

Switched Mode Power Conversion

Semester II Academic Year 2025-26

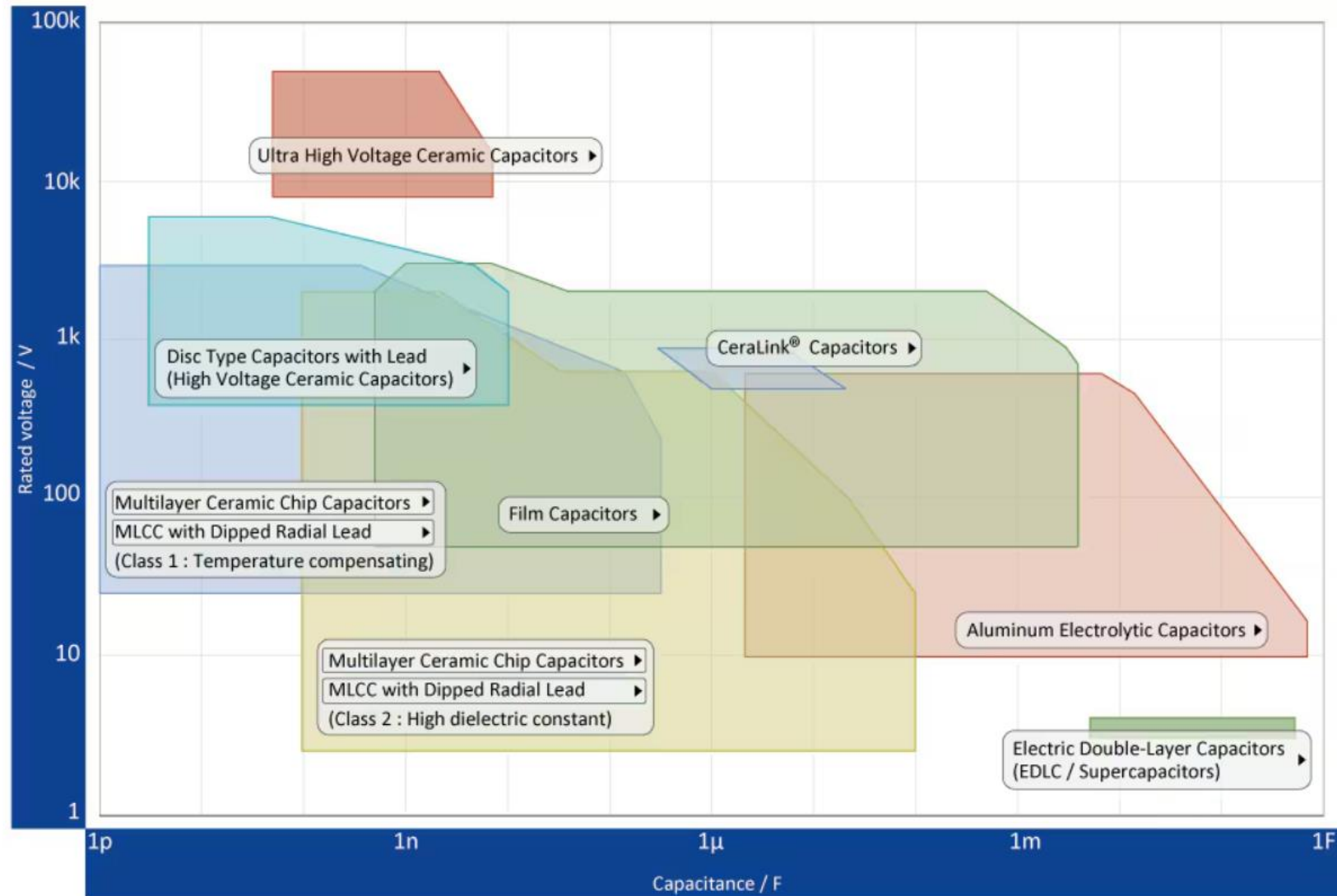
Lecture 35

21st April 2026



Minimizing influence of DC bus inductance

DC bus capacitor – types of capacitors





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DC bus capacitor – types of capacitors

capacitor type	max. possible capacitance	voltage range	max. permissible current	max. operating temperature	Applications
Aluminum Electrolytic Capacitor	> 1F ●	ca. 600 V ●	ca. 0.05 A/ μ F ●	85°C up to 150°C ●	smoothing. buffering. DC Link
Film Capacitors	> 8mF ●	ca. 3kV ●	ca. 3 A/ μ F ●	max. 110°C ●	DC Link. EMI suppression. filtering
MLCC's	> 100 μ F ●	ca. 10 kV ●	ca. 10 A/ μ F ●	85°C up to 200°C ●	EMI suppression. buffering. coupling



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DC bus capacitor – typical information in datasheet

