

Ød ±0.05	p = 10	p > 10	p = 37.5
	0.6	0.8	1.0

All dimensions are in mm.

PRODUCT CODE SYSTEM

The part number, comprising 14 digits, is formed as follows:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
R	6	0										-	

- Digit 1 to 3 Series code.
- Digit 4 d.c. rated voltage:
C =50V D =63V E =100V G =160V
I =250V M =400V P =630V Q =1000V
- Digit 5 Pitch:
F=10mm; I=15mm; N=22.5mm; R=27.5mm;
W=37.5mm
- Digit 6 to 9 Digits 7 - 8 - 9 indicate the first three digits of Capacitance value and the 6th digit indicates the number of zeros that must be added to obtain the Rated Capacitance in pF.
- Digit 10 to 11 Mechanical version and/or packaging (table 1)
- Digit 12 Identifies the dimensions and electrical characteristics.
- Digit 13 Internal use
- Digit 14 Capacitance tolerance:
J=5%; K=10%; M=20%.

Table 1 (for more detailed information, please refer to page 14)

Standard packaging style	Lead length (mm)	Taping style			Ordering code (Digit 10 to 11)
		P ₂ (mm)	Fig. (No.)	Pitch (mm)	
AMMO-PACK		12.70	1	10.0/15.0	DQ
AMMO-PACK		19.05	2	22.5	DQ
REEL Ø 355mm		12.70	1	10.0/15.0	GY
REEL Ø 500mm		12.70	1	10.0/15.0	CK
REEL Ø 500mm		19.05	2	22.5/27.5	CK
Loose, short leads	4 ⁺²				AA
Loose, long leads (p<10mm)	17 ^{+1/-2}				Z3
Loose, long leads (p≥15mm)	30 ⁺⁵				40
	25 ^{+2/-1}				50

Note: Ammo-pack is the preferred packaging for taped version.

**METALLIZED POLYESTER FILM CAPACITOR
D.C. MULTIPURPOSE APPLICATIONS**

Typical applications: blocking, coupling, decoupling, by-passing, interference suppression in low voltage applications (i.e.: AUTOMOTIVE).

PRODUCT CODE: **R60**

Note: Special version, in compliance with DIN 44122 is available upon request.

Construction:

- **STACKED technology for pitch 10mm**
(Rated Voltage from 50 to 630Vdc)
- **WOUND technology from pitch 10 to 27.5mm**
(Rated Voltage from 63 to 1000Vdc)

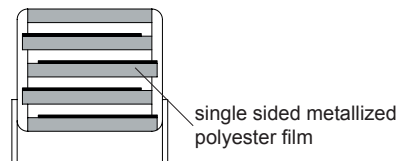
Pitch (mm)	Box thickness (B) (mm)	Maximum dimensions (mm)		
		B max	H max	L max
10.0	All	B +0.2	H +0.1	L +0.2
15.0	<7.5	B +0.2	H +0.1	L +0.3
15.0	≥7.5	B +0.2	H +0.1	L +0.5
22.5	All	B +0.2	H +0.1	L +0.3
27.5	All	B +0.2	H +0.1	L +0.3
37.5	All	B +0.3	H +0.1	L +0.3

GENERAL TECHNICAL DATA

- Dielectric:** polyester film (polyethylene terephthalate).
- Plates:** aluminium layer deposited by evaporation under vacuum.
- Winding:** non-inductive type.
- Leads:** tinned wire.
- Protection:** plastic case, thermosetting resin filled.
Box material is solvent resistant and flame retardant according to UL94.
- Marking:** Manufacturer's logo (if requested), capacitance, tolerance, D.C. rated voltage.
- Climatic category:** 55/105/56 IEC 60068-1
- Operating temperature range:** -55 to +105°C
Upper operating temperature of +125°C is allowed for a max.operating time of 1000h.

