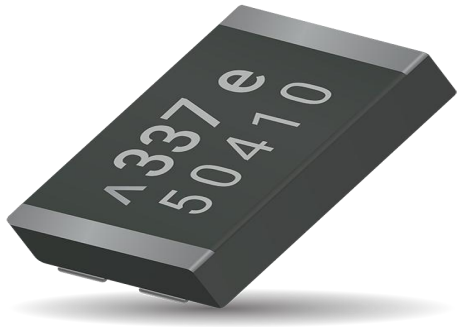
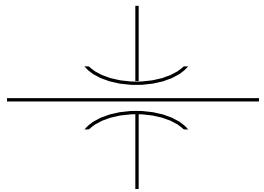
Low Inductance Bulk Capacitors





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Outline

Need for High Quality Power by Advanced ICs

Low Inductance Bulk Capacitor - What is it

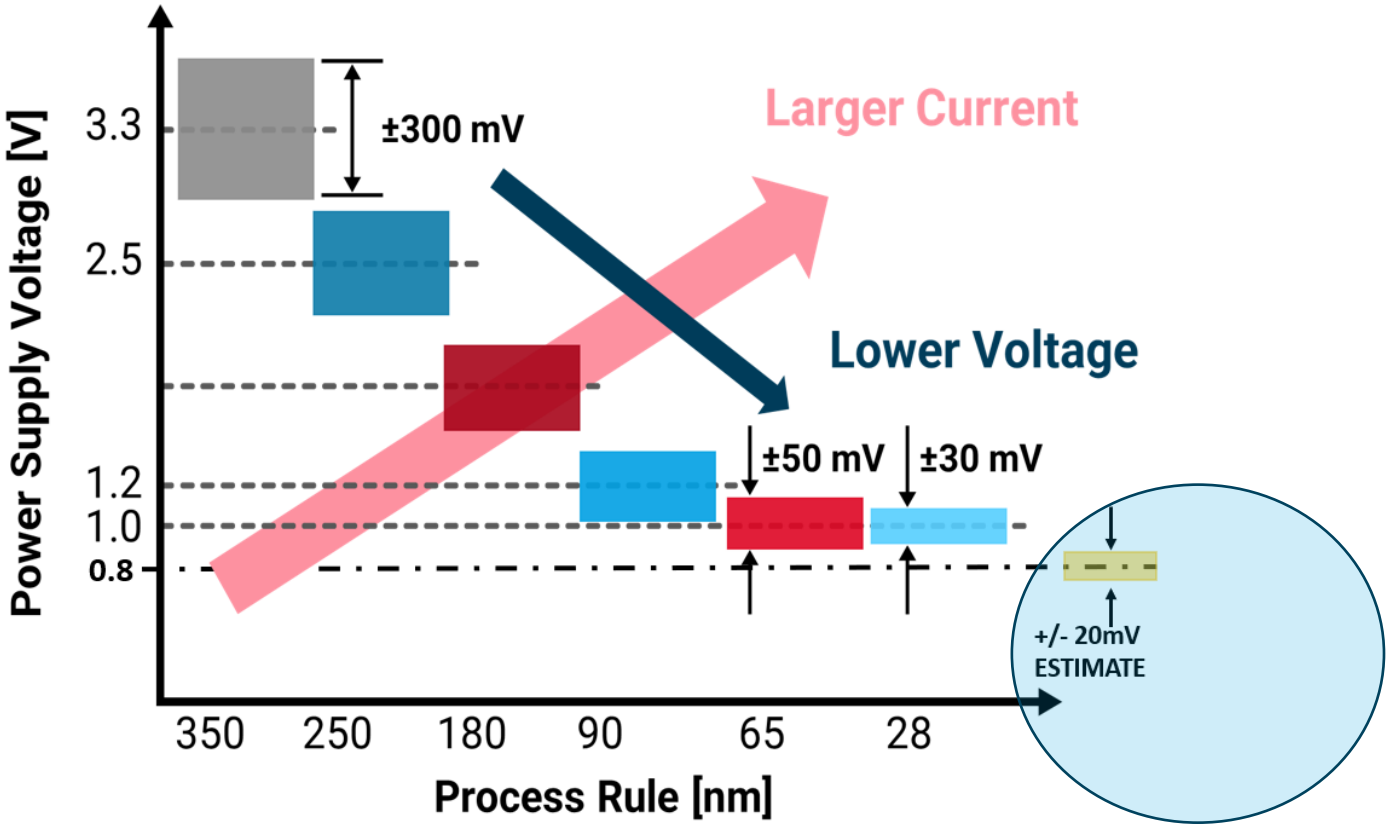
LIBC device details

In circuit performance

Summary

