



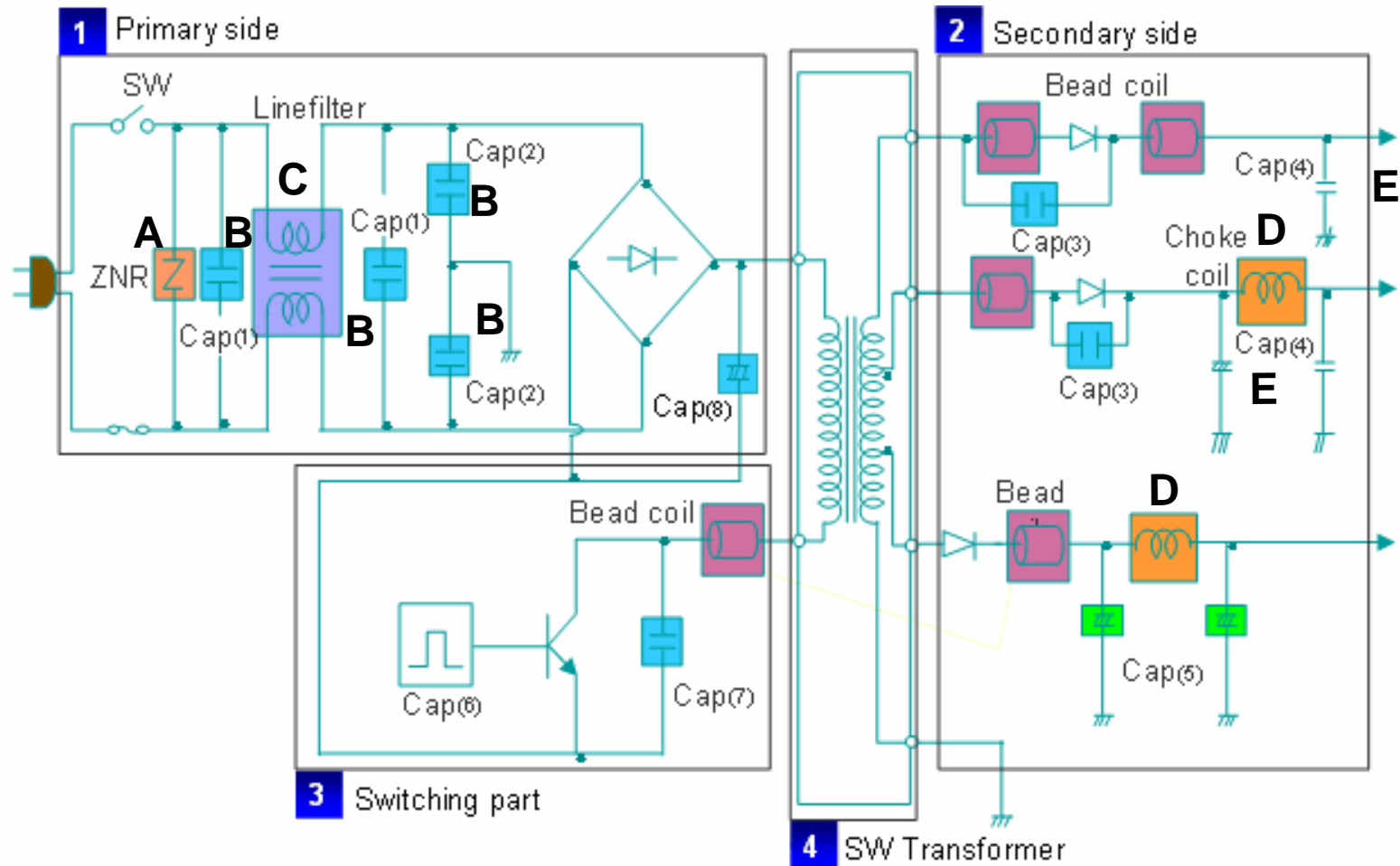
Passive Components for Power Supplies

TTI Webinar
September 19, 2006

Leonard A. (Len) Metzger

Panasonic ideas for life

AC/DC Power Supply

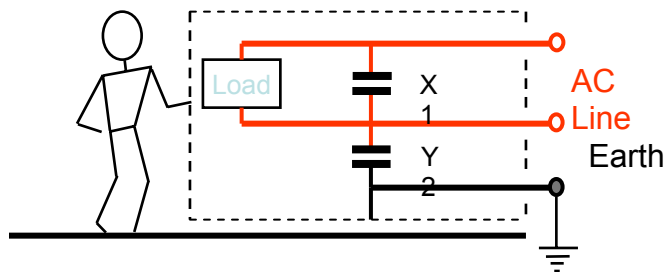


Sub-class of Electromagnetic Interference Suppression Capacitors(IEC60384-14 2nd Ed.)