Related documents: IEC 60384-2

Winding scheme



**METALLIZED POLYESTER FILM CAPACITOR
D.C. MULTIPURPOSE APPLICATIONS**

PRODUCT CODE: R60

STACKED VERSION

Rated Cap.	50Vdc/30Vac Std dimensions				Max dv/dt (V/μs)	Max K ₀ (V ² /μs)	Part Number
	B	H	L	p			
1.5 μF	4.0	9.0	13.0	10.0	30	3 E3	R60CF4150--6--
2.2 μF	4.0	9.0	13.0	10.0	30	3 E3	R60CF4220--6--
3.3 μF	5.0	11.0	13.0	10.0	30	3 E3	R60CF4330--6--
4.7 μF	6.0	12.0	13.0	10.0	30	3 E3	R60CF4470--6--
5.6 μF	6.0	12.0	13.0	10.0	30	3 E3	R60CF4560--6--

Rated Cap.	63Vdc/40Vac Std dimensions				Max dv/dt (V/μs)	Max K ₀ (V ² /μs)	Part Number
	B	H	L	p			
1.0 μF	4.0	9.0	13.0	10.0	50	6.3 E3	R60DF4100--6--
1.5 μF	5.0	11.0	13.0	10.0	50	6.3 E3	R60DF4150--6--
2.2 μF	5.0	11.0	13.0	10.0	50	6.3 E3	R60DF4220--6--
3.3 μF	6.0	12.0	13.0	10.0	50	6.3 E3	R60DF4330--6--

Rated Cap.	100Vdc/63Vac Std dimensions				Max dv/dt (V/μs)	Max K ₀ (V ² /μs)	Part Number
	B	H	L	p			
0.33 μF	4.0	9.0	13.0	10.0	75	15 E3	R60EF3330--6--
0.47 μF	4.0	9.0	13.0	10.0	75	15 E3	R60EF3470--6--
0.68 μF	4.0	9.0	13.0	10.0	75	15 E3	R60EF3680--6--
1.0 μF	5.0	11.0	13.0	10.0	75	15 E3	R60EF4100--6--
1.5 μF	5.0	11.0	13.0	10.0	75	15 E3	R60EF4150--6--

Rated Cap.	160Vdc/90Vac Std dimensions				Max dv/dt (V/μs)	Max K ₀ (V ² /μs)	Part Number
	B	H	L	p			
0.22 μF	4.0	9.0	13.0	10.0	100	32 E3	R60GF3220--6--
0.33 μF	4.0	9.0	13.0	10.0	100	32 E3	R60GF3330--6--
0.47 μF	5.0	11.0	13.0	10.0	100	32 E3	R60GF3470--6--
0.68 μF	6.0	12.0	13.0	10.0	100	32 E3	R60GF3680--6--

Mechanical version and packaging (Table1) _____
Internal use _____
Tolerance: J (±5%); K (±10%); M (±20%) _____

Rated Cap.	250Vdc/160Vac Std dimensions				Max dv/dt (V/μs)	Max K ₀ (V ² /μs)	Part Number
	B	H	L	p			
0.10 μF	4.0	9.0	13.0	10.0	150	75 E3	R60IF3100--6--
0.15 μF	4.0	9.0	13.0	10.0	150	75 E3	R60IF3150--6--
0.22 μF	5.0	11.0	13.0	10.0	150	75 E3	R60IF3220--6--
0.33 μF	5.0	11.0	13.0	10.0	150	75 E3	R60IF3330--6--
0.47 μF	6.0	12.0	13.0	10.0	150	75 E3	R60IF3470--6--

Rated Cap.	400Vdc/200Vac Std dimensions				Max dv/dt (V/μs)	Max K ₀ (V ² /μs)	Part Number
	B	H	L	p			
0.033 μF	4.0	9.0	13.0	10.0	175	140 E3	R60MF2330--6--
0.047 μF	4.0	9.0	13.0	10.0	175	140 E3	R60MF2470--6--
0.068 μF	4.0	9.0	13.0	10.0	175	140 E3	R60MF2680--6--
0.10 μF	5.0	11.0	13.0	10.0	175	140 E3	R60MF3100--6--
0.15 μF	6.0	12.0	13.0	10.0	175	140 E3	R60MF3150--6--

Rated Cap.	630Vdc/220Vac Std dimensions				Max dv/dt (V/μs)	Max K ₀ (V ² /μs)	Part Number
	B	H	L	p			
0.010 μF	4.0	9.0	13.0	10.0	200	250 E3	R60PF2100--6--
0.015 μF	4.0	9.0	13.0	10.0	200	250 E3	R60PF2150--6--
0.022 μF	4.0	9.0	13.0	10.0	200	250 E3	R60PF2220--6--
0.033 μF	5.0	11.0	13.0	10.0	200	250 E3	R60PF2330--6--
0.047 μF	5.0	11.0	13.0	10.0	200	250 E3	R60PF2470--6--

Mechanical version and packaging (Table1) _____
Internal use _____
Tolerance: J (±5%); K (±10%); M (±20%) _____

All dimensions are in mm.

