MKT Capacitors

S B 32520
...B 32529

A-05-17-05

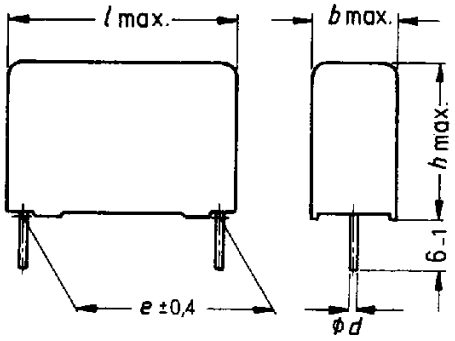
Metalized polyester film capacitors in accordance with DIN 44112
V_R = 63 to 630 Vdc

With quality assessment according to CECC 30401-043, edition 1, June 1983.

Self-healing capacitor with polyethyleneterephthalate dielectric. Encapsulated in a flame-retardant rectangular plastic case (in accordance with UL 94 V-0). Epoxy resin sealed for humidity resistance. For improved solderability, the package is provided with spacers. Connections: parallel leads, tinned, plug-in in the lead spacing. Particularly suited for space-saving assembly at high packing density on any PC board.

Packaging on continuous tapes

Capacitors with 5 mm and 7.5 mm lead spacing, as well as capacitors with a lead spacing of 7.5/5 mm (leads crimped to a lead spacing of 5 mm) are also available on continuous tape. For taping instructions and ordering code information refer to page 46.



Dimensions in mm

l	Lead spacing e	dia. d
7.5	5	0.5
10	7.5	0.6
13	10	0.6
18	15	0.8
27	22.5	0.8
31.5	27.5	0.8

DIN climatic category in acc. with DIN 40040	**F M E / J R**
Lower category temperature	**F** – 55°C/– 67°F
Upper category temperature	**M** +100°C/+212°F[1])
Humidity category	**E** average relative humidity ≤75%; 95% for 30 days per year continuously; 85% for the remaining days occasionally; rare, brief dew precipitation permitted
Failure rate (40°C/104°F, V_R)	**J** 30×10^{-9}/h = 30 fit for conversion tables for other stresses and temperatures see page 42.
Load duration	**R** $\geq 10^5$ h
Failure criteria	
Total failure	Short or open circuit
Failure due to variations	Capacitance change $\frac{\Delta C}{C}$ >±10%
	Dissipation factor tan δ > 2 × upper category values
	Insulation resistance < 150 MΩ (≤0.33 µF)
	< 50 s (>0.33 µF)

[1]) Shelf and service life at temperatures >100 ... 125°C/212 ... 257°F, 1000 h max., V_C = 0.5 V_R.

Lead spacing			LS 27.5mm			
Rated dc voltage			100V	250V	400V	630V
Rated capacitance		Tolerance	Dimensions b x h x l (mm) and ordering code B32524 –			
C_R						
4700	pF	± 20% M ± 10% K ± 5% J				
6800	pF					
0.01	µF					
0.015	µF					
0.022	µF					
0.033	µF					
0.047	µF					
0.068	µF					
0.1	µF					
0.15	µF					
0.22	µF					
0.33	µF					11.5x21.0x31.5 M8334
0.47	µF					13.5x23.0x31.5 M8474
0.68	µF				11.5x21.0x31.5 M6684	15.0x24.5x31.5 M8684
1	µF				11.5x21.0x31.5 M6105	
1.5	µF			11.5x21.0x31.5 M3155	13.5x23.0x31.5 M6155	
2.2	µF			11.5x21.0x31.5 M3225		
3.3	µF			13.5x23.0x31.5 M3335		
4.7	µF		11.5x21.0x31.5 M1475	15.0x24.5x31.5 M3475		
6.8	µF		13.5x23.0x31.5 M1685			
10.0	µF		15.0x24.5x31.5 M1106			

IEC climatic category in acc. with DIN IEC 68-1	**55/100/56**
Damp heat test in acc. with DIN IEC 68-2-3	**Conditions** Test temperature: +40°C/+104°F Relative humidity: (93 $^{+2}_{-3}$) % Test duration: 56 days **Test criteria** Capacitance change $\frac{\Delta C}{C}$: ≤±5% Dissipation factor change Δ tan δ at 1 kHz: ≤5 × 10⁻³ Insulation resistance: ≥50% of the minimum value as supplied
Resistance to vibration Test Fc in acc. with DIN IEC 68-2-6: vibration, sinusoidal	Duration of endurance conditioning: 6 h Frequency range: 10...55 Hz Displacement amplitude: 0.75 mm (conforming to 98.1 m/s² max. or to 10 *g*) At 10 Hz...2 kHz capacitors with LS ≥22.5 mm must additionally be fixed at the case.
Resistance to soldering heat[1] Test Tb in acc. with DIN IEC 68-2-20	Solder bath temperature: max. 260°C/500°F Soldering duration: max. 5 s Capacitance change $\frac{\Delta C}{C}$: ≤±2%
Resistance to cleaning agents	Refer to section "General Information", page 37.
Capacitance drift i_z	±3%

