

DATA SHEET

NAFTA 3188,
O88/O89 PHC-ST
Aluminum electrolytic capacitors
Power High Current, Screw Terminals

Product specification
Supersedes data of 1st August 2001
File under BCcomponents, BC01

2001 Nov 27

Aluminum electrolytic capacitors Power High Current, Screw Terminals

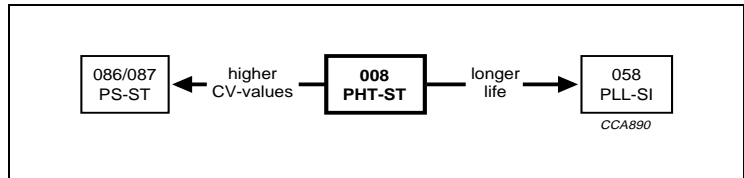
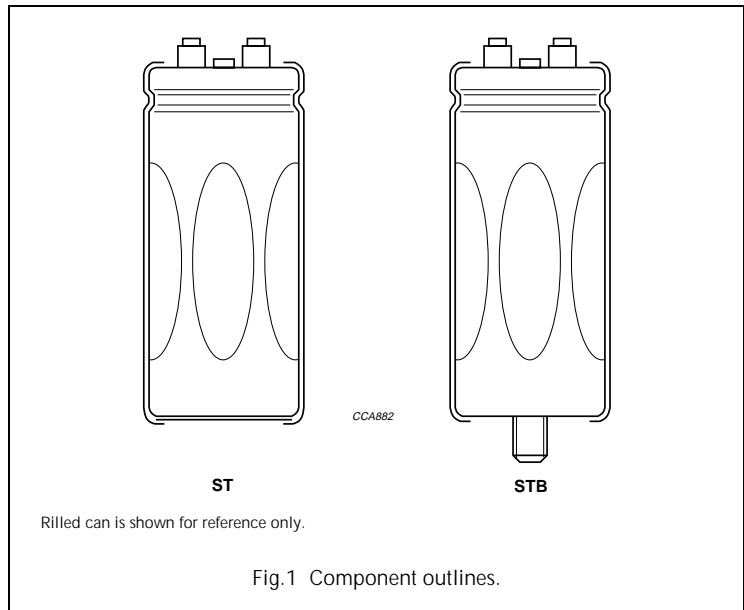
NAFTA 3188,
088/089 PHC-ST

FEATURES

- Polarized aluminum electrolytic capacitors, non-solid electrolyte
- Large types, minimized dimensions, cylindrical aluminum case, insulated with a blue sleeve
- Bolt version available for case $\varnothing D = 50, 65$ and 75 mm ($\varnothing D = 2", 2.5"$ and $3"$)
- Pressure relief in the sealing disk
- Charge and discharge proof
- High ripple current capability
- High resistance to shock and vibration.

APPLICATIONS

- General purpose, computer and industrial systems
- Smoothing and filtering
- Standard and switched mode power supplies
- Welding
- Energy storage in pulse systems
- Motor control devices
- Uninterruptable power supplies (UPS).



QUICK REFERENCE DATA

DESCRIPTION	VALUE	
	088	089
Case size (in millimetres and inches)	BA 35 × 54 mm (1.375" × 2.125") to GN 76 × 220 mm (3.000" × 8.625")	
Rated capacitance range, C_R	270 to 820000 μ F	
Tolerance on C_R	-10 to +30% ⁽¹⁾ ; -10 to +50%; \pm 20%	
Rated voltage range, U_R	16 to 100 V	200 to 450 V
Category temperature range	-40 to +85 °C	
Endurance test at 85 °C	4000 hours	
Useful life at 85 °C	8000 hours	
Useful life at 40 °C and $1.2 \times I_R$ applied	120000 hours	
Shelf life at 0 V, 85 °C	500 hours	
Based on sectional specification	IEC 60384-4	
Climatic category IEC 60068	40/085/56	

Note

1. Standard tolerance on C_R .

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Selection chart for C_R , U_R and relevant nominal case sizes ($\varnothing D \times L$ in mm); NAFTA 3188, 088 PHC-ST

Preferred types in **bold**.

C_R (μF)	U_R (V)						
	16	25	40	50	63	75	100
1800	–	–	–	–	–	–	35 × 54
2700	–	–	–	–	–	35 × 54	35 × 80
3900	–	–	–	–	–	–	35 × 105
4700	–	–	–	–	35 × 54	35 × 80	–
6800	–	–	–	35 × 54	35 × 80	35 × 105	50 × 80
8200	–	–	35 × 54	–	–	–	–
10000	–	–	–	35 × 80	35 × 105	–	50 × 105
12000	–	35 × 54	35 × 80	–	–	50 × 80	50 × 118
15000	–	–	–	35 × 105	–	–	50 × 143
18000	–	–	35 × 105	–	50 × 80	50 × 105	65 × 105
22000	35 × 54	35 × 80	–	–	–	50 × 130	65 × 130
	–	–	–	–	–	–	65 × 143
27000	–	–	50 × 80	50 × 80	50 × 105	50 × 143	65 × 143
	–	–	–	–	–	65 × 105	76 × 118
33000	–	35 × 105	–	–	50 × 130	65 × 118	–
39000	35 × 80	–	–	50 × 105	50 × 143	65 × 143	76 × 143
	–	–	–	–	65 × 105	76 × 105	–
47000	–	–	50 × 105	50 × 130	65 × 118	76 × 118	–
56000	35 × 105	50 × 80	50 × 130	50 × 143	65 × 143	76 × 143	76 × 220
	–	–	–	65 × 105	76 × 105	–	–
68000	–	–	50 × 143	65 × 118	76 × 118	–	–
	–	–	65 × 105	–	–	–	–
82000	50 × 80	50 × 105	65 × 118	65 × 143	76 × 143	–	–
	–	–	–	76 × 105	–	–	–
100000	–	50 × 130	65 × 143	76 × 118	–	76 × 220	–
	–	–	76 × 105	–	–	–	–
120000	50 × 105	50 × 143	76 × 118	76 × 143	–	–	–
	–	65 × 105	–	–	–	–	–
150000	50 × 130	65 × 118	76 × 143	–	76 × 220	–	–
	50 × 143	–	–	–	–	–	–
180000	–	65 × 143	–	–	–	–	–
	–	76 × 105	–	–	–	–	–
220000	65 × 105	76 × 118	–	76 × 220	–	–	–
270000	65 × 118	76 × 143	76 × 220	–	–	–	–
330000	65 × 143	–	–	–	–	–	–
	76 × 105	–	–	–	–	–	–
390000	76 × 118	–	–	–	–	–	–
470000	76 × 143	76 × 220	–	–	–	–	–
820000	76 × 220	–	–	–	–	–	–
1000000	76 × 220	–	–	–	–	–	–