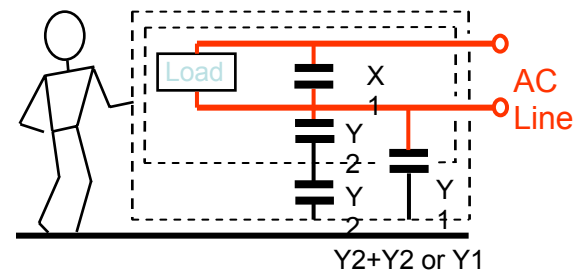
Sub-class	Type of insulation bridged	Range of Rated Voltage	Peak impulse test voltage	Withstanding test voltage	Related Panasonic's Ceramic Capacitors
Y1	Double insulation or Reinforced insulation	250 V	8.0 kV	4000 VAC	Type NS-A
Y2	Basic insulation or Supplementary insulation	150 V 250 V	5.0 kV	1500 VAC	Type TS and BC
Y3	Basic insulation or Supplementary insulation	250 V	None	1500 VAC	↑
Y4	Basic insulation or Supplementary insulation	250 V	2.5 kV	900 VAC	↑

Sub-class	Peak impulse voltage in service	IEC 664 of insulation category	Application	Peak impulse test voltage (When $\square \geq 1\mu\text{F}$)	Withstanding test voltage
X1	2.5 kV 4.0 kV	\square	High pulse application	4.0 kV	4.3UR(DC) UR:Rated Voltage
X2	2.5 kV	\square	General purpos	2.5 kV	
X3	1.2 kV	\square	General purpos	None	

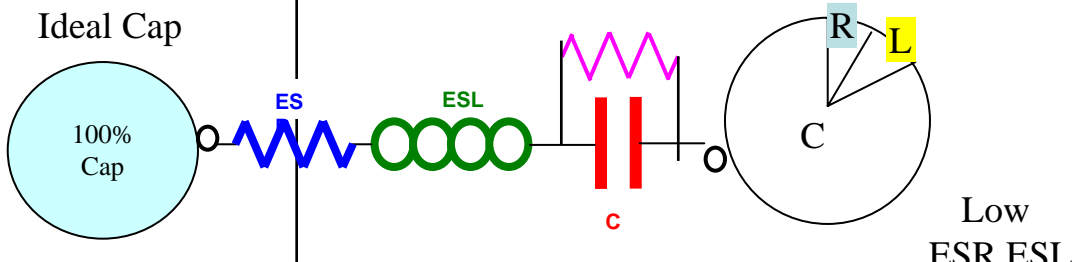
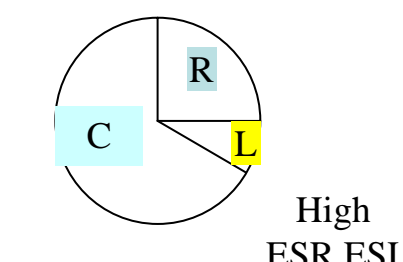
Example of Y and X capacitor used in protection class \square (Basic insulation equipment)



Example of Y and X capacitor used in protection class \square (Double insulation equipment)



Film Technology Comparison to other Capacitor Technologies

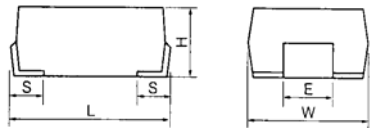
	Film	MLCC	Tantalum
Material	PPS	Ceramic	Oxidized manganese
Electrical Loss (DF %)	Very Low (PPS=0.6%)	Higher (1 to 5%)	Much Higher (6 to 10%)
Fragile Or Flexible	Flexible No Cracking	Fragile Crack	Weak
	-	Piezo-Effect, DC Bias	Need Voltage derating
Failure mode	Open (Safety) Self Healing Function	Short	Short Catch Fire (Dangerous)
Temp Characteristic	Stable	Large change	Larger than Film
Tolerance	2%,5% (Include Temp Change)	5%,10%(Exclude Temp Change)	20% (Include Temp Change)
Polarity	Non Polar	Non Polar	Polar
Ideal Cap			