Self inductance

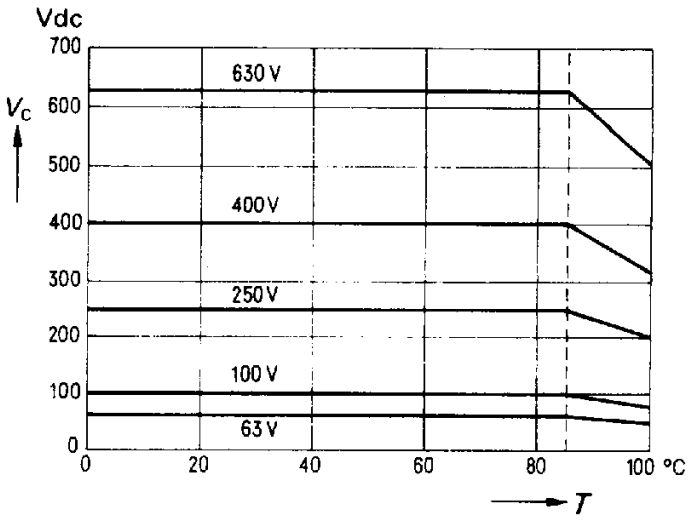
Lead spacing (mm)	5	7.5	10	15	22.5	27.5
Self inductance (approx. nH)	5	8	9	10	20	20

Dissipation factor tan δ measured at 20°C/68°F

Upper limits/Average production values

	C_R < 0.1 µF	C_R ≥ 0.1 ... < 1 µF	C_R ≥ 1 µF
at 1 kHz	8/ 5 × 10⁻³	10/ 6 × 10⁻³	10/7 × 10⁻³
at 10 kHz	15/12 × 10⁻³	20/15 × 10⁻³	–
at 100 kHz	30/18 × 10⁻³	–	–

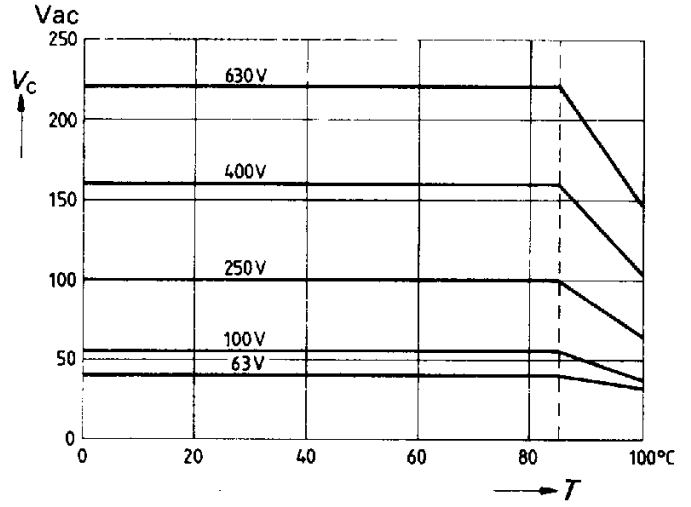
Category voltage V_C versus temperature T at dc operation



2000 h max. $1.25 \times V_C$

for milliseconds (e.g. switchings) $1.50 \times V_C$

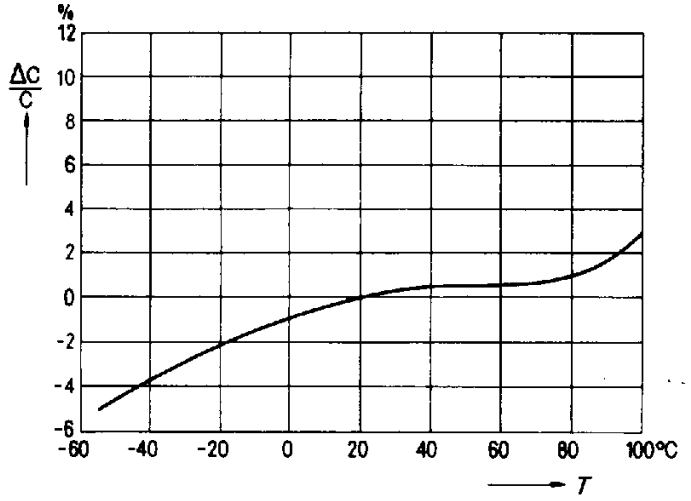
Category voltage V_C[1)][2)] versus temperature T at ac operation at 50 Hz



max. 2000 hours $1.25 \times V_C$

for milliseconds (e.g. switchings) $1.50 \times V_C$

Capacitance change $\frac{\Delta C}{C}$ versus temperature T (typical values, measured at 1 kHz)