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Selection chart for C_R , U_R and relevant nominal case sizes ($\varnothing D \times L$ in mm); NAFTA 3188, 089 PHC-ST

Preferred types in **bold**.

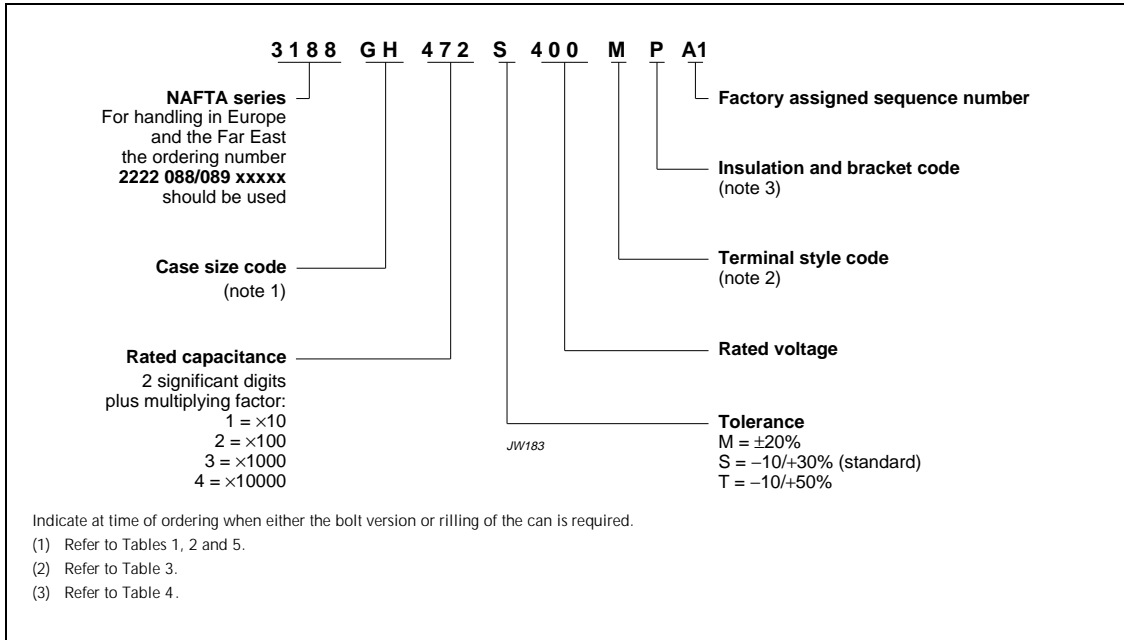
C_R (μF)	U_R (V)				
	200	250	350	400	450
270	–	–	–	35 × 54	–
330	–	–	35 × 54	–	–
390	–	–	–	–	–
470	–	35 × 54	–	35 × 80	–
560	–	–	35 × 80	–	–
680	35 × 54	–	–	35 × 105	–
820	–	35 × 80	35 × 105	–	–
1000	–	–	–	50 × 80	50 × 105
1200	35 × 80	35 × 105	50 × 80	–	–
1500	–	–	–	50 × 105	50 × 130
1800	35 × 105	50 × 80	50 × 105	50 × 118	–
2200	–	–	50 × 118	50 × 143	76 × 118
	–	–	–	65 × 105	–
2700	50 × 80	50 × 105	50 × 143	65 × 130	–
	–	–	65 × 105	–	–
3300	–	50 × 118	65 × 130	65 × 143	–
	–	–	–	76 × 105	76 × 118
3900	50 × 105	50 × 143	65 × 143	76 × 118	76 × 143
	–	–	76 × 105	–	–
4700	50 × 118	65 × 105	76 × 118	76 × 143	–
5600	50 × 143	65 × 130	76 × 143	–	–
6800	65 × 105	65 × 143	–	–	–
	–	76 × 105	–	–	–
8200	65 × 130	76 × 118	–	76 × 220	–
10000	65 × 143	76 × 143	76 × 220	–	–
	76 × 105	–	–	–	–
12000	76 × 118	–	–	–	–
	–	76 × 220	–	–	–
15000	76 × 143	–	–	–	–
22000	76 × 220	–	–	–	–