ZNR SMD Molded Type (ERZVFxxxx)

Features

- # Large withstanding surge current capability
In compact size
- # Designed for flow / reflow soldering
- # Completely Lead-Free component
- # Safety Standards
UL1449 (TVSS) - - - In the process of applying

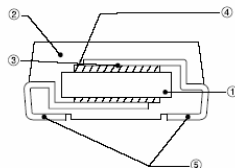
Dimensions in mm



(not to scale)

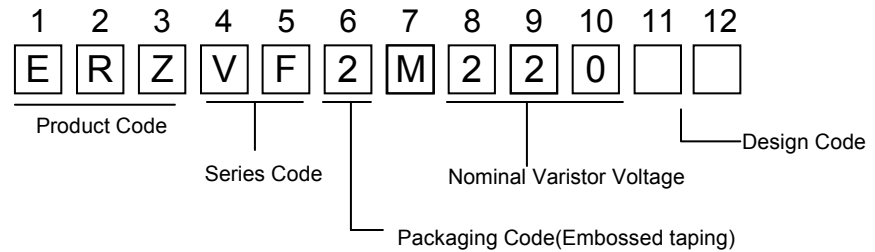
Unit : mm

Type	VF2M
L	8.0 ± 0.5
W	6.0 ± 0.4
H	3.2±0.3
S	1.3 ± 0.3
E	2.5 ± 0.2



① ZNR element	ZnO etc.
② Resin mold	Epoxy Resin(UL94V-0 approved)
③ Conductive adhesive	Silver
④ Electrode	Silver
⑤ Lead terminals	Sn plated Ni-Fe Alloy

Explanation of Part Numbers



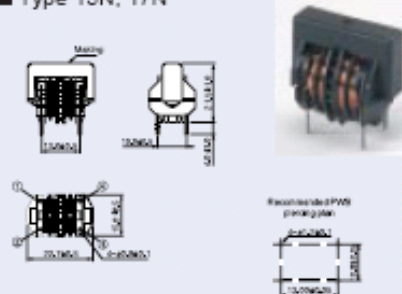
Ratings and Characteristics

Characteristics Parts No.	Varistor Voltage (at 1mA)	Clamping Voltage (max.)		Max. Peak Current (8/20uA,2times)
ERZVF2M220	20 ~ 24 V	43 V	at 2.5 A	125 A
ERZVF2M270	24 ~30 V	53 V	at 2.5 A	125 A
ERZVF2M330	30 ~36 V	65 V	at 2.5 A	125 A
ERZVF2M390	35 ~43 V	77 V	at 2.5 A	125 A
ERZVF2M470	42 ~52 V	93 V	at 2.5 A	125 A
ERZVF2M560	50 ~62 V	110 V	at 2.5 A	125 A
ERZVF2M680	61 ~75 V	135 V	at 2.5 A	125 A
ERZVF2M820	74 ~ 90 V	135 V	at 10 A	600 A
ERZVF2M101	90 ~110 V	165 V	at 10 A	600 A
ERZVF2M121	108 ~132 V	200 V	at 10 A	600 A
ERZVF2M151	135 ~165 V	250 V	at 10 A	600 A
ERZVF2M201	185 ~225 V	340 V	at 10 A	600 A
ERZVF2M221	198 ~242 V	360 V	at 10 A	600 A
ERZVF2M241	216 ~264 V	395 V	at 10 A	600 A
ERZVF2M271	247 ~303 V	455 V	at 10 A	600 A
ERZVF2M331	297 ~363 V	545 V	at 10 A	300 A
ERZVF2M361	324 ~396 V	595 V	at 10 A	300 A
ERZVF2M391	351 ~429 V	650 V	at 10 A	300 A
ERZVF2M431	387 ~473 V	710 V	at 10 A	300 A
ERZVF2M471	423 ~517 V	775 V	at 10 A	300 A