ELECTRICAL DATA AND ORDERING INFORMATION								
U_R (V)	C_R (μ F)	NOMINAL CASE SIZE $\varnothing$ D x L (mm)	I_R 100 Hz 105 °C (A)	I_{L5} 5 min (mA)	$\tan \delta$ 100 Hz	MAX. ESR 100 Hz (m Ω)	MAX. Z 10 kHz (m Ω)	CATALOG NUMBER MAL2299.....
350	820	35 x 50	3.15	0.578	0.15	170	125	55821E3
	820	40 x 40	3.00	0.578	0.15	180	130	65821E3
	1000	35 x 60	3.70	0.704	0.15	140	105	55102E3
	1000	40 x 50	3.75	0.704	0.15	145	105	65102E3
	1200	35 x 70	4.15	0.844	0.15	120	85	55122E3
	1500	35 x 80	4.70	1.054	0.15	95	70	55152E3
	1500	40 x 60	4.60	1.054	0.15	100	75	65152E3
	1800	35 x 100	5.90	1.264	0.15	80	60	55182E3
	1800	40 x 80	5.40	1.264	0.15	85	65	65182E3
	1800	45 x 60	5.20	1.264	0.15	90	70	75182E3
	2200	40 x 100	6.45	1.544	0.15	65	50	55222E3
	2200	45 x 80	6.10	1.544	0.15	70	55	65222E3
	2700	40 x 100	6.85	1.894	0.15	55	45	55272E3
	3300	45 x 100	7.60	2.314	0.15	50	40	55332E3

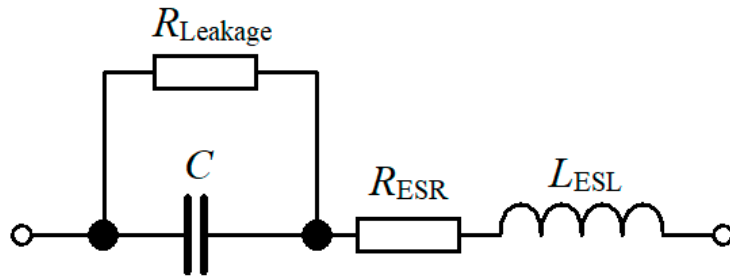
If the voltage and capacitance requirement is satisfied but RMS ripple current is not, then what to do ?

Having parallel branches to ensure rated ripple current of DC bus is greater than required ripple current



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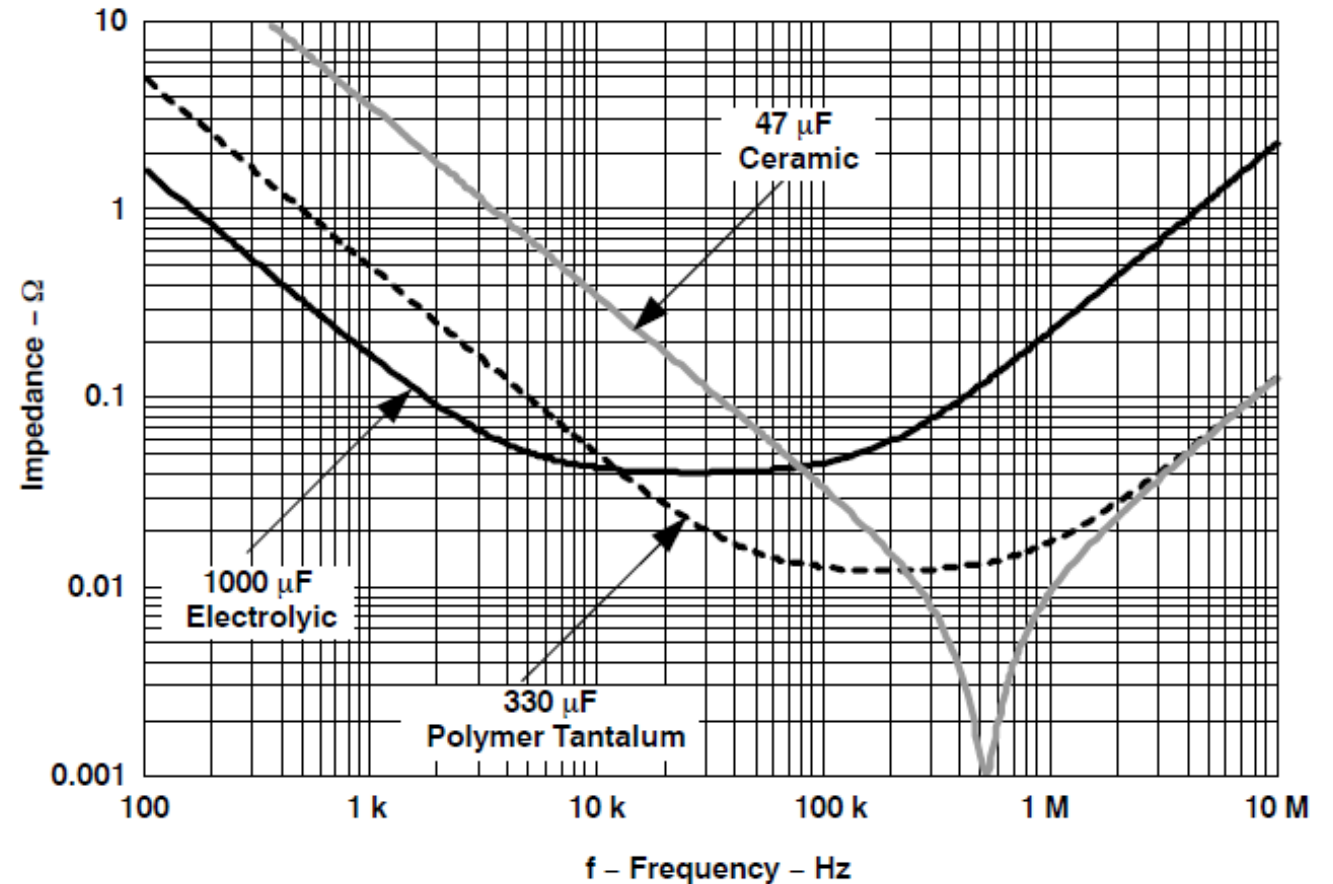
DC bus capacitor – frequency characteristics