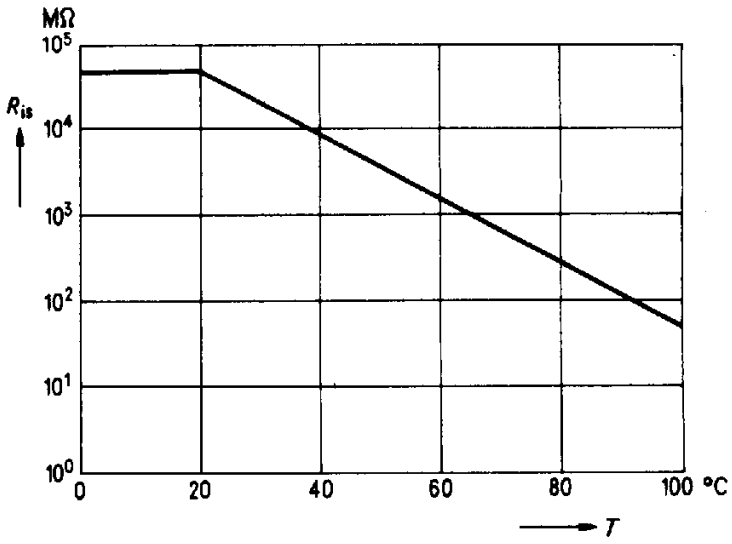


[1)] The sum of the dc voltage and the peak value of an ac voltage superimposed on the dc voltage may not exceed the rated voltage.

[2)] Capacitors of the 630 Vdc series can be used as 250 Vac line power parallel capacitors if it is ensured that voltage peaks occurring occasionally during operation do not exceed 1000 V.

Insulation resistance R_{is} versus temperature T

Typical values measured at 20°C/68°F and a relative humidity ≤65%



Insulation resistance R_{is} and time constant τ

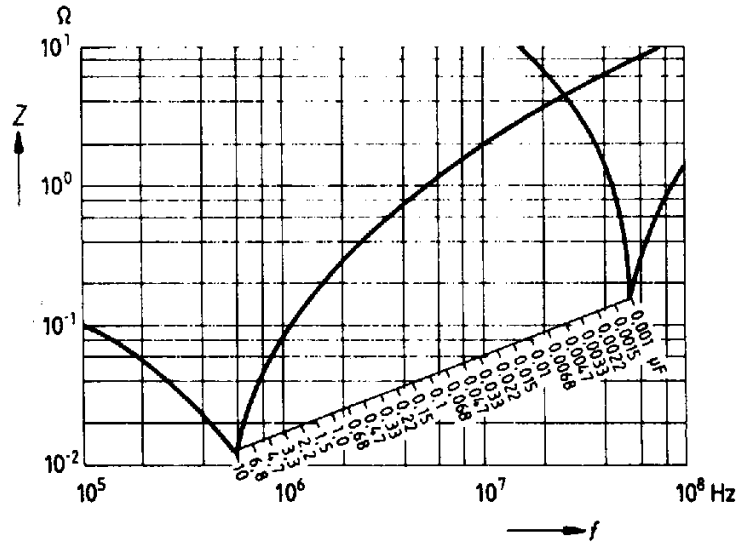
Minimum value as supplied[1])

V_R	$C_R \leq 0.33$ µF	$C_R > 0.33$ µF
≤100 V	3750 MΩ	1250 sec
≥250 V	7500 MΩ	2500 sec

Average value as supplied

V_R	$C_R \leq 0.33$ µF	$C_R > 0.33$ µF
≤100 V	>30 000 MΩ	>10 000 sec
≥250 V	>75 000 MΩ	>25 000 sec

Impedance Z versus frequency f (typical values)



[1]) The indicated values apply at the time of delivery. During the service life, the insulation may temporarily decrease to approx. 10% of the value at the time of delivery, especially if the max. permissible relative humidity of 95% of the humidity category E is applied for a longer period, or if the capacitor is operated close to the upper category temperature.

Pulse Handling Capability

Rated Voltage		LS 5	LS 7.5	LS 10	LS 15	LS 22.5	LS 27.5
63 V –	U_{ss}/τ in V/µs k_0 in V²/µs	150 20.000	80 10.000	50 6.300	30 3.800	2 250	
100 V –		200 40.000	100 20.000	75 15.000	50 10.000	2.5 500	2 400
250 V –		400 125.000	200 100.000	150 75.000	100 50.000	4 2.000	3 1.500
400 V –		500 320.000	250 200.000	175 150.000	125 100.000	7 5.600	5 4.000
630 V –					15 19.000	10 12.600	8 10.000

For a voltage deviation of $V_{pp} < V_R$ the value of the permissible voltage rate of rise V_{pp}/τ can be multiplied by the factor V_R/V_{pp}. The data of the nomogram must be considered in case of periodic pulses. See also calculation example in section "General Information", para. 5.2.6.