Line Filters

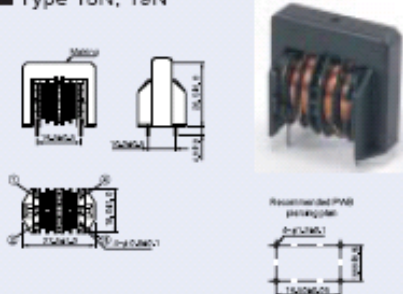
Series N/High N

■ Type 15N, 17N



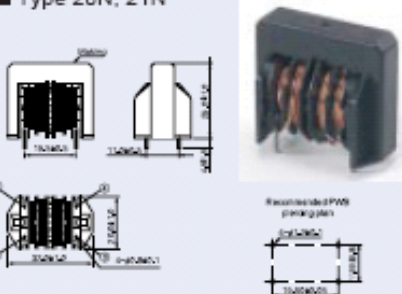
Recommended PWB pinning plan

■ Type 18N, 19N



Recommended PWB pinning plan

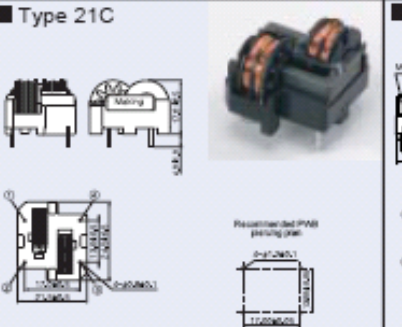
■ Type 20N, 21N



Recommended PWB pinning plan

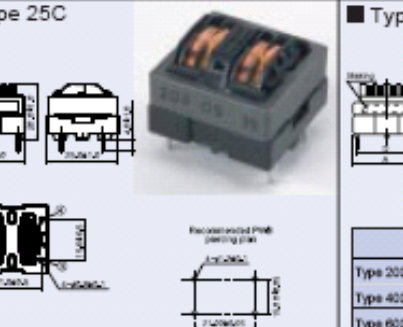
Series C

■ Type 21C



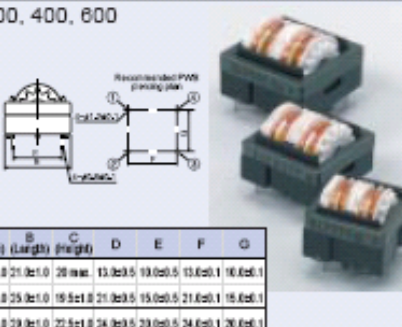
Recommended PWB pinning plan

■ Type 25C



Recommended PWB pinning plan

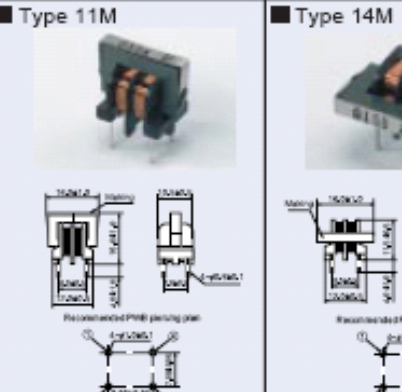
■ Type 200, 400, 600



	A	B	C	D	E	F	G
	(Width)	(Length)	(Height)				
Type 200	26.6±0.1	21.0±1.0	28 max.	13.0±0.5	19.0±0.5	13.0±0.1	10.0±0.1
Type 400	24.6±0.1	25.0±1.0	19.5±1.0	21.0±0.5	15.0±0.5	21.0±0.1	15.0±0.1
Type 600	28.5±0.1	29.0±1.0	22.5±1.0	24.0±0.5	20.0±0.5	24.0±0.1	20.0±0.1