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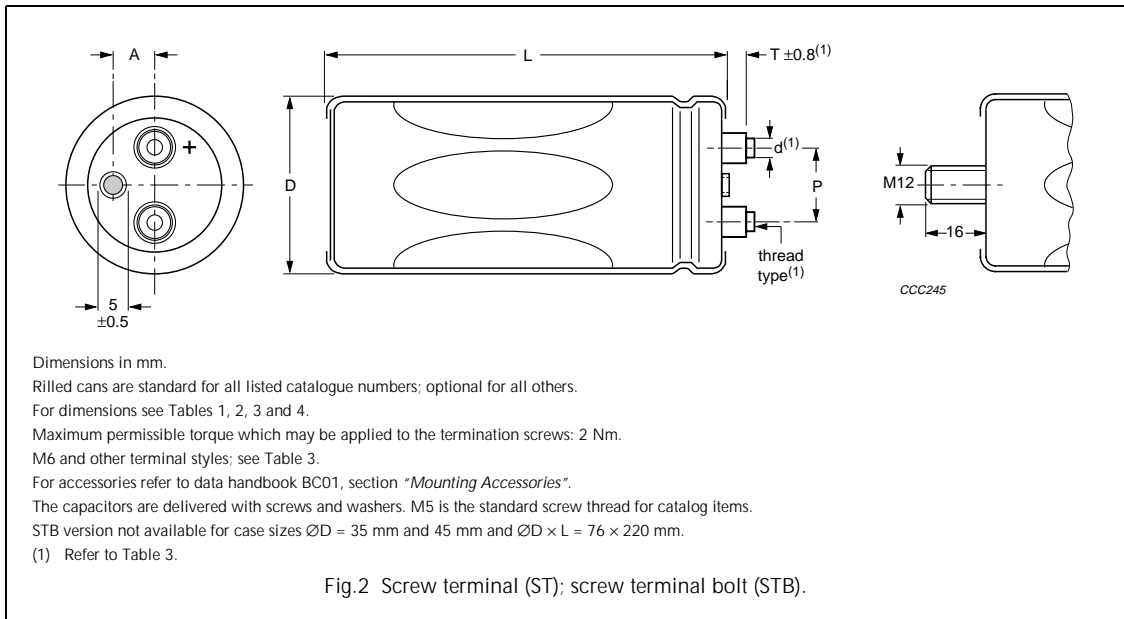
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ORDERING INFORMATION

NAFTA part numbering system



MECHANICAL DATA



Aluminum electrolytic capacitors

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Table 1 Physical dimensions in millimetres (uninsulated case), mass and packaging information; see Fig.2

CASE CODE	∅D ±0.8 (mm)	L ±1.57 (mm)	P ±0.4 (mm)	A (mm)	MASS (g)	PACKAGING QUANTITIES (units per box)	CARDBOARD BOX DIMENSIONS l × w × h (mm)
Dimensions in millimetres							
BA	34.9	54.0	12.7	8.0	≈72	150	402 × 200 × 258
BB	34.9	66.7	12.7	8.0	≈90	150	402 × 200 × 258
BC	34.9	79.4	12.7	8.0	≈105	150	402 × 200 × 283
BD	34.9	92.1	12.7	8.0	≈120	100	402 × 200 × 258
BE	34.9	104.8	12.7	8.0	≈135	100	402 × 200 × 258
BF	34.9	117.5	12.7	8.0	≈170	100	402 × 200 × 258
BG	34.9	130.2	12.7	8.0	≈220	100	402 × 200 × 283
BH	34.9	142.9	12.7	8.0	≈270	100	402 × 200 × 315
DA	44.5	54.0	19.1	11.5	≈160	96	324 × 216 × 289
DB	44.5	66.7	19.1	11.5	≈175	72	332 × 221 × 278
DC	44.5	79.4	19.1	11.5	≈180	72	332 × 221 × 278
DD	44.5	92.1	19.1	11.5	≈205	48	324 × 216 × 289
DE	44.5	104.8	19.1	11.5	≈220	48	324 × 216 × 289
DF	44.5	117.5	19.1	11.5	≈235	48	324 × 216 × 289
DG	44.5	130.2	19.1	11.5	≈250	48	324 × 216 × 289
DH	44.5	142.9	19.1	11.5	≈270	24	324 × 216 × 315
EA	50.8	54.0	22.2	12.7	≈170	96	324 × 216 × 289
EB	50.8	66.7	22.2	12.7	≈180	72	332 × 221 × 278
EC	50.8	79.4	22.2	12.7	≈190	72	332 × 221 × 278
ED	50.8	92.1	22.2	12.7	≈220	48	324 × 216 × 289
EE	50.8	104.8	22.2	12.7	≈255	48	324 × 216 × 289
EF	50.8	117.5	22.2	12.7	≈290	48	324 × 216 × 289
EG	50.8	130.2	22.2	12.7	≈320	48	324 × 216 × 289
EH	50.8	142.9	22.2	12.7	≈350	48	324 × 216 × 315
FB	63.5	66.7	28.6	15.9	≈300	40	343 × 275 × 240
FC	63.5	79.4	28.6	15.9	≈370	40	343 × 275 × 240
FD	63.5	92.1	28.6	15.9	≈400	40	343 × 275 × 240
FE	63.5	104.8	28.6	15.9	≈445	40	343 × 275 × 240
FF	63.5	117.5	28.6	15.9	≈600	40	343 × 275 × 315
FG	63.5	130.2	28.6	15.9	≈650	40	343 × 275 × 315
FH	63.5	142.9	28.6	15.9	≈600	20	343 × 275 × 240
GC	76.2	79.4	31.8	19.0	≈520	60	397 × 320 × 292
GD	76.2	92.1	31.8	19.0	≈570	20	397 × 320 × 121
GE	76.2	104.8	31.8	19.0	≈600	20	397 × 320 × 121
GF	76.2	117.5	31.8	19.0	≈720	20	397 × 320 × 147
GG	76.2	130.2	31.8	19.0	≈850	20	397 × 320 × 147
GH	76.2	142.9	31.8	19.0	≈970	20	397 × 320 × 178
GJ	76.2	149.2	31.8	19.0	≈1050	20	397 × 320 × 178
GN	76.2	219.1	31.8	19.0	≈1460	16	426 × 410 × 237