AC power handling capability at higher frequencies

The maximum permissible peak voltage $\hat{V}$ for sinusoidal and non-sinusoidal voltages (pulse, sawtooth, trapezoidal voltages) can be determined from the nomogram.

The nomogram is based on 10°C/50°F inherent temperature rise of the capacitor; this must be considered during operation with regard to the permissible upper category temperature.

The following limits may not be exceeded:

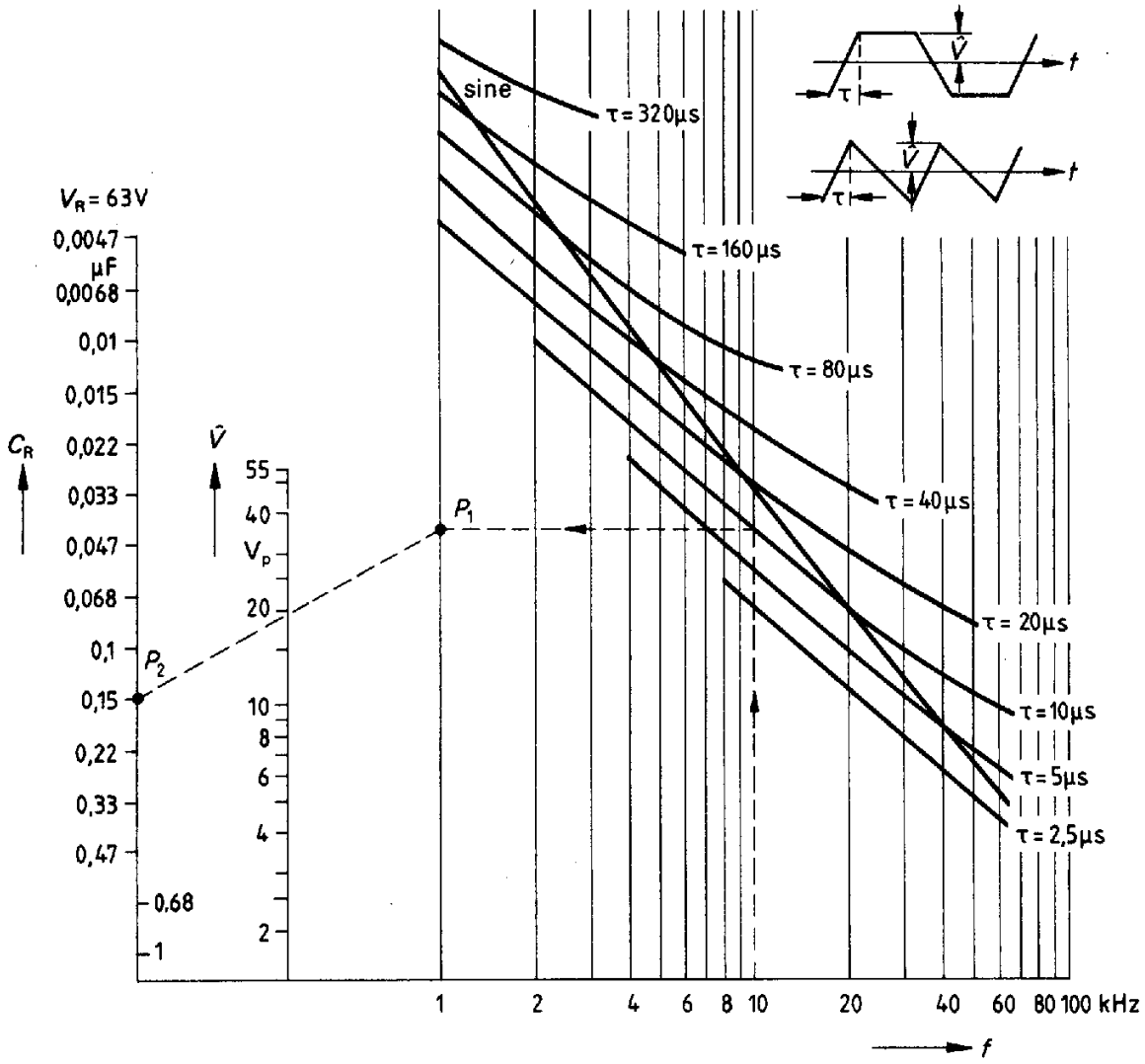
Rated dc voltage V_R	63 V	100 V	250 V	400 V	630 V
Limit voltage $\hat{V}_l$	55 V	85 V	140 V	224 V	280 V

B 32529, LS 5 mm

Nomogram to determine the permissible peak voltage $\hat{V}$

Determine the intersections P_1 and P_2 according to the plotted example. The intersection of the line connecting P_1 with P_2 and the $\hat{V}$ scale gives the maximum permissible peak voltage.