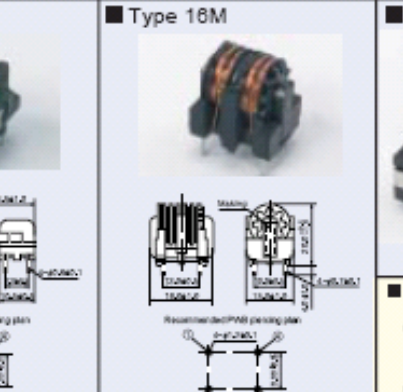
Series M

■ Type 11M



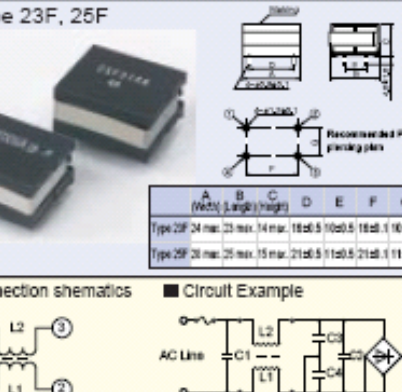
Recommended PWB pinning plan

■ Type 14M



Recommended PWB pinning plan

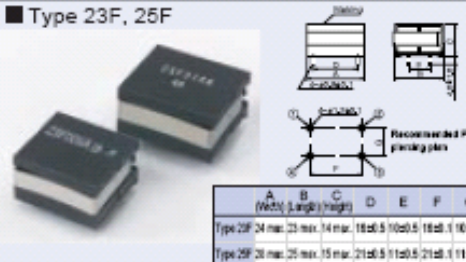
■ Type 16M



Recommended PWB pinning plan

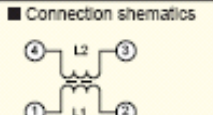
Series F

■ Type 23F, 25F

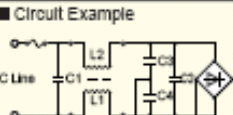


	A	B	C	D	E	F	G
	(Width)	(Length)	(Height)				
Type 23F	24 max.	23 max.	14 max.	18±0.5	10±0.5	18±0.1	10±0.1
Type 25F	28 max.	25 max.	15 max.	21±0.5	11±0.5	21±0.1	11±0.1




■ Connection schematics

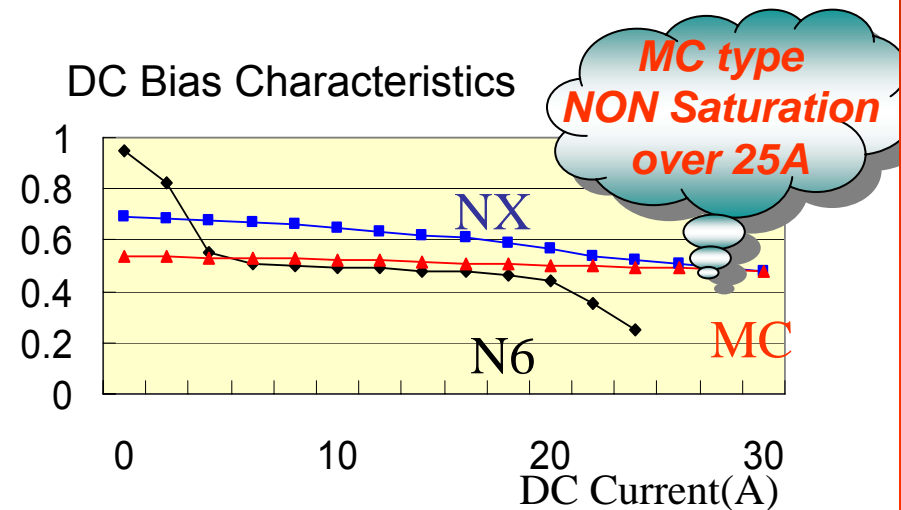
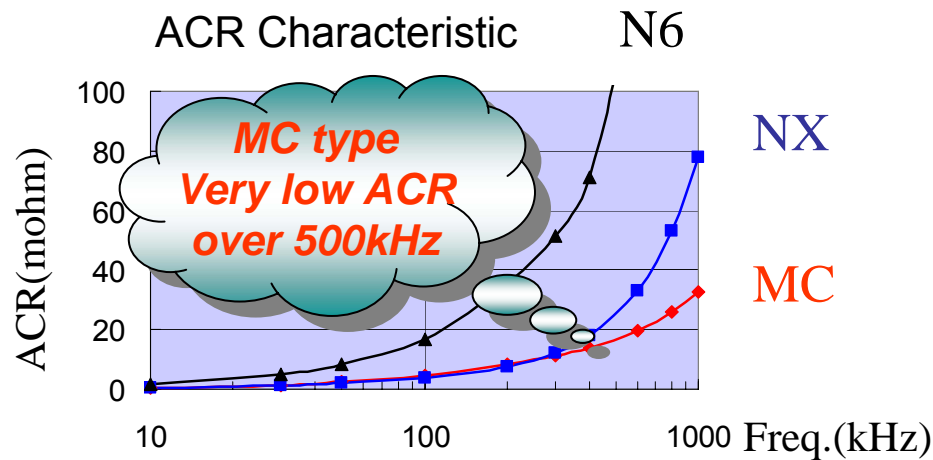