Note: If the working voltage (V) is lower than the rated voltage (V_R), the capacitor may work at higher dv/dt. In this case the maximum value allowed is obtained multiplying the above value (see table dv/dt) with the ratio V_R/V.

The pulse characteristic K₀ depends on the voltage wave-form and in any case it cannot overcome the value given in the above table.

*Not suitable for across-the-line applications. Please refer to Interference Suppression Capacitors (page 145).

**METALLIZED POLYESTER FILM CAPACITOR
D.C. MULTIPURPOSE APPLICATIONS**

PRODUCT CODE: **R60**

WOUND VERSION

Rated Cap.	1000Vdc/250Vac* Std dimensions				Max dv/dt (V/μs)	Max K ₀ (V ² /μs)	Part Number
	B	H	L	p			
1000 pF	4.0	9.0	13.0	10.0	60	120 E3	R60QF1100--0--
1500 pF	4.0	9.0	13.0	10.0	60	120 E3	R60QF1150--0--
2200 pF	4.0	9.0	13.0	10.0	60	120 E3	R60QF1220--0--
3300 pF	4.0	9.0	13.0	10.0	60	120 E3	R60QF1330--0--
4700 pF	5.0	11.0	13.0	10.0	60	120 E3	R60QF1470--0--
6800 pF	6.0	12.0	13.0	10.0	60	120 E3	R60QF1680--0--
0.010 μF	5.0	11.0	18.0	15.0	30	60 E3	R60QI2100--0--
0.015 μF	5.0	11.0	18.0	15.0	30	60 E3	R60QI2150--3--
0.022 μF	6.0	12.0	18.0	15.0	30	60 E3	R60QI2220--3--
0.033 μF	7.5	13.5	18.0	15.0	30	60 E3	R60QI2330--3--
0.033 μF	9.0	12.5	18.0	15.0	30	60 E3	R60QI2330--L--
0.047 μF	10.0	16.0	18.0	15.0	30	60 E3	R60QI2470--0--
0.047 μF	13.0	12.0	18.0	15.0	30	60 E3	R60QI2470--L--
0.068 μF	11.0	19.0	18.0	15.0	30	60 E3	R60QI2680--0--
0.033 μF	6.0	15.0	26.5	22.5	15	30 E3	R60QN2330--0--
0.047 μF	6.0	15.0	26.5	22.5	15	30 E3	R60QN2470--0--
0.068 μF	7.0	16.0	26.5	22.5	15	30 E3	R60QN2680--3--
0.10 μF	8.5	17.0	26.5	22.5	15	30 E3	R60QN3100--3--
0.15 μF	13.0	22.0	26.5	22.5	15	30 E3	R60QN3150--0--
0.15 μF	9.0	17.0	32.0	27.5	12	24 E3	R60QR3150--3--
0.22 μF	9.0	17.0	32.0	27.5	12	24 E3	R60QR3220--4--
0.33 μF	11.0	20.0	32.0	27.5	12	24 E3	R60QR3330--4--
0.47 μF	13.0	22.0	32.0	27.5	12	24 E3	R60QR3470--4--
0.68 μF	14.0	28.0	32.0	27.5	12	24 E3	R60QR3680--4--
1.00 μF	18.0	33.0	32.0	27.5	12	24 E3	R60QR4100--4--
1.50 μF	22.0	37.0	32.0	27.5	12	24 E3	R60QR4150--4--
0.47 μF	11.0	22.0	41.5	37.5	10	20 E3	R60QW3470--3--
0.68 μF	11.0	22.0	41.5	37.5	10	20 E3	R60QW3680--4--
1.00 μF	13.0	24.0	41.5	37.5	10	20 E3	R60QW4100--4--
1.50 μF	16.0	28.5	41.5	37.5	10	20 E3	R60QW4150--4--
2.20 μF	19.0	32.0	41.5	37.5	10	20 E3	R60QW4220--3--
3.30 μF	24.0	44.0	41.5	37.5	10	20 E3	R60QW4330--0--
4.70 μF	30.0	45.0	41.5	37.5	10	20 E3	R60QW4470--4--

All dimensions are in mm.

Note 1: If the working voltage (V) is lower than the rated voltage (V_R), the capacitor may work at higher dv/dt. In this case the maximum value allowed is obtained multiplying the above value (see table dv/dt) with the ratio V_R/V. The pulse characteristic K₀ depends on the voltage wave-form and in any case it cannot overcome the value given in the above table.

Note 2: Rated voltages higher than 1000Vdc are available upon request.