Key Application Driving Cap Innovation Power Distribution Networks

Higher Current
Reduced Voltages
Greatly reduced ripple

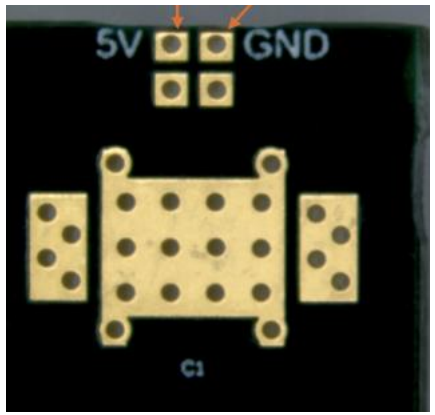


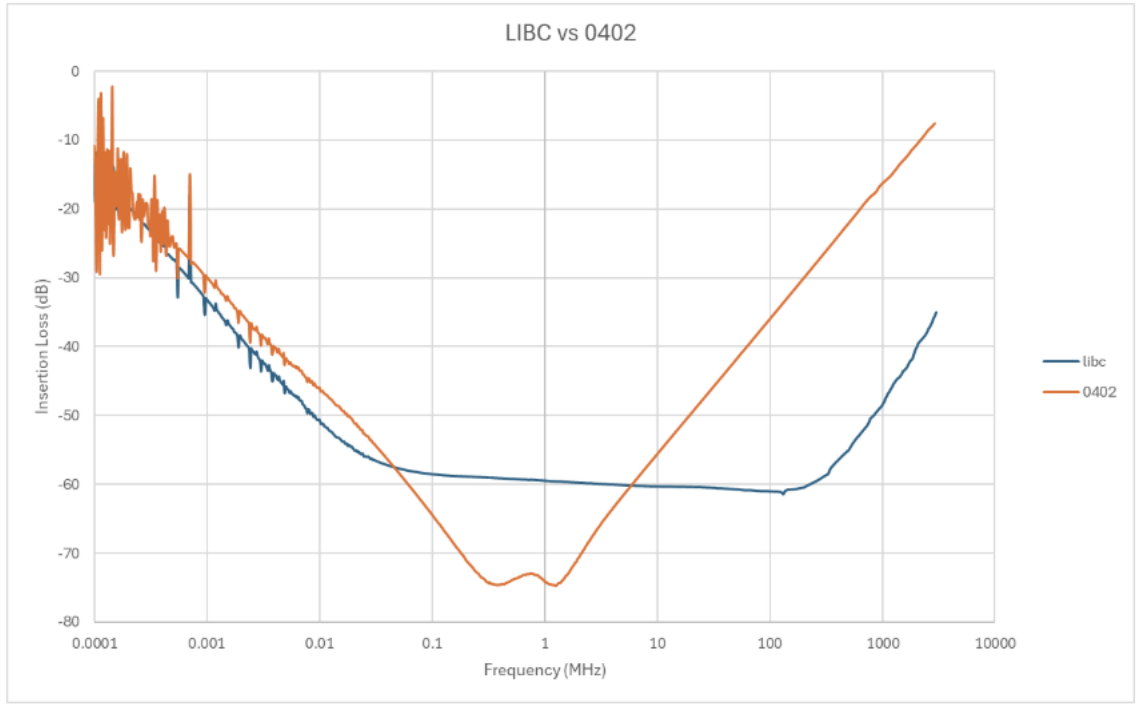
Proprietary region

Edited source: Rohm Semiconductors

NOTES

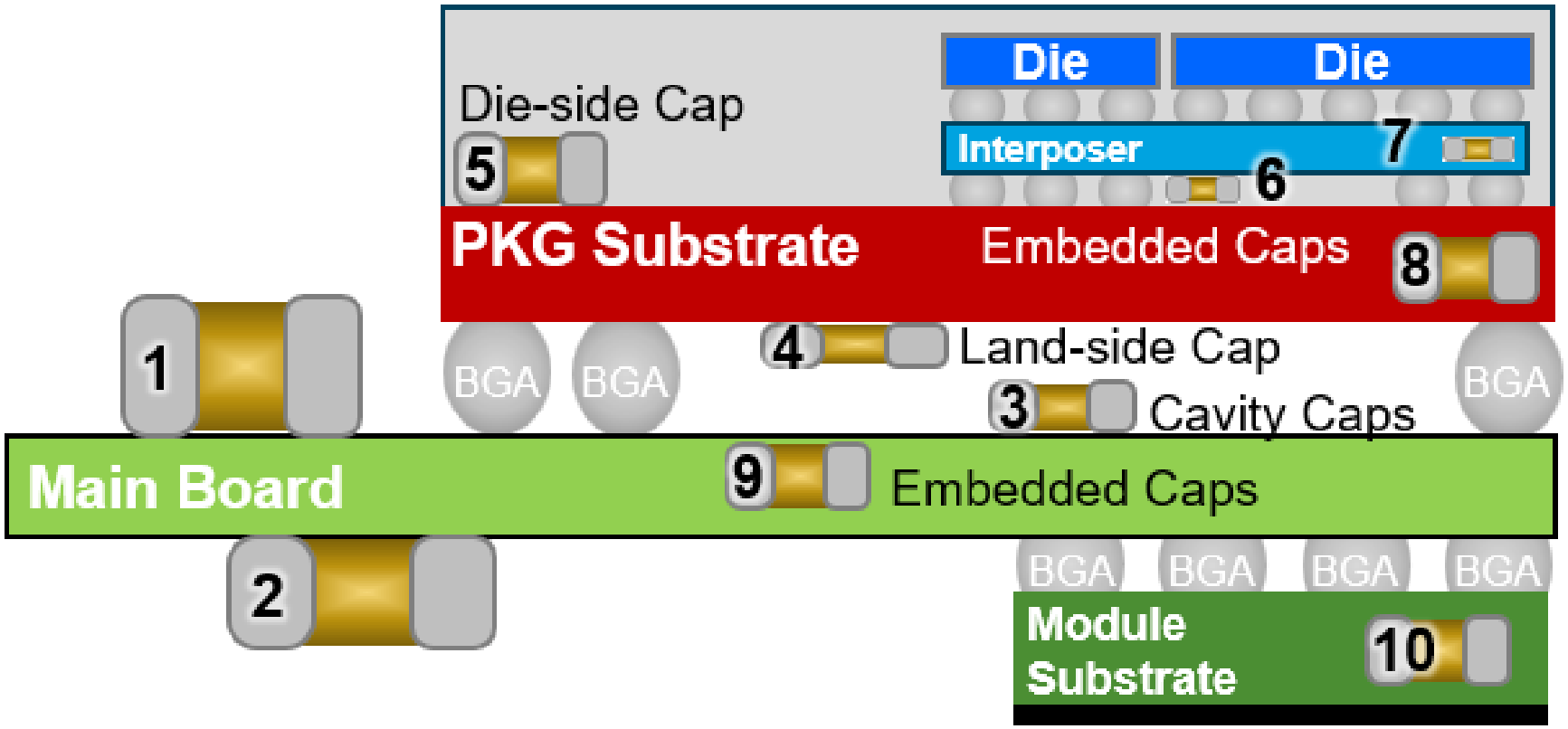
Higher Current
Reduced Voltages
Greatly reduced ripple





Capacitors provide solutions to improve Power Quality

Existing Capacitor Placements



But there is a practical limitation to the number of capacitors used

Passive component technology trend:

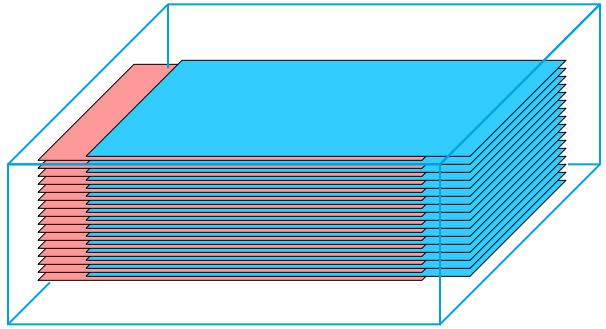
MINIATURIZATION

- IMPACT OF MINIATURIZED PASSIVES IS OF EXTREME IMPORTANCE
- 10 X 10 PART USE EXAMPLE IS SHOWN BELOW:

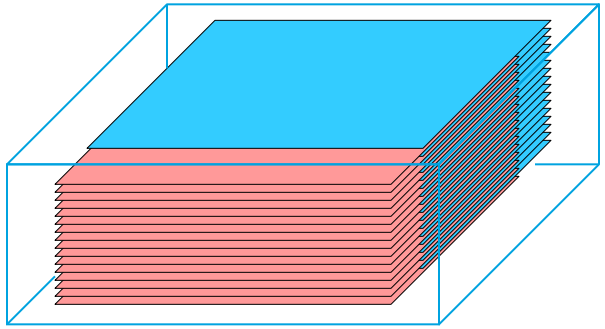
Size	Typical Chip Size (mm)	Mounting Area Ratio*	Weight (g/100pcs)	Weight Down Ratio
0805	2.0 x 1.25	100.0%	2.346	100.0%
0603	1.6 x 0.8	56.0%	0.901	38.4%
0402	1.0 x 0.5	25.7%	0.281	12.0%
0201	0.6 x 0.3	12.0%	0.043	1.8%
01005	0.4 x 0.2	7.1%	0.010	0.4%
008004	0.25 x 0.125	4.2%	0.001	0.1%

This technology advancement will impact military & COTS parts

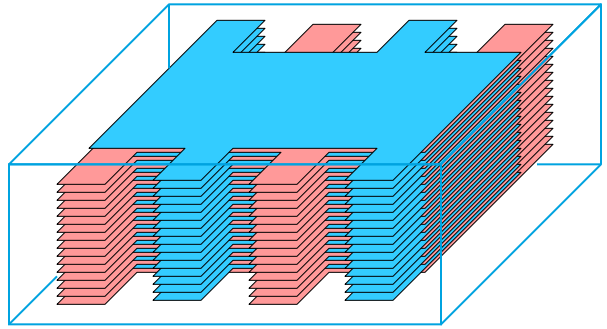
HISTORY - Low Inductance MLCCs



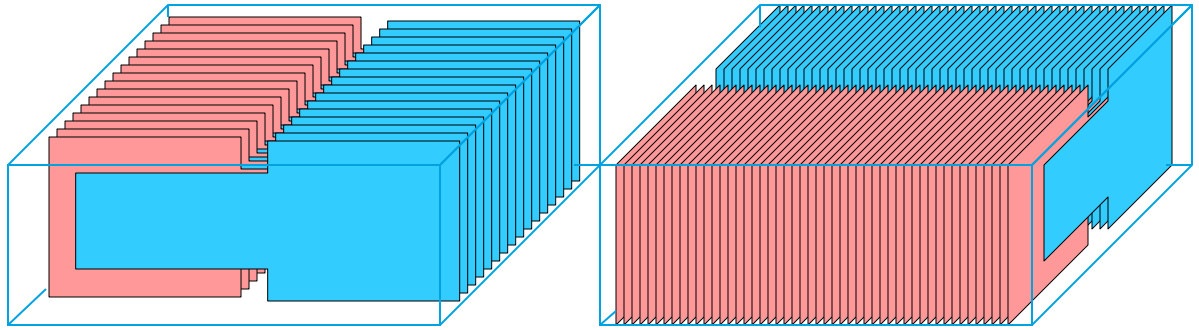
MLCC 700ph 0805
- Horizontal Electrodes
- Power I/O at ends of chip
- Relatively high ESL



LICC 130 ph 0508
- Horizontal Electrodes
- Power I/O at sides of chip
- Moderate ESL



IDC 45ph 0508
- Horizontal Electrodes
- Power I/O at sides/ends of chip
- Parallel current paths
- Low ESL



Two-Terminal 45 to 130 ph
- Vertical electrodes
- Power I/O at bottom of chip
- Low ESL

Low inductance MLCCs generally followed a progression of increasing reliability levels once introduced