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Table 2 Physical dimensions in inches (uninsulated case), mass and packaging information; see Fig.2

CASE CODE	∅D ±0.031 (inches)	L ±0.062 (inches)	P ±0.014 (inches)	A (inches)	MASS (g)	PACKAGING QUANTITIES (units per box)	CARDBOARD BOX DIMENSIONS l × w × h (inches)
Dimensions in inches							
BA	1.375	2.125	0.5	0.39	≈72	150	15.825 × 7.875 × 10.125
BB	1.375	2.625	0.5	0.39	≈90	150	15.825 × 7.875 × 10.125
BC	1.375	3.125	0.5	0.39	≈105	150	15.825 × 7.875 × 11.125
BD	1.375	3.625	0.5	0.39	≈120	100	15.825 × 7.875 × 10.125
BE	1.375	4.125	0.5	0.39	≈135	100	15.825 × 7.875 × 10.125
BF	1.375	4.625	0.5	0.39	≈170	100	15.825 × 7.875 × 10.125
BG	1.375	5.125	0.5	0.39	≈220	100	15.825 × 7.875 × 11.125
BH	1.375	5.625	0.5	0.39	≈270	100	15.825 × 7.875 × 12.400
DA	1.75	2.125	0.75	0.453	≈160	96	12.750 × 8.500 × 11.375
DB	1.75	2.625	0.75	0.453	≈175	72	13.700 × 8.700 × 11.000
DC	1.75	3.125	0.75	0.453	≈180	72	13.700 × 8.700 × 11.000
DD	1.75	3.625	0.75	0.453	≈205	48	12.750 × 8.500 × 11.375
DE	1.75	4.125	0.75	0.453	≈220	48	12.750 × 8.500 × 11.375
DF	1.75	4.625	0.75	0.453	≈235	48	12.750 × 8.500 × 11.375
DG	1.75	5.125	0.75	0.453	≈250	48	12.750 × 8.500 × 11.375
DH	1.75	5.625	0.75	0.453	≈270	24	12.750 × 8.500 × 12.400
EA	2	2.125	0.875	0.5	≈170	96	12.750 × 8.500 × 11.375
EB	2	2.625	0.875	0.5	≈180	72	13.750 × 8.700 × 11.000
EC	2	3.125	0.875	0.5	≈190	72	13.750 × 8.700 × 11.000
ED	2	3.625	0.875	0.5	≈220	48	12.750 × 8.500 × 11.375
EE	2	4.125	0.875	0.5	≈255	48	12.750 × 8.500 × 11.375
EF	2	4.625	0.875	0.5	≈290	48	12.750 × 8.500 × 11.375
EG	2	5.125	0.875	0.5	≈320	48	12.750 × 8.500 × 11.375
EH	2	5.625	0.875	0.5	≈350	48	12.750 × 8.500 × 12.400
FB	2.5	2.625	1.125	0.625	≈300	40	13.500 × 10.825 × 9.500
FC	2.5	3.125	1.125	0.625	≈370	40	13.500 × 10.825 × 9.500
FD	2.5	3.625	1.125	0.625	≈400	40	13.500 × 10.825 × 9.500
FE	2.5	4.125	1.125	0.625	≈445	40	13.500 × 10.825 × 9.500
FF	2.5	4.625	1.125	0.625	≈600	40	13.500 × 10.825 × 12.400
FG	2.5	5.125	1.125	0.625	≈650	40	13.500 × 10.825 × 12.400
FH	2.5	5.625	1.125	0.625	≈600	20	13.500 × 10.825 × 9.500
GC	3	3.125	1.25	0.75	≈520	60	15.630 × 12.600 × 11.500
GD	3	3.625	1.25	0.75	≈570	20	15.630 × 12.600 × 4.750
GE	3	4.125	1.25	0.75	≈600	20	15.630 × 12.600 × 4.750
GF	3	4.625	1.25	0.75	≈720	20	15.630 × 12.600 × 5.750
GG	3	5.125	1.25	0.75	≈850	20	15.630 × 12.600 × 5.750
GH	3	5.625	1.25	0.75	≈970	20	15.630 × 12.600 × 7.000
GJ	3	5.825	1.25	0.75	≈1050	20	15.630 × 12.600 × 7.000
GN	3	8.625	1.25	0.75	≈1460	16	16.775 × 16.125 × 9.250

Aluminum electrolytic capacitors

Power High Current, Screw Terminals

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Table 3 NAFTA terminal style code; standard types in **bold**.