* Not suitable for across-the-line applications. Please refer to Interference Suppression Capacitors (page 151).

Mechanical version and packaging (Table1) _____
Internal use _____
Tolerance: J (±5%); K (±10%); M (±20%) _____

**METALLIZED POLYESTER FILM CAPACITOR
D.C. MULTIPURPOSE APPLICATIONS**

PRODUCT CODE: R60

ELECTRICAL CHARACTERISTICS

Rated voltage (V_R): 50Vdc - 63Vdc - 100Vdc - 160Vdc
- 250Vdc - 400Vdc - 630Vdc - 1000Vdc .

Rated temperature (T_R): +85°C

Temperature derated voltage:

for temperatures between +85°C and +125°C
a decreasing factor of 1.25% per degree °C on the rated
voltage V_R (d.c. and a.c.) has to be applied.

Capacitance range: 1000pF to 220µF

Capacitance values:

E6 series (IEC 60063 Norm).

Capacitance tolerances (measured at 1 kHz):
±5% (J); ±10% (K); ±20% (M).

Total self-inductance (L): (lead length ~2mm)

Pitch (mm)	10	15	22.5	27.5	37.5
L(nH) ≈	9	10	18	18	22

Dissipation factor (DF):

$\text{tg} \delta \cdot 10^{-4}$ at +25°C ±5°C

kHz	C ≤ 1µF	C > 1µF
1	≤ 100	≤ 100
10	≤ 150	

Insulation resistance:

Test conditions

Temperature: +25°C ± 5°C
Voltage charge time: 1 min
Voltage charge: 50 Vdc for $V_R < 100$ Vdc
100 Vdc for $V_R \geq 100$ Vdc

Performance

For $V_R \leq 100$ Vdc
≥ 3750 MΩ for C ≤ 0.33µF (50000 MΩ)*
≥ 1250 s for C > 0.33µF (5000 s)*

For $V_R > 100$ Vdc
≥ 30000 MΩ for C ≤ 0.33µF (50000 MΩ)*
≥ 10000 s for C > 0.33µF (17000 s)*

*Typical value

Test voltage between terminations:

1.6x V_R applied for 2 s at +25°C ± 5°C

TEST METHOD AND PERFORMANCE

Damp heat, steady state:

Test conditions

Temperature: +40°C ± 2°C
Relative humidity (RH): 93% ± 2%
Test duration: 56 days

Performance

Capacitance change $|\Delta C/C|$: ≤ 5%
DF change ($\Delta \text{tg} \delta$): ≤ 50x10⁻⁴ at 1kHz
Insulation resistance: ≥ 50% of initial limit.

Endurance:

Test conditions

Temperature: +105°C ± 2°C
Test duration: 2000 h
Voltage applied: 1.25x V_C

Performance

Capacitance change $|\Delta C/C|$: ≤ 5%
DF change ($\Delta \text{tg} \delta$): ≤ 50x10⁻⁴ at 10kHz for C ≤ 1µF
≤ 30x10⁻⁴ at 1kHz for C > 1µF
Insulation resistance: ≥ 50% of initial limit.

Resistance to soldering heat:

Test conditions

Solder bath temperature: +260°C ± 5°C
Dipping time (with heat screen): 10 s ± 1 s

Performance

Capacitance change $|\Delta C/C|$: ≤ 2%
DF change ($\Delta \text{tg} \delta$): ≤ 50x10⁻⁴ at 10kHz for C ≤ 1µF
≤ 30x10⁻⁴ at 1kHz for C > 1µF
Insulation resistance: ≥ initial limit.

Long term stability (after two years):

Storage: standard environmental conditions (see page 12).

Performance

Capacitance change $|\Delta C/C|$: ≤ 3% for C ≤ 0.1µF
≤ 2% for C > 0.1µF

RELIABILITY:

Reference MIL HDB 217

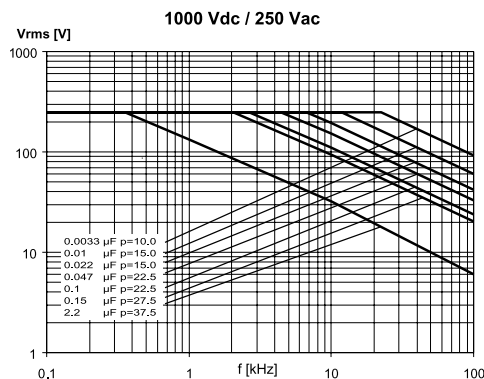
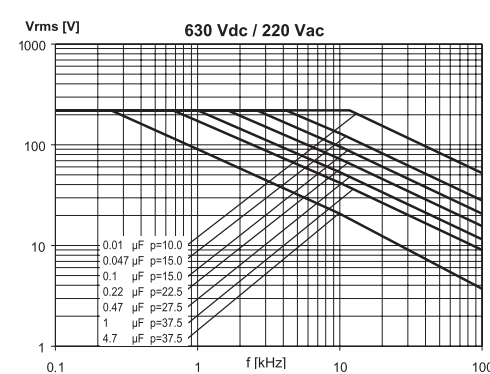
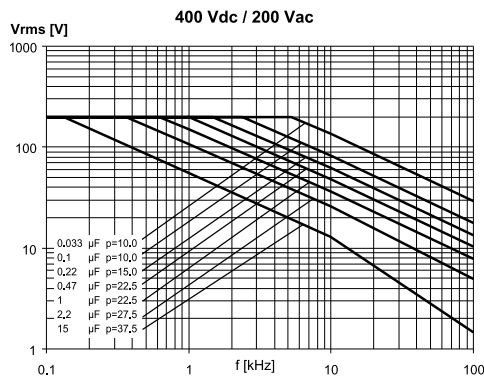
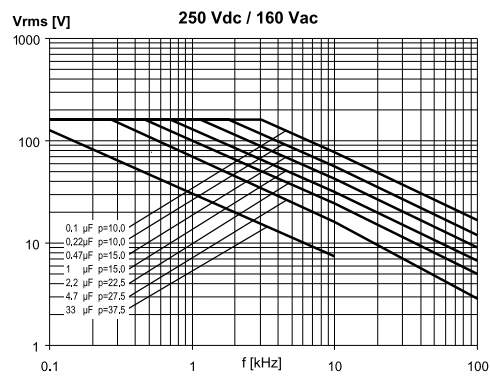
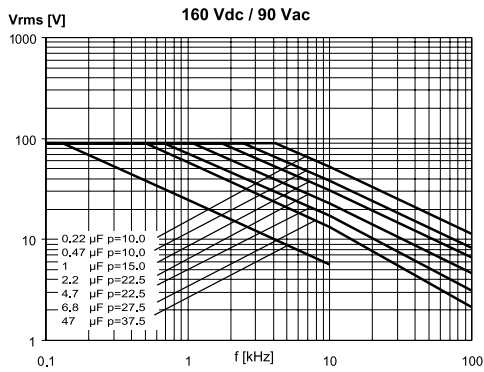
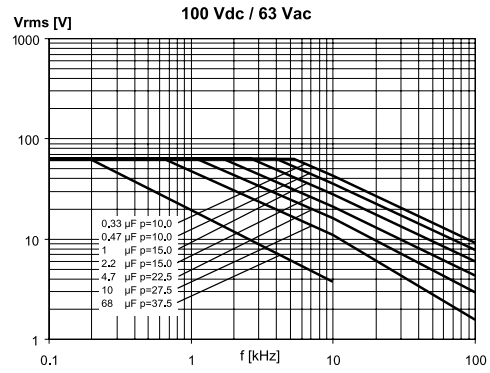
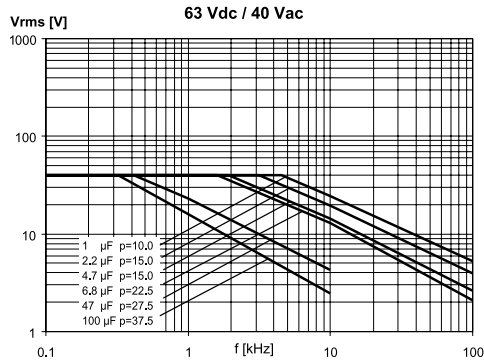
Application conditions:

Temperature: +40°C ± 2°C
Voltage: 0.5x V_R
Failure rate: ≤ 5 FIT
(1 FIT = 1x10⁻⁹ failures/componentsxh)

Failure criteria:

Short or open circuit
Capacitance change $|\Delta C/C|$: > 10%
DF change ($\Delta \text{tg} \delta$): > 2xinitial limit.
Insulation resistance: < 0.005xinitial limit.