In case of a trapezoidal voltage load, the second harmonic frequency must be considered. With sinusoidal voltage load, the "sine" characteristic applies.



Example:

f = 10 kHz	(repetition frequency)	intersection P_1
τ = 10 µs	(rise time)	
C_R = 0.15 µF	(capacitance)	intersection P_2
V_R = 63 V	(rated voltage)	

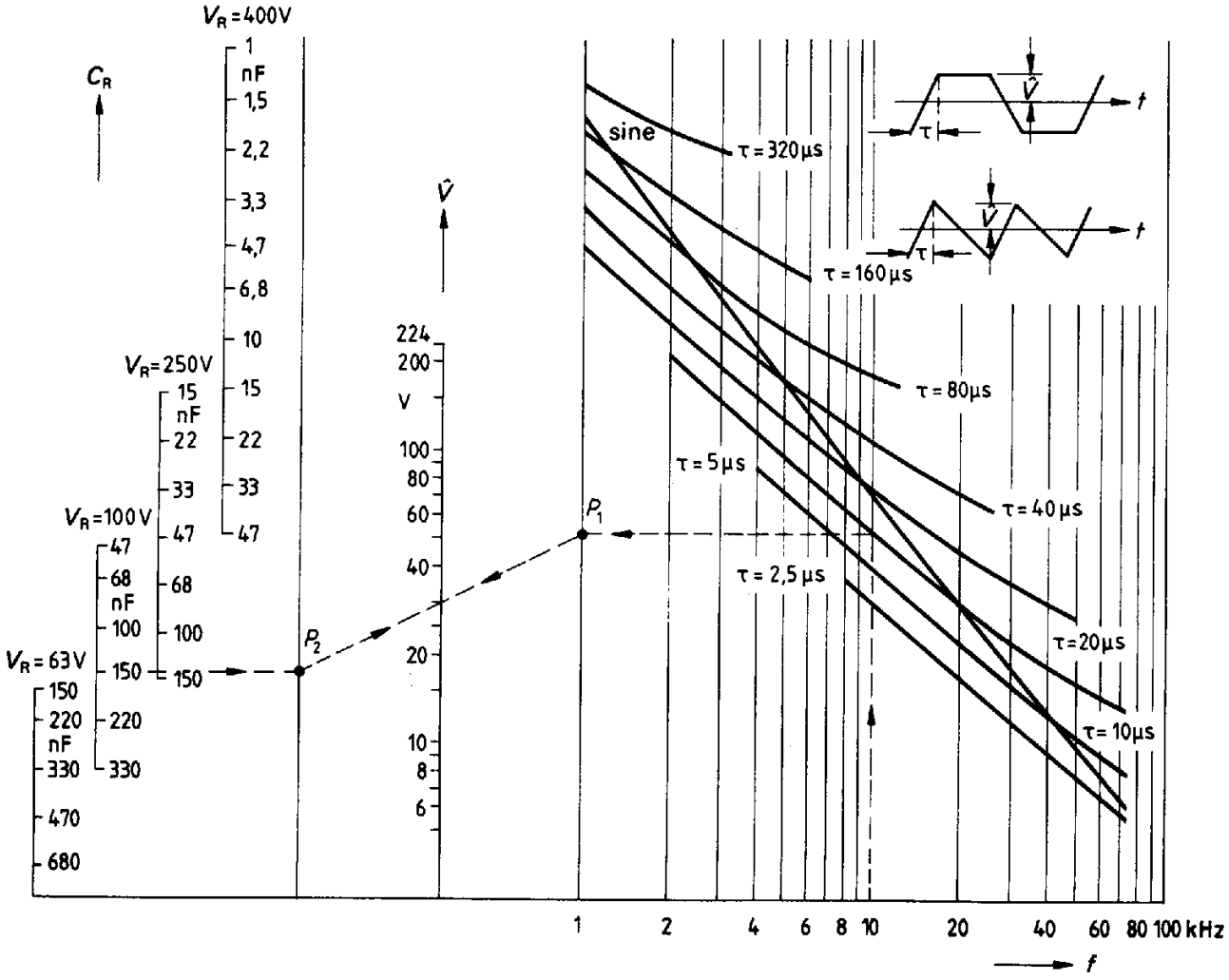
According to the dashed line in the above graph, this results in a max. peak voltage $\hat{V}$ of approx. 19 V.

B 32520, LS 7.5 mm

Nomogram to determine the permissible peak voltage $\hat{V}$

Determine the intersections P_1 and P_2 according to the plotted example. The intersection of the line connecting P_1 with P_2 and the $\hat{V}$ scale gives the maximum permissible peak voltage.

In case of a trapezoidal voltage load with two steep edges, the second harmonic frequency must be considered. With sinusoidal voltage load, the "sine" characteristic applies.