CODE	TERMINAL STYLE	THREAD TYPE	d (mm)	T (mm)	d (inches)	T (inches)
A	high post	10-32	8	6.4	.315	0.250
B	low post	10-32	8	1.6	.315	0.063
D	high current; see note 1	1/4-28	17	3.2	.670	0.125
J	high current; see note 1	M6	17	3.2	.670	0.125
M	high post	M5	8	6.4	.315	0.250
K	high current; see note 1	1/4-28	17	6.4	.670	0.250

Note

1. Case $\varnothing D = 65$ mm (2.5") and $\varnothing D = 76$ mm (3.0") cans only; for 30 A and up.

Table 4 NAFTA insulation and clamp/bracket codes; standard types in **bold**. See note 1

CODE	CLAMP/BRACKET	INSULATION TYPE	DIMENSION ADDERS		
			D	L	H
			Dimensions in mm		
P	no	0.2 mm polymeric	+0.51	+0.81	+0.61
H	no	0.3 mm polymeric	+0.63	+1.58	+1.14
N	no	none	–	–	–
R	yes	0.2 mm polymeric	+0.51	+0.81	+0.61
J	yes	0.3 mm polymeric	+0.63	+1.58	+1.14
X	yes	none	–	–	–
			Dimensions in inches		
P	no	0.008" polymeric	+0.020	+0.032	+0.024
H	no	0.012" polymeric	+0.030	+0.062	+0.045
N	no	none	–	–	–
R	yes	0.008" polymeric	+0.020	+0.032	+0.024
J	yes	0.012" polymeric	+0.030	+0.062	+0.045
X	yes	none	–	–	–

Note

1. For clamp/bracket dimensions refer to data handbook BC01, section "Mounting Accessories".

MARKING

The capacitors are marked (where possible) with the following information:

- Rated capacitance (in μF)
- Tolerance on rated capacitance
- Rated voltage (in V)
- Date code in "yyww" (year, week) format
- Name of manufacturer
- NAFTA code number 17 digits
- Code number 12 digits (12NC; NAFTA customers will not see the 12NC).

Aluminum electrolytic capacitors

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ELECTRICAL DATA AND ORDERING INFORMATION

Unless otherwise specified, all electrical values in Tables 5 and 6 apply at
 $T_{amb} = 25\text{ °C}$, $P = 86\text{ to }106\text{ kPa}$, $RH = 45\text{ to }75\%$.

SYMBOL	DESCRIPTION
C_R	rated capacitance at 100/120 Hz
I_R	rated RMS ripple current at 85 °C
I_{L5}	max. leakage current after 5 minutes at U_R
ESR	max. equivalent series resistance at 100/120 Hz
Z	impedance at 20 kHz on request
Tan δ	max. dissipation factor at 100/120 Hz

Ordering example

Electrolytic capacitor 089 series

10000 $\mu\text{F}/200\text{ V}$; $-10/+30\%$

High post code "M", insulation type
 "H", 0.6 mm polymeric

Nominal case size:

$\varnothing 65 \times 143\text{ mm}$, ST version

Catalogue number: 2222 089 12103.

Table 5 Electrical data and ordering information for **088 PHC-ST** preferred types in **bold**

U_R (V)	C_R 100/120 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	I_R 100/120 Hz 85 °C (A)	I_{L5} 5 min (mA)	ESR MAX. 100/120 Hz (m Ω)	Tan δ MAX. 100/120 Hz	CATALOGUE NUMBER (see Table 6, note 1) 2222
16	22000	35 × 54	BA	12	1.78	10	0.18	088 15223
	39000	35 × 80	BC	17	2.37	7	0.22	088 15393
	56000	35 × 105	BE	21	2.84	6	0.27	088 15563
	82000	50 × 80	EC	24	3.44	6	0.40	088 15823
	120000	50 × 105	EE	30	4.16	6	0.49	088 15124
	150000	50 × 130	EG	30	4.65	4	0.49	088 15154
	150000	50 × 143	EH	30	4.65	4	0.49	088 25154
	220000	65 × 105	FE	44	5.63	3	0.54	088 15224
	270000	65 × 118	FF	48	6.00	3	0.66	088 15274
	330000	65 × 143	FH	50	6.00	3	0.81	088 15334
	330000	76 × 105	GE	50	6.00	3	0.81	088 25334
	390000	76 × 118	GF	50	6.00	3	0.96	088 15394
	470000	76 × 143	GH	50	6.00	2	0.77	088 15474
	820000	76 × 220	GN	50	6.00	2	1.34	088 15824
1000000	76 × 220	GN	50	6.00	2	1.47	088 15105	
25	12000	35 × 54	BA	6.8	1.64	32	0.31	088 16123
	22000	35 × 80	BC	9.6	2.22	22	0.40	088 16223
	33000	35 × 105	BE	12	2.72	17	0.46	088 16333
	56000	50 × 80	EC	21	3.55	7	0.32	088 16563
	82000	50 × 105	EE	28	4.30	5	0.33	088 16823
	100000	50 × 130	EG	30	4.74	5	0.41	088 16104
	120000	50 × 143	EH	30	5.20	4	0.39	088 16124
	120000	65 × 105	FE	35	5.20	5	0.49	088 26124
	150000	65 × 118	FF	38	5.81	4	0.49	088 16154
	180000	65 × 143	FH	41	6.00	4	0.59	088 16184
	180000	76 × 105	GE	42	6.00	4	0.59	088 26184