MAX. VOLTAGE (Vr.m.s.) VERSUS FREQUENCY (sinusoidal wave-form / Th ≤ 40°C)

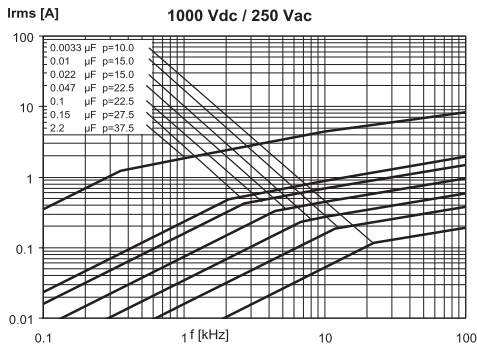
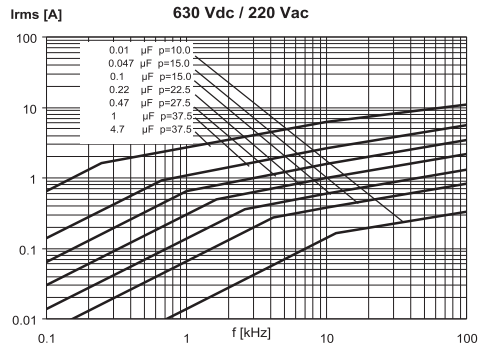
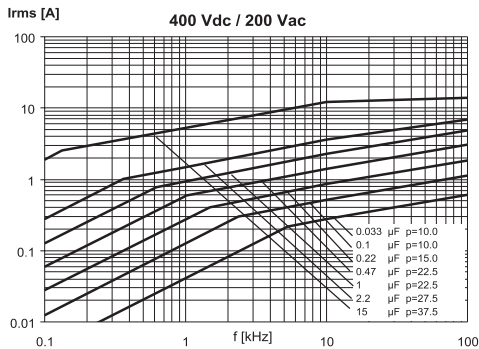
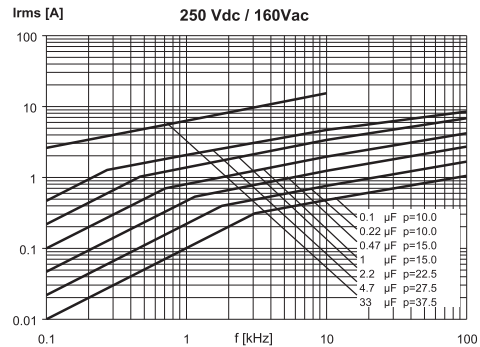
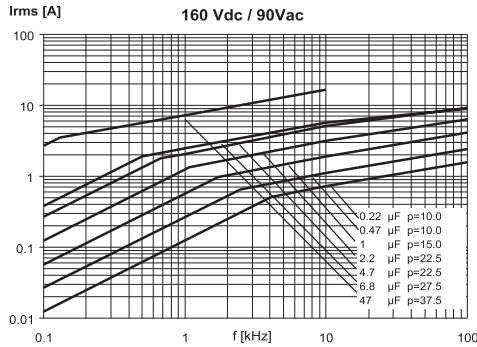
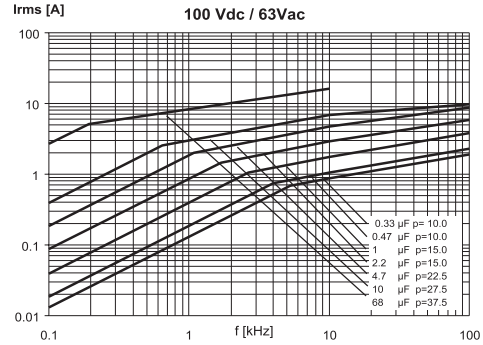
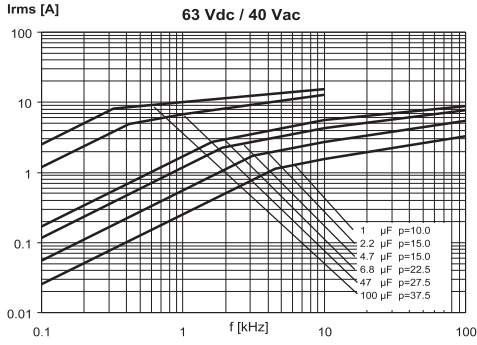


Note: p (pitch) in mm.

**METALLIZED POLYESTER FILM CAPACITOR
D.C. MULTIPURPOSE APPLICATIONS**

PRODUCT CODE: R60

MAX. CURRENT ($I_{r.m.s.}$) VERSUS FREQUENCY (sinusoidal wave-form / $T_h \leq 40^\circ\text{C}$)



Note: p (pitch) in mm.