Example:

f = 10 kHz	(repetition frequency)	intersection P_1
τ = 10 µs	(rise time)	
C_R = 150 nF	(capacitance)	intersection P_2
V_R = 100 V	(rated voltage)	

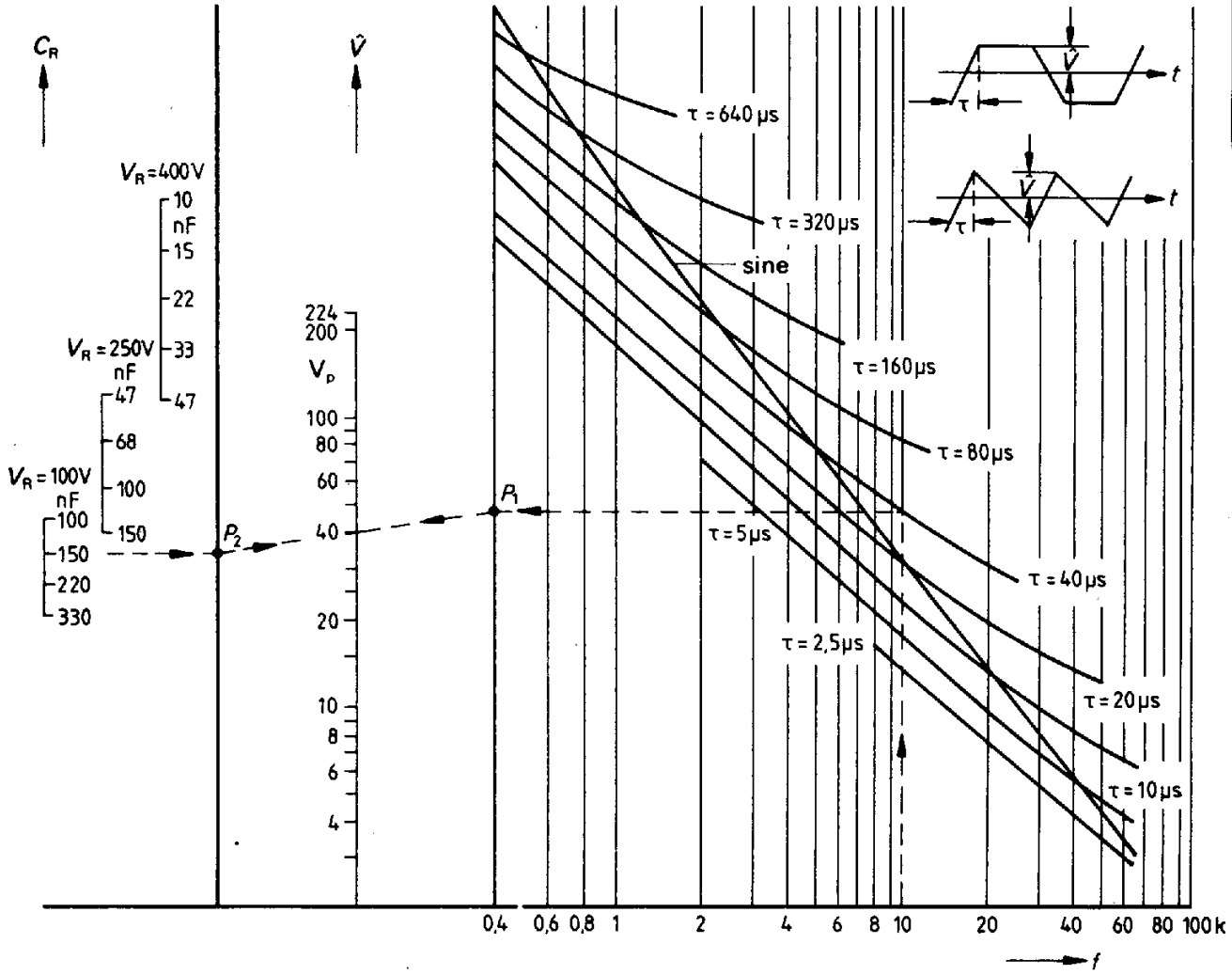
According to the dashed line in the above graph, this results in a max. peak voltage $\hat{V}$ of approx. 30 V.

B 32521, LS 10 mm

Nomogram to determine the permissible peak voltage $\hat{V}$

Determine the intersections P_1 and P_2 according to the plotted example. The intersection of the line connecting P_1 with P_2 and the $\hat{V}$ scale gives the maximum permissible peak voltage.

In case of a trapezoidal voltage load with two steep edges, the second harmonic frequency must be considered. With sinusoidal voltage load, the "sine" characteristic applies.