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U _R (V)	C _R 100/120 Hz (μF)	NOMINAL CASE SIZE ØD × L (mm)	CASE CODE	I _R 100/120 Hz 85 °C (A)	I _{L5} 5 min (mA)	ESR MAX. 100/120 Hz (mΩ)	Tan δ MAX. 100/120 Hz	CATALOGUE NUMBER (see Table 6, note 1) 2222
25	220000	76 × 118	GF	46	7.04	4	0.72	088 16224
	270000	76 × 143	GH	49	7.79	4	0.88	088 16274
	470000	76 × 220	GN	50	10.28	3	1.15	088 16474
40	8200	35 × 54	BA	6.1	1.72	39	0.26	088 17822
	12000	35 × 80	BC	8.7	2.08	27	0.26	088 17123
	18000	35 × 105	BE	11	2.55	20	0.29	088 17183
	27000	50 × 80	EC	19	3.12	9	0.20	088 17273
	47000	50 × 105	EE	25	4.11	6	0.23	088 17473
	56000	50 × 130	EG	30	4.49	5	0.23	088 17563
	68000	50 × 143	EH	30	4.95	5	0.28	088 17683
	68000	65 × 105	FE	32	4.95	5	0.28	088 27683
	82000	65 × 118	FF	35	5.43	5	0.33	088 17823
	100000	65 × 143	FH	38	6.00	5	0.41	088 17104
	100000	76 × 105	GE	38	6.00	5	0.41	088 27104
	120000	76 × 118	GF	42	6.00	4	0.39	088 17124
150000	76 × 143	GH	46	6.00	4	0.49	088 17154	
	270000	76 × 220	GN	50	6.00	3	0.66	088 17274
50	6800	35 × 54	BA	5.9	1.75	42	0.23	088 11682
	10000	35 × 80	BC	8.4	2.12	28	0.23	088 11103
	15000	35 × 105	BE	11	2.60	21	0.26	088 11153
	27000	50 × 80	EC	14	3.49	15	0.33	088 11273
	39000	50 × 105	EE	19	4.19	11	0.35	088 11393
	47000	50 × 130	EG	21	4.60	10	0.38	088 11473
	56000	50 × 143	EH	24	5.02	9	0.41	088 11563
	56000	65 × 105	FE	26	5.02	8	0.37	088 21563
	68000	65 × 118	FF	29	5.53	7	0.39	088 11683
	82000	65 × 143	FH	34	6.00	6	0.40	088 11823
	82000	76 × 105	GE	32	6.00	6	0.40	088 21823
	100000	76 × 118	GF	36	6.00	6	0.49	088 11104
	120000	76 × 143	GH	39	6.00	5	0.49	088 11124
	220000	76 × 220	GN	50	6.00	4	0.72	088 11224
	63	4700	35 × 54	BA	5.9	1.63	42	0.16
6800		35 × 80	BC	8.4	1.96	29	0.16	088 18682
10000		35 × 105	BE	11	2.38	21	0.17	088 18103
18000		50 × 80	EC	14	3.19	15	0.22	088 18183
27000		50 × 105	EE	19	3.91	11	0.24	088 18273
33000		50 × 130	EG	23	4.33	9	0.24	088 18333
39000		50 × 143	EH	25	4.70	9	0.29	088 18393

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U _R (V)	C _R 100/120 Hz (μF)	NOMINAL CASE SIZE ØD × L (mm)	CASE CODE	I _R 100/120 Hz 85 °C (A)	I _{L5} 5 min (mA)	ESR MAX. 100/120 Hz (mΩ)	Tan δ MAX. 100/120 Hz	CATALOGUE NUMBER (see Table 6, note 1) 2222
63	39000	65 × 105	FE	26	4.70	8	0.25	088 28393
	47000	65 × 118	FF	28	5.16	7	0.27	088 18473
	56000	65 × 143	FH	31	5.63	7	0.32	088 18563
	56000	76 × 105	GE	32	5.63	7	0.32	088 28563
	68000	76 × 118	GF	36	6.00	6	0.33	088 18683
	82000	76 × 143	GH	39	6.00	5	0.33	088 18823
	150000	76 × 220	GN	50	6.00	4	0.49	088 18154
75	2700	35 × 54	BA	5.7	1.35	46	0.10	088 12272
	4700	35 × 80	BC	8.2	1.78	30	0.12	088 12472
	6800	35 × 105	BE	10	2.14	22	0.12	088 12682
	12000	50 × 80	EC	14	2.85	16	0.16	088 12123
	18000	50 × 105	EE	18	3.49	12	0.18	088 12183
	22000	50 × 130	EG	22	3.85	10	0.18	088 12223
	27000	50 × 143	EH	24	4.27	9	0.20	088 12273
	27000	65 × 105	FE	25	4.27	8	0.18	088 22273
	33000	65 × 118	FF	28	4.72	7	0.19	088 12333
	39000	65 × 143	FH	33	5.13	6	0.19	088 12393
	39000	76 × 105	GE	33	5.13	6	0.19	088 22393
	47000	76 × 118	GF	35	5.63	6	0.23	088 12473
	56000	76 × 143	GH	41	6.00	5	0.23	088 12563
	100000	76 × 220	GN	50	6.00	4	0.33	088 12104
	100	1800	35 × 54	BA	4	1.27	79	0.12
2700		35 × 80	BC	5.9	1.56	51	0.11	088 19272
4700		35 × 105	BE	8.9	2.06	32	0.12	088 19472
6800		50 × 80	EC	6.8	2.47	64	0.36	088 19682
10000		50 × 105	EE	10	3.00	38	0.31	088 19103
12000		50 × 130	EG	11	3.29	34	0.33	088 19123
15000		50 × 143	EH	13	3.67	28	0.34	088 19153
18000		65 × 105	FE	17	4.02	18	0.26	088 19183
22000		65 × 130	FG	20	4.45	14	0.26	088 19223
22000		65 × 143	FH	15	4.45	25	0.45	088 29223
27000		76 × 105	GE	22	4.93	13	0.29	088 19273
27000		76 × 118	GF	18	4.93	20	0.44	088 29273
39000		76 × 143	GH	21	6.00	16	0.51	088 19393
56000		76 × 220	GN	25	6.00	14	0.64	088 19563

