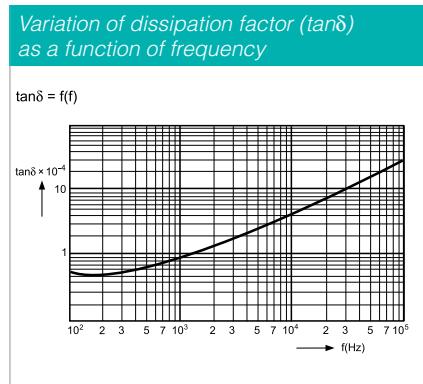
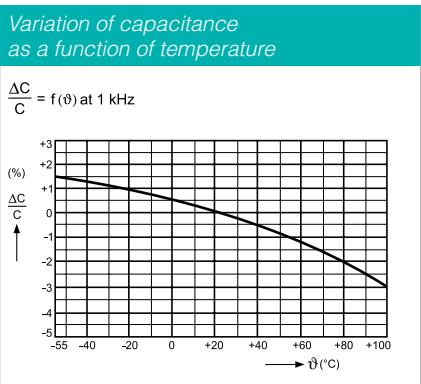
Type KNU

Metallized polypropylene capacitors

As a dielectric a high quality polypropylene film of excellent electrical properties is used. Electrodes are of vacuum evaporated metal on dielectric. Leads are electrically welded on

contact surface of capacitors. So the possibility for bad contact or even loss of contact during the operation of capacitors is excluded.

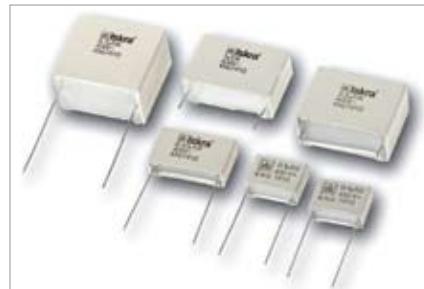
Typical electrical characteristics of metallized polypropylene capacitors KNU



Capacitors

Type KNU 1910

radial leads, pitch 10 mm to 27,5 mm



TECHNICAL DATA

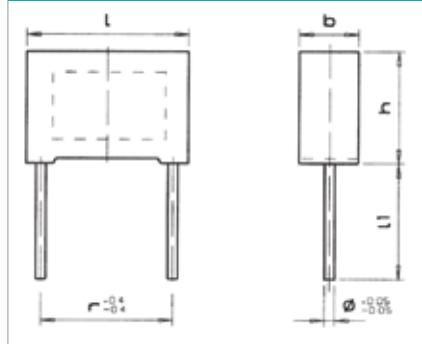
General technical data

Dielectric:	polypropylene film
Electrodes:	vacuum metallized on dielectric
Winding:	non-inductive construction, flat shape
Leads:	tinned copper wire, standard lengths l_1 : $4^{\pm 0,5}$; $6^{\pm 1}$; $25^{\pm 5}$. Other lead lengths on request.
Encapsulation:	flame-retardant plastic case with flame-retardant epoxy resin seal, UL 94 V-0, resistant to wash in halogenated solvents
Marking:	Iskra symbol, capacitance, tolerance, rated voltage, type designation
Climatic category:	55/100/56 IEC 60068-1
Temperature range:	- 55 °C to + 100 °C
Complies with standards:	IEC 60384-16

Electrical data

Capacitance range:	1000 pF to 6,8 µF
Standard values of capacitance (C_R):	range E6
Capacitance tolerance:	± 20 % (M); ± 10 % (K) and ± 5 % (J) on special request
Temperature coefficient of capacitance (T_C):	appr. -200×10^{-6} / °C
Rated voltage (U_R):	250 V DC, 400 V DC, 630 V DC, 1000 V DC, 1600 V DC
Allowed alternative voltage up to 60 Hz:	160 V AC, 220 V AC, 250 V AC, 300 V AC, 500 V AC
Category voltage (U_C):	up to + 85 °C $U_C = U_R$; from + 85 °C to + 100 °C voltage U_R is lowered for 1,35 % per 1 °C
Test voltage:	$1,6 \times U_R$, 2 s
Insulation resistance (R_i) at 20 °C:	$\geq 100000 \text{ M}\Omega$ at 20 °C for $C_R \leq 0,33 \mu\text{F}$ $R_i \times C_R \geq 30000 \text{ s}$ at 20 °C for $C_R > 0,33 \mu\text{F}$
Self inductance:	appr. 10 nH/cm length of capacitor and leads
Soldering on printed circuit boards:	temperature of soldering bath 270 °C max., soldering time 5 s max.

KNU1910 (dimensions in mm)



Diameter of leads:

r (mm)	ø (mm)
10	0,6
15; 22,5; 27,5	0,8

Pulse loading (du/dt):

U_R (V DC)	Pitch r (mm)			
	10	15	22,5	27,5
Allowed pulse loading (V/µs)				
250	180	120	60	45
400	200	150	90	65
630	230	180	120	90
1000	-	210	130	100
1600	-	450	190	140

Dissipation factor ($\tan \delta$):

f (kHz)	$C_R \leq 0,1 \mu F$	$0,1 \mu F < C_R \leq 1 \mu F$	$C_R > 1 \mu F$
1	$\leq 5 \times 10^{-4}$	$\leq 5 \times 10^{-4}$	$\leq 5 \times 10^{-4}$
10	$\leq 10 \times 10^{-4}$	$\leq 20 \times 10^{-4}$	-
100	$\leq 30 \times 10^{-4}$	-	-