AEC-Q200

DLA

DESC

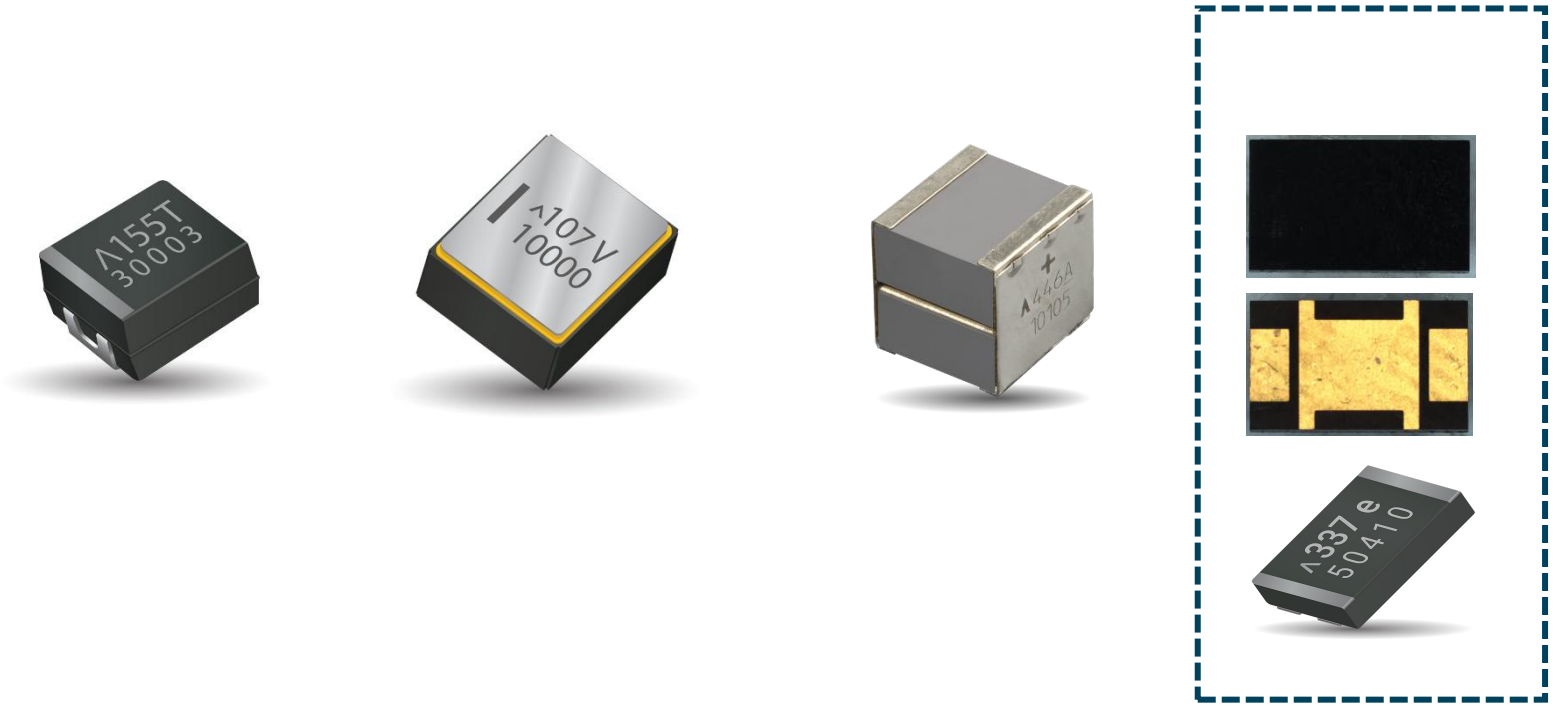
IECQ-CECC

SCD

DSCC

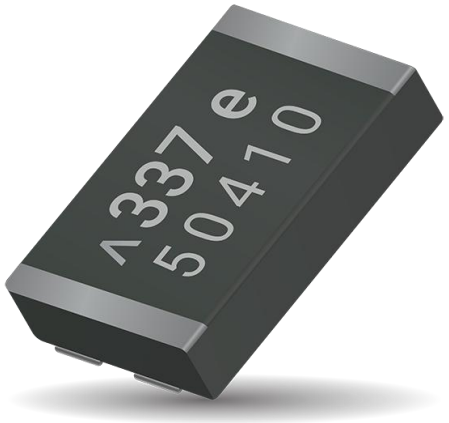
MIL-PRF

Bulk Capacitors are now following a low inductance evolution & high reliability trajectory



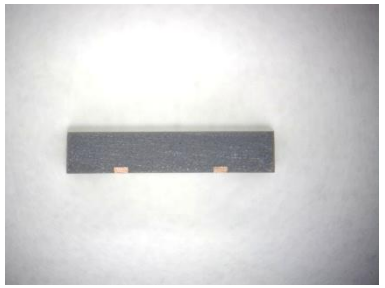
Introducing Low Inductance Bulk Capacitors

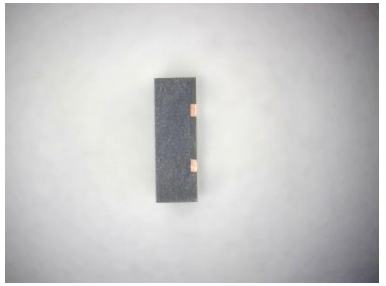
What is LIBC

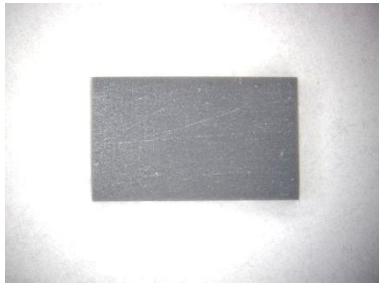


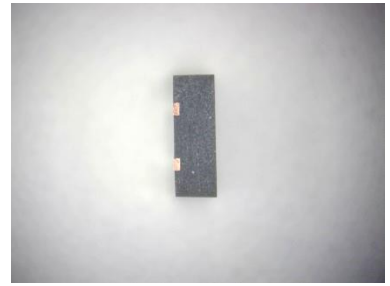
Polymer tantalum electrolytic capacitor technology