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Table 6 Electrical data and ordering information for **O89 PHC-ST**; preferred types in **bold**

U_R (V)	C_R 100/120 Hz (μF)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	I_R 100/120 Hz 85 °C (A)	I_{L5} 5 min (mA)	ESR MAX. 100/120 Hz (m Ω)	Tan δ MAX. 100/120 Hz	CATALOGUE NUMBER (note 1) 2222
200	680	35 × 54	BA	2.9	1.11	130	0.07	089 12681
	1200	35 × 80	BC	4.1	1.47	76	0.07	089 12122
	1800	35 × 105	BE	6.9	1.80	53	0.08	089 12182
	2700	50 × 80	EC	6.2	2.20	76	0.17	089 12272
	3900	50 × 105	EE	8.5	2.65	51	0.16	089 12392
	4700	50 × 130	EG	11	2.91	36	0.14	089 12472
	5600	50 × 143	EH	15	3.17	20	0.09	089 12562
	6800	65 × 105	FE	14	3.50	24	0.13	089 12682
	8200	65 × 118	FF	16	3.64	21	0.14	089 12822
	10000	65 × 143	FH	20	4.24	17	0.14	089 12103
	10000	76 × 105	GE	16	4.24	25	0.20	089 22103
	12000	76 × 118	GF	18	6.00	22	0.22	089 12123
	15000	76 × 143	GH	21	6.00	19	0.23	089 12153
	22000	76 × 220	GN	25	6.00	15	0.27	089 12223
250	470	35 × 54	BA	2.9	1.03	130	0.05	089 13471
	820	35 × 80	BC	4.7	1.36	86	0.06	089 13821
	1200	35 × 105	BE	6.8	1.64	54	0.05	089 13122
	1800	50 × 80	EC	6.9	2.01	76	0.11	089 13182
	2700	50 × 105	EE	8.4	2.46	52	0.11	089 13272
	3300	50 × 130	EG	14	2.72	22	0.06	089 13332
	3900	50 × 143	EH	16	2.96	19	0.06	089 13392
	4700	65 × 105	FE	14	3.25	25	0.10	089 13472
	5600	65 × 118	FF	16	3.55	20	0.09	089 13562
	6800	65 × 143	FH	18	3.91	17	0.09	089 13682
	6800	76 × 105	GE	18	3.91	17	0.09	089 23682
	8200	76 × 118	GF	16	4.30	24	0.16	089 13822
	10000	76 × 143	GH	21	4.74	18	0.15	089 13103
	12000	76 × 220	GN	25	5.20	16	0.16	089 13123

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U_R (V)	C_R 100/120 Hz (μ F)	NOMINAL CASE SIZE $\varnothing D \times L$ (mm)	CASE CODE	I_R 100/120 Hz 85 °C (A)	I_{L5} 5 min (mA)	ESR MAX. 100/120 Hz (m Ω)	Tan δ MAX. 100/120 Hz	CATALOGUE NUMBER (note 1) 2222
350	330	35 × 54	BA	1.9	1.02	290	0.08	089 15331
	560	35 × 80	BC	2.9	1.33	191	0.09	089 15561
	820	35 × 105	BE	4.2	1.61	129	0.09	089 15821
	1200	50 × 80	EC	5	1.94	122	0.12	089 15122
	1800	50 × 105	EE	7.3	2.38	74	0.11	089 15182
	2200	50 × 130	EG	9.1	2.63	49	0.09	089 15222
	2700	50 × 143	EH	10	2.92	39	0.09	089 15272
	2700	65 × 105	FE	10	2.92	47	0.10	089 25272
	3300	65 × 118	FF	12	3.22	39	0.11	089 15332
	3900	65 × 143	FH	13	3.50	34	0.11	089 15392
	3900	76 × 105	GE	13	3.50	34	0.11	089 25392
	4700	76 × 118	GF	14	3.85	34	0.13	089 15472
	5600	76 × 143	GH	16	4.20	28	0.13	089 15562
10000	76 × 220	GN	25	5.61	18	0.15	089 15103	
400	270	35 × 54	BA	1.7	0.99	333	0.07	089 16271
	470	35 × 80	BC	2.9	1.30	224	0.09	089 16471
	680	35 × 105	BE	4.1	1.56	134	0.07	089 16681
	1000	50 × 80	EC	4.8	1.90	127	0.10	089 16102
	1500	50 × 105	EE	7.8	2.32	63	0.08	089 16152
	1800	50 × 130	EG	8.8	2.55	53	0.08	089 16182
	2200	50 × 143	EH	9.8	2.81	45	0.08	089 16222
	2200	65 × 105	FE	9.8	2.81	45	0.08	089 26222
	2700	65 × 118	FF	10.7	3.12	47	0.10	089 16272
	3300	65 × 143	FH	13	3.45	35	0.09	089 16332
	3300	76 × 105	GE	13	3.45	35	0.09	089 26332
	3900	76 × 118	GF	13	3.75	37	0.12	089 16392
	4700	76 × 143	GH	15	4.11	31	0.12	089 16472
8200	76 × 220	GN	22	5.43	24	0.16	089 16822	
450	1000	50 × 105	EE	5.5	2.0	102	0.05	089 17102
	1500	50 × 130	EG	7.4	2.5	70	0.05	089 17152
	2200	65 × 118	FF	10.5	3.0	46	0.05	089 17222
	3300	76 × 118	GF	13.8	3.65	34	0.05	089 17332
	3900	76 × 143	GH	19.1	4.0	22	0.06	089 17392