Example:

f = 10 kHz	(repetition frequency)	intersection P_1
τ = 40 µs	(rise time)	
C_R = 150 nF	(capacitance)	intersection P_2
V_R = 100 V	(rated voltage)	

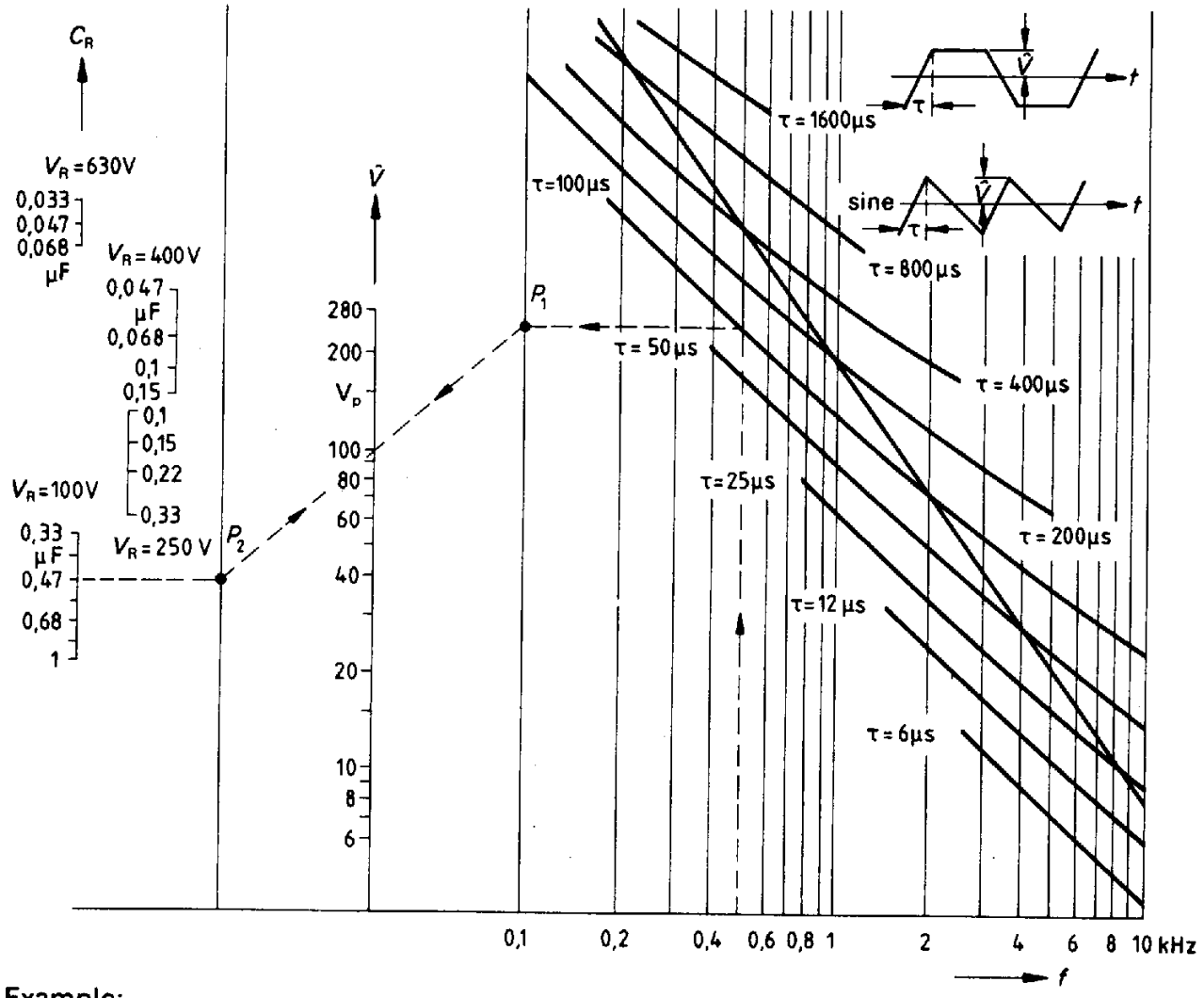
According to the dashed line in the above graph, this results in a max. peak voltage $\hat{V}$ of approx. 40 V.

B 32522, LS 15 mm

Nomogram to determine the permissible peak voltage $\hat{V}$

Determine the intersections P_1 and P_2 according to the plotted example. The intersection of the line connecting P_1 with P_2 and the $\hat{V}$ scale gives the maximum permissible peak voltage.

In case of a trapezoidal voltage load with two steep edges, the second harmonic frequency must be considered. With sinusoidal voltage load, the "sine" characteristic applies.



Example:

f = 0.5 kHz	(repetition frequency)	intersection P_1
τ = 100 µs	(rise time)	
C_R = 0.47 µF	(capacitance)	intersection P_2
V_R = 100 V	(rated voltage)	

According to the dashed line in the above graph, this results in a max. peak voltage $\hat{V}$ of approx. 100 V.