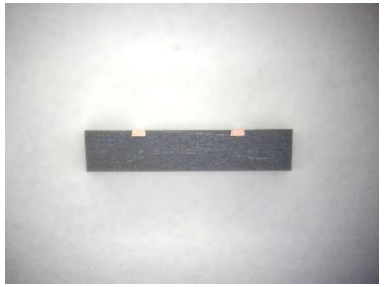
- Low inductance / high CV
- Low ESR / high RMS
- Extended frequency range response

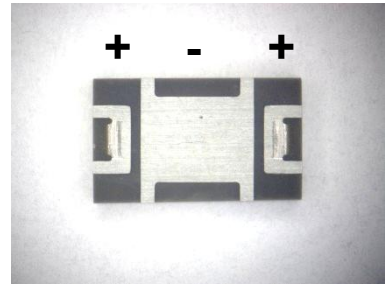








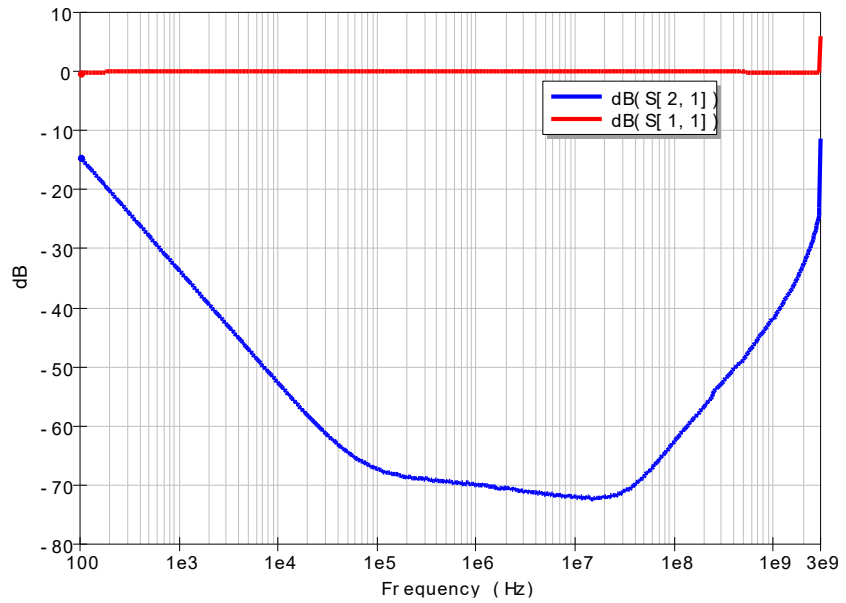




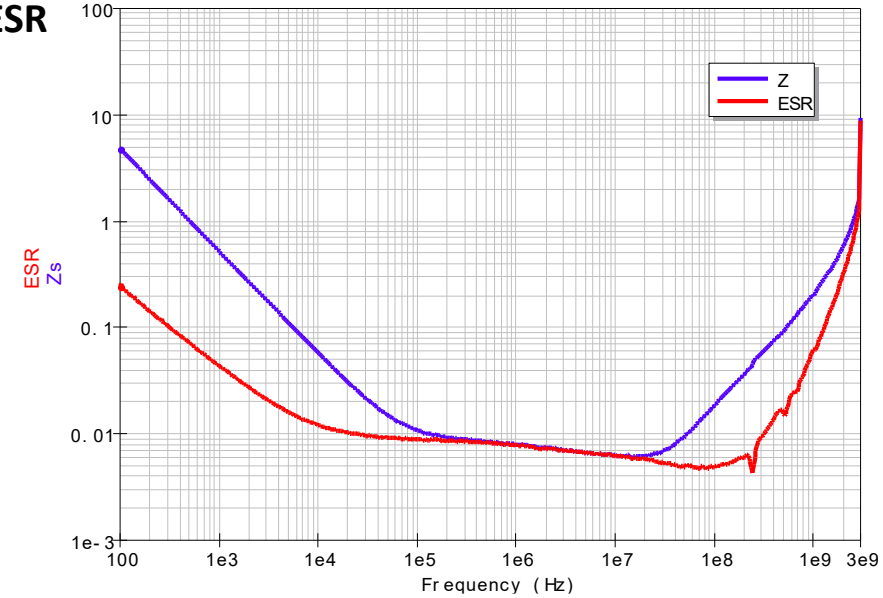
Example:
330uF/2.5V
Size (mm): 7.3 × 4.3 × 1.5
Package: liquid resin