Note

- Catalogue type applies to the terminal style "M", high post (see Table 3); the insulation type "P", 0.2 mm polymeric (see Table 4); tolerance $-10/+30\%$ and to the ST version; for STB version (not preferred) replace 8th digit by '5' if ST version is '1' (2222 088/089 5....) or replace 8th digit by '6' if ST version is '2' (2222 088/089 6....). STB version is not available for $\varnothing D = 35$ mm and 45 mm and for case size $\varnothing 76 \times 220$ mm.

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Additional electrical data

PARAMETER	CONDITIONS	VALUE
Voltage		
Surge voltage for short periods	≤250 V versions	$U_s = 1.3 \times U_R$
	≥350 V versions	$U_s = 1.15 \times U_R$
Reverse voltage		$U_{rev} \leq 1 \text{ V}$
Current		
Leakage current	after 5 minutes at U_R	$I_{L5} \leq 0.003 \times \sqrt{C \times V} \text{ (mA)}$
Inductance		
Equivalent series inductance (ESL)	case ØD = 35 mm, (1.375")	typ. 18 nH
	case ØD = 45 mm, (1.75")	typ. 23 nH
	case ØD = 50 mm, (2.0")	typ. 25 nH
	case ØD = 65 mm, (2.5")	typ. 27 nH
	case ØD = 76 mm, (3.0")	typ. 29 nH

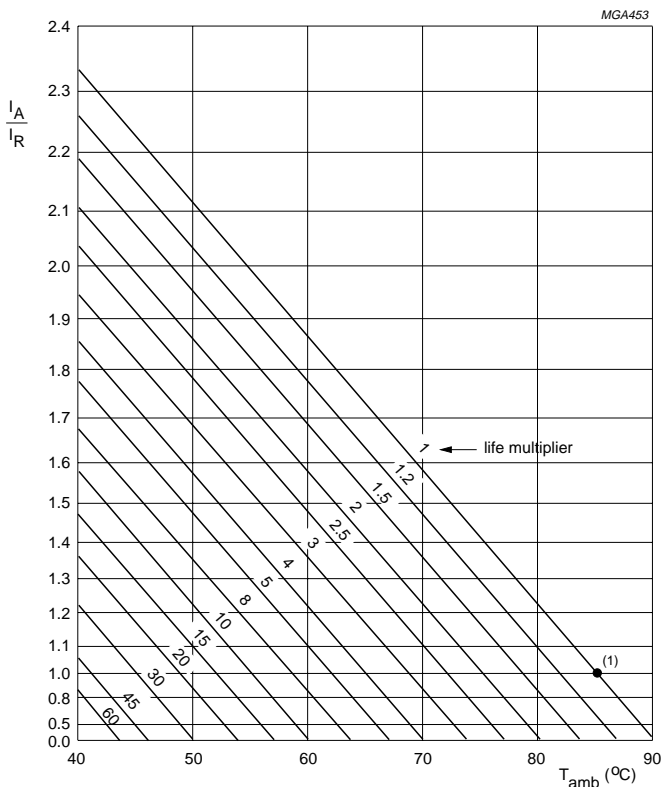
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RIPPLE CURRENT AND USEFUL LIFE

Table 7 Multiplier of ripple current (I_R) as a function of frequency

FREQUENCY (Hz)	I_R MULTIPLIER	
	088	089
60	0.9	0.9
100/120	1.00	1.00
300	1.15	1.25
1000	1.25	1.40
≥ 10000	1.30	1.50



I_A = actual ripple current at 100/120 Hz and 85 °C.
 I_R = rated ripple current at 100/120 Hz and 85 °C.
 With an absolute maximum of 50 A at 85 °C.
 (1) Useful life at 85 °C and I_R applied: 5000 hours (4000 hours for ≥ 100 V types).

Fig.3 Multiplier of useful life as a function of ambient temperature and ripple current load.

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SPECIFIC TESTS AND REQUIREMENTS

General tests and requirements are specified in data handbook BC01, section "Tests and Requirements".

Table 8 Test procedures and requirements

TEST		PROCEDURE (quick reference)	REQUIREMENTS
NAME OF TEST	REFERENCE		
Endurance	IEC 60384-4 subclause 4.13	$T_{amb} = 85\text{ °C}$; U_R applied; 4000 hours	$\Delta C/C: \pm 10\%$ $ESR \leq 2 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$
Useful life	CECC 30301 subclause 1.8.1	$T_{amb} = 85\text{ °C}$; U_R and I_R applied; 8000 hours	$\Delta C/C: \pm 15\%$ $ESR \leq 3 \times \text{spec. limit}$ $I_{L5} \leq \text{spec. limit}$ no short or open circuit, no visible damage total failure percentage: $\leq 3\%$
Shelf life (storage at high temperature)	IEC 60384-4 subclause 4.17	$T_{amb} = 85\text{ °C}$; no voltage applied; 500 hours after test: U_R to be applied for 30 minutes, 24 to 48 hours before measurement	$\Delta C/C: \pm 10\%$ $I_{L5} \leq 2 \times \text{spec. limit}$ $ESR \leq 1.75 \times \text{spec. limit}$