■ Circuit Example

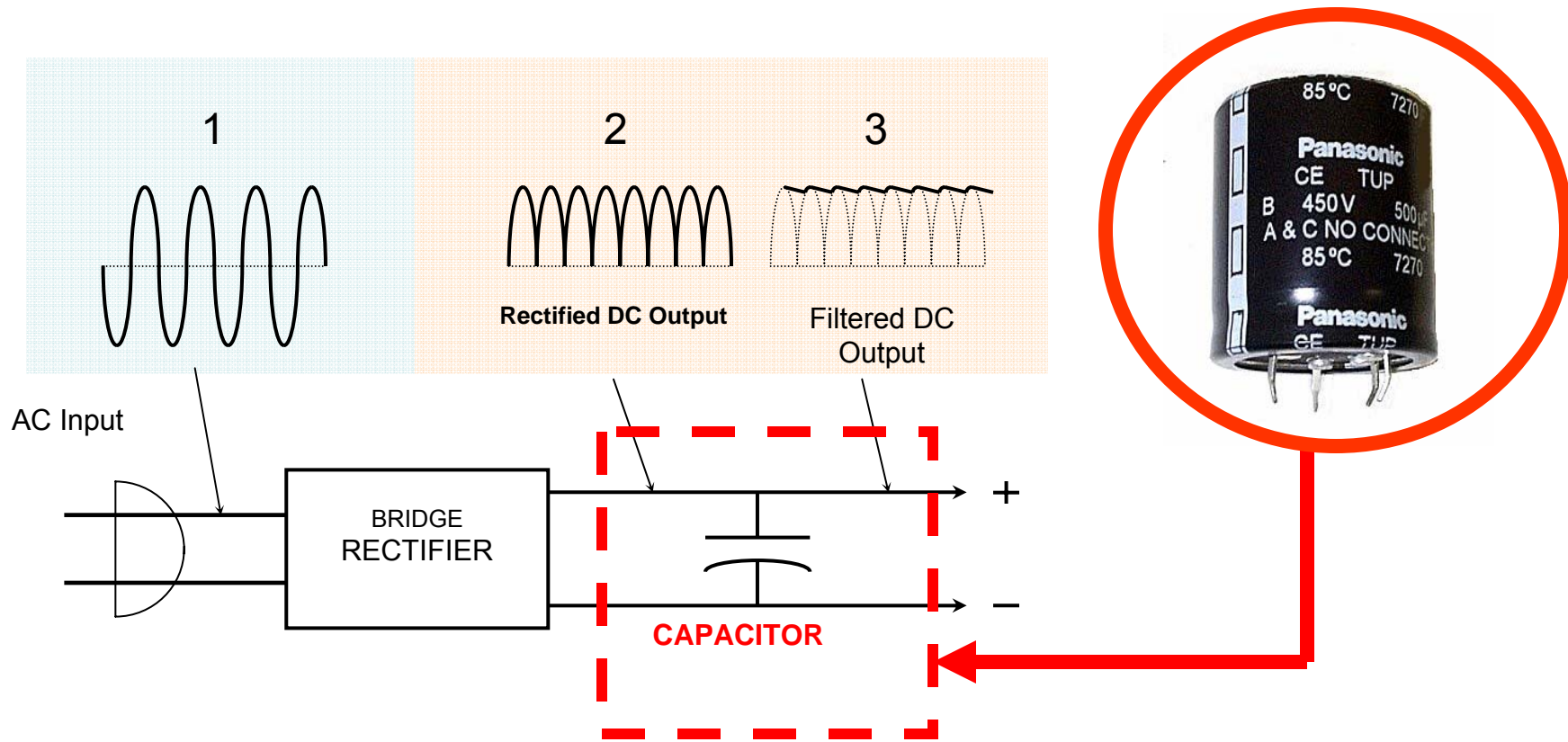


Power Choke Coil's (PCC) Overview

Series	MC type ETQP4L 	NX1 type ETQP3H	NX2 type ETQP2H	NX3 type ETQP1H	N6 type ETQP6F 
Real estate (L x W)	10 x 10 mm	13 x 12.9 mm 			12.5 x 12.5mm
Height max.	4.0 mm	3.9 mm	4.9 mm	6.0 mm	5.7 mm
Core Material	Metal Composite	Metal Powder			Mn-Zn Ferrite
Inductance range	0.19-0.56 uH	0.36-1.43uH	0.29-2.61uH	0.60-1.00uH	0.8-10.2 uH
DCR (mohm) max.	0.77-1.76	1.04-4.52	0.54-4.98	0.90-1.56	2.24-13.3
DCR tolerance	+/-10%	+/-20% (Maximum Specification)			