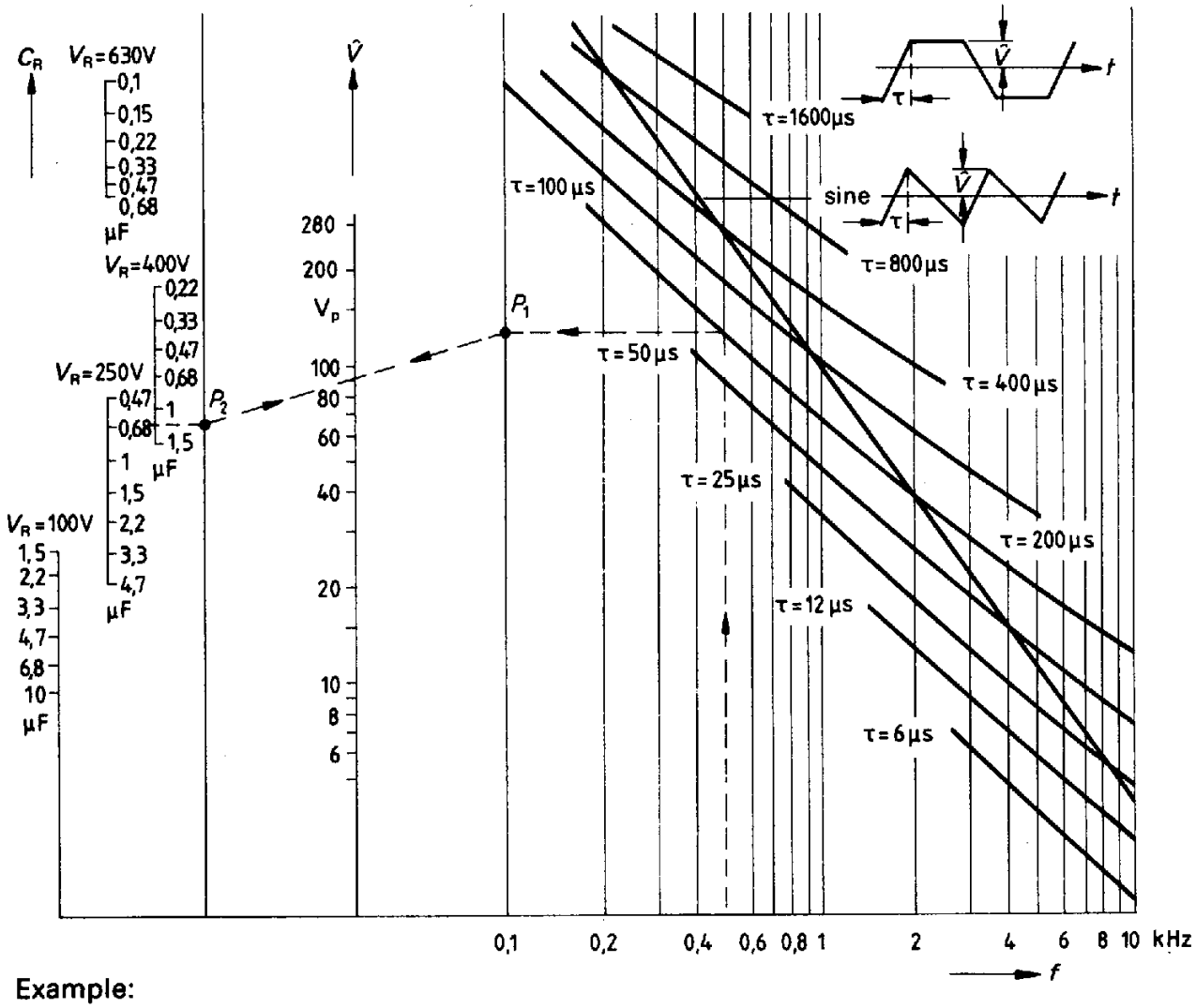
For loads at frequencies >10 kHz, please contact us.

B 32523, LS 22.5 mm
B 32524, LS 27.5 mm

Nomogram to determine the permissible peak voltage $\hat{V}$

Determine the intersections P_1 and P_2 according to the plotted example. The intersection of the line connecting P_1 with P_2 and the $\hat{V}$ scale gives the maximum permissible peak voltage.

In case of a trapezoidal voltage load with two steep edges, the second harmonic frequency must be considered. With sinusoidal voltage load, the "sine" characteristic applies.



Example:

f = 0.5 kHz	(repetition frequency)	intersection P_1
τ = 100 µs	(rise time)	
C_R = 0.68 µF	(capacitance)	intersection P_2
V_R = 250 V	(rated voltage)	

According to the dashed line in the above graph, this results in a max. peak voltage $\hat{V}$ of approx. 90 V.

For loads at frequencies >10 kHz, please contact us.