$$Z = j\omega L_{ESL} + R_{ESR} + \frac{R_{leakage}}{j\omega C R_{leakage} + 1}$$

Design objective – dominant ripple frequencies should be lesser than the resonating frequency

As switching frequency increases the requirement for capacitors of higher resonating frequency arises





Minimizing influence of DC bus inductance

DC bus capacitor – high frequency

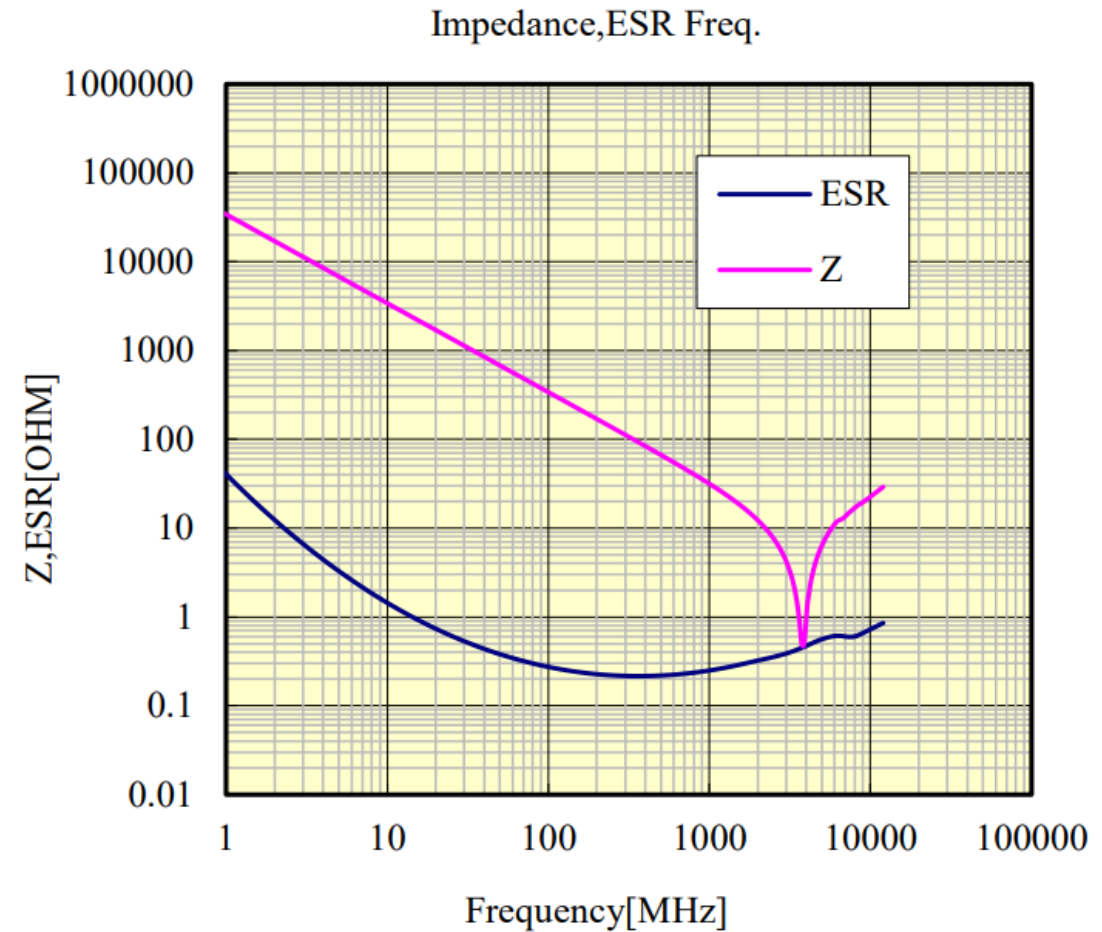
Ceramic capacitors

Lower value

Lower voltage rating

Multilayered Ceramic capacitors
(MLCC) higher voltage

Challenge – how do we physically connect multiple capacitors in DC bus while reducing the stray inductance ?



4.7 pF, 50 V ceramic capacitor