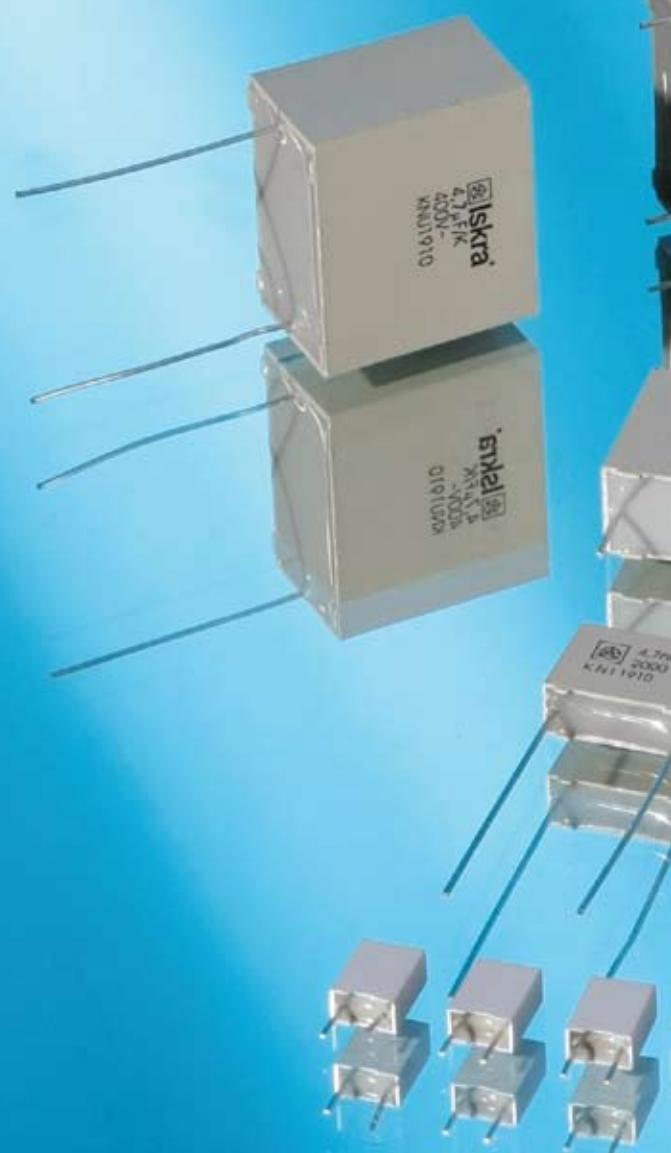
Dimensional data: KNU1910

Capa- citance (μF)	Rated voltage U_R																			
	250 V DC				400 V DC				630 V DC				1000 V DC				1600 V DC			
	$I_{max.}$	$h_{max.}$	$b_{max.}$	r	$I_{max.}$	$h_{max.}$	$b_{max.}$	r	$I_{max.}$	$h_{max.}$	$b_{max.}$	r	$I_{max.}$	$h_{max.}$	$b_{max.}$	r	$I_{max.}$	$h_{max.}$	$b_{max.}$	r
	(mm)				(mm)				(mm)				(mm)				(mm)			
0,001																	18	11	5	15
0,0015																	18	11	5	15
0,0022																	18	11	5	15
0,0033																	18	11	5	15
0,0047									13	9	4	10					18	11	5	15
0,0068									13	9	4	10					18	11	5	15
0,01					13	9	4	10	13	9	4	10	18	11	5	15	18	11	5,5	15
0,015					13	9	4	10	13	9,5	4,3	10	18	11	5	15	18	13	7	15
0,022	13	9	4	10	13	9	4	10	13	10,5	5	10	18	11	5	15	18	14,5	8,5	15
0,033	13	9	4	10	13	9,5	4,3	10	13	11,5	6	10	18	11	5,5	15	26,5	15	6	22,5
0,047	13	9	4	10	13	10,5	5	10	18	11	5	15	18	13	7	15	26,5	16	7	22,5
0,068	13	9,5	4,3	10	13	11,5	6	10	18	11	5,5	15	18	13,5	7,5	15	26,5	18,5	9	22,5
0,1	13	10,5	5	10	18	11	5	15	18	13	7	15	26,5	15	6	22,5	26,5	20,5	11	22,5
0,15	13	11,5	6	10	18	11	5,5	15	18	14,5	8,5	15	26,5	16,5	7,5	22,5	31,5	21	12	27,5
0,22	18	11	5	15	18	13	7	15	26,5	15	6	22,5	26,5	18,5	9	22,5	31,5	23,5	14	27,5
0,33	18	12	6	15	18	14,5	8,5	15	26,5	16,5	7,5	22,5	31,5	19	10	27,5	31,5	26,5	17	27,5
0,47	18	13	7	15	26,5	16	7	22,5	26,5	18,5	9	22,5	31,5	21	12	27,5				
0,68	18	14,5	9	15	26,5	17	8,5	22,5	26,5	20,5	11	22,5	31,5	23,5	14	27,5				
1	26,5	15	6	22,5	26,5	18,5	10	22,5	31,5	21	12	27,5	31,5	26,5	17	27,5				
1,5	26,5	17	8,5	22,5	31,5	19	10	27,5												
2,2	26,5	20,5	11	22,5	31,5	23,5	14	27,5												
3,3	31,5	21	12	27,5																
4,7	31,5	23,5	14	27,5																
6,8	31,5	26,5	17	27,5																

Taped version details data see page 11

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