The Snap-in style Aluminum Electrolytic Capacitor



Large Can Snap-In 2 & 3 pin

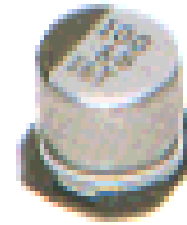


	TS-UP	85°	3000 hr	16-500 volt
Higher C/V	TS-UQ	85°	2000 hr	16-450 volt
	TS-HA	105°	3000 hr	10-450 volt
Higher C/V	TS-HB	105°	3000 hr	160-450 volt
Highest C/V	TS-HC	105°	2000 hr	10-450 volt
Very high Ripple	TS-ED	105°	3000 hr	200-450 volt
Highest Ripple*	TS-EE	105°	3000 hr	200-450 volt
Longest Life	TS-XB	105°	7000 hr	160-450 volt

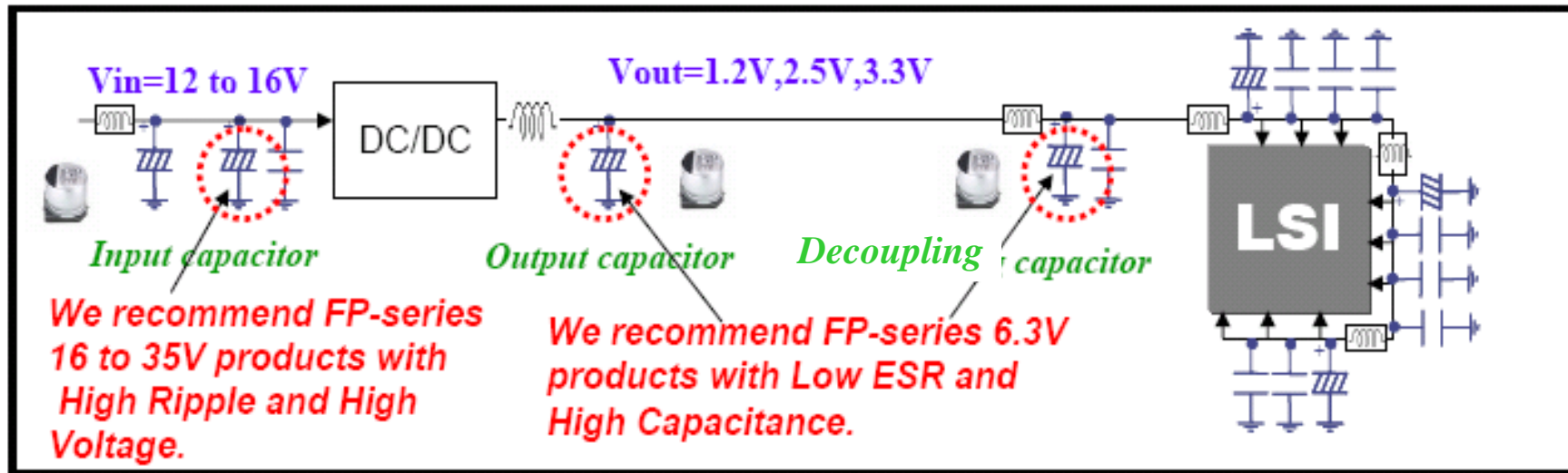
TS Type

*“Produced in
Tennessee, USA”*

Low ESR New FP Series coming soon



30-50% Lower ESR than our FK Series



SP-Cap
Specialty Polymer Capacitor

EEF Polymer Al Capacitors – Low ESR and Solid Polymer Electrolyte



Thank You!

For more information on Passives for Power Supplies, please see:

http://industrial.panasonic.com/ww/products_e/passive_electromech_e/passive_electromech_e.html and click on Application Notes for Passive components, then Power supply

Then: Power Supply



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