LIBC 330uF/2.5V De-Embedded from test card

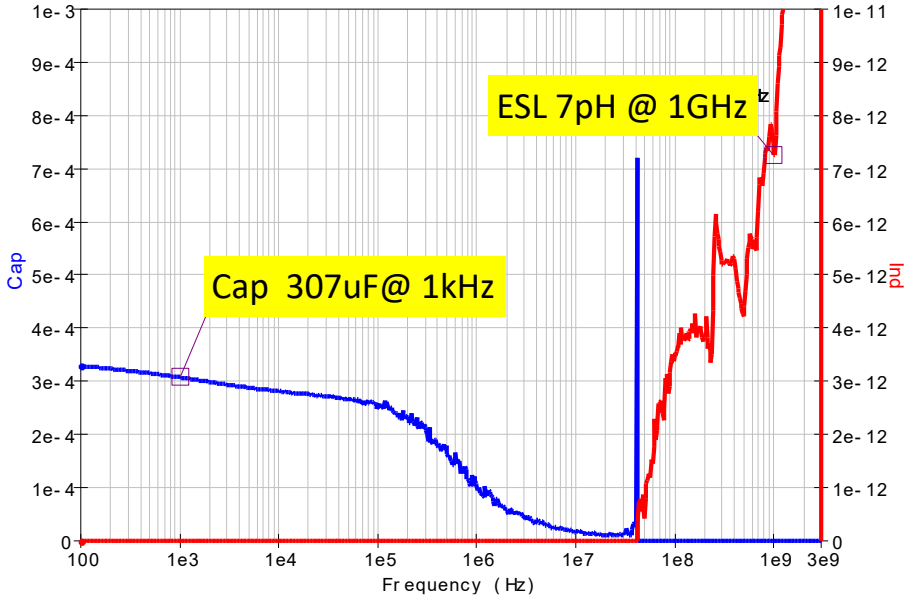
S-para



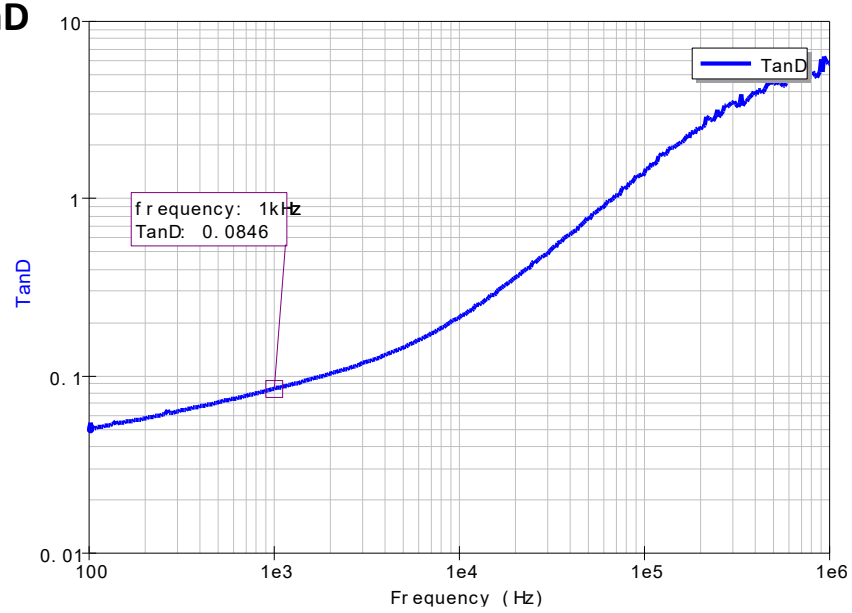
Z, ESR



Cap
ESL



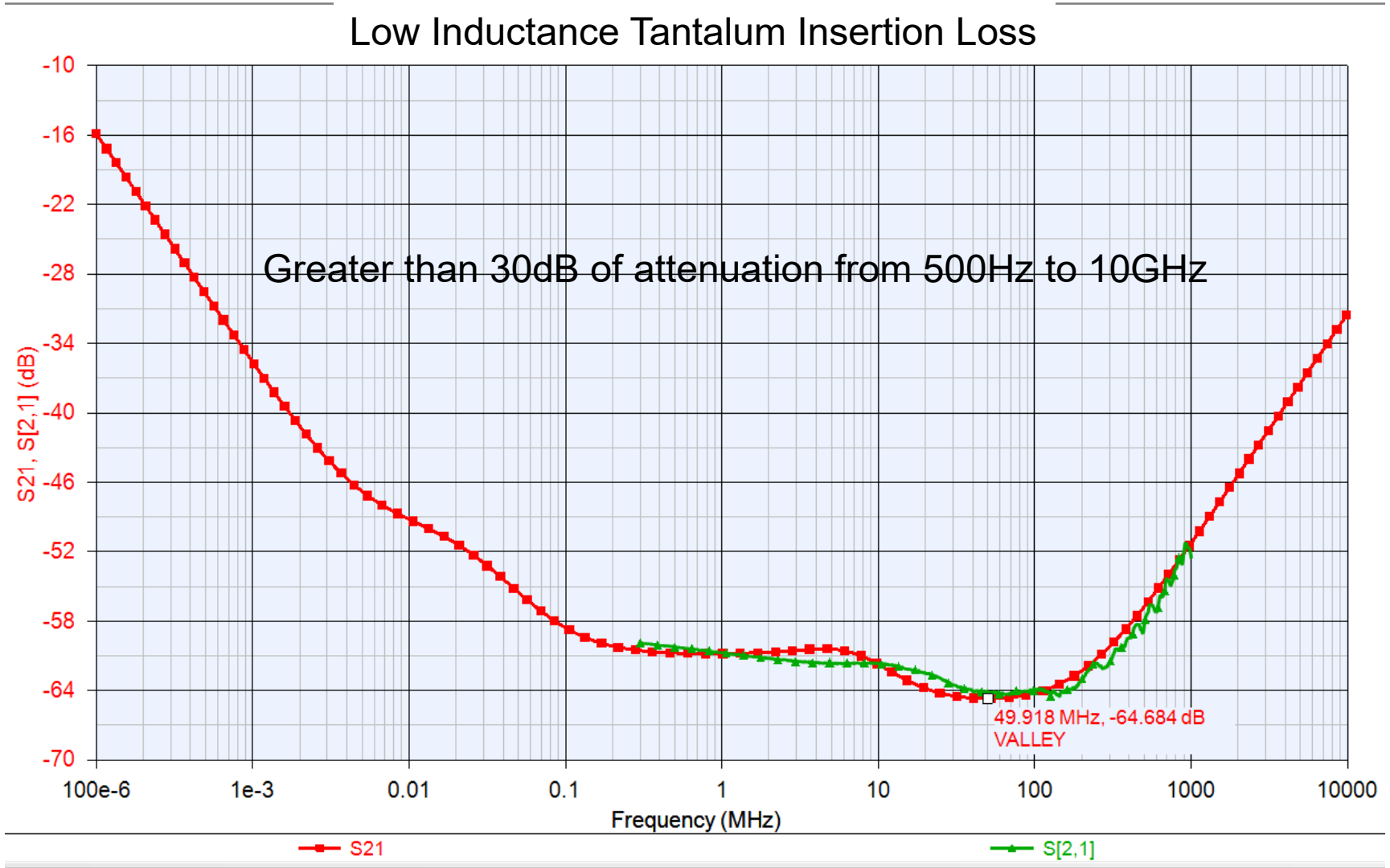
TanD



LIBC - Feedthrough Mode

- Provides > -30dB attenuation for many orders of magnitude (~300 KHz to ~3 GHz)
- broadband filtering

- Can withstand high dI/dt loads - little temperature rise with current (3-4 A limits)

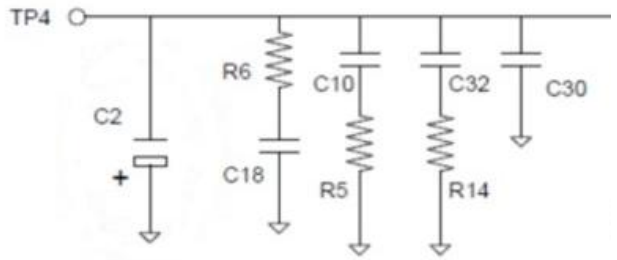


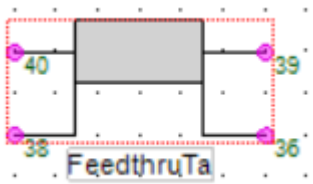
Green=Measured Red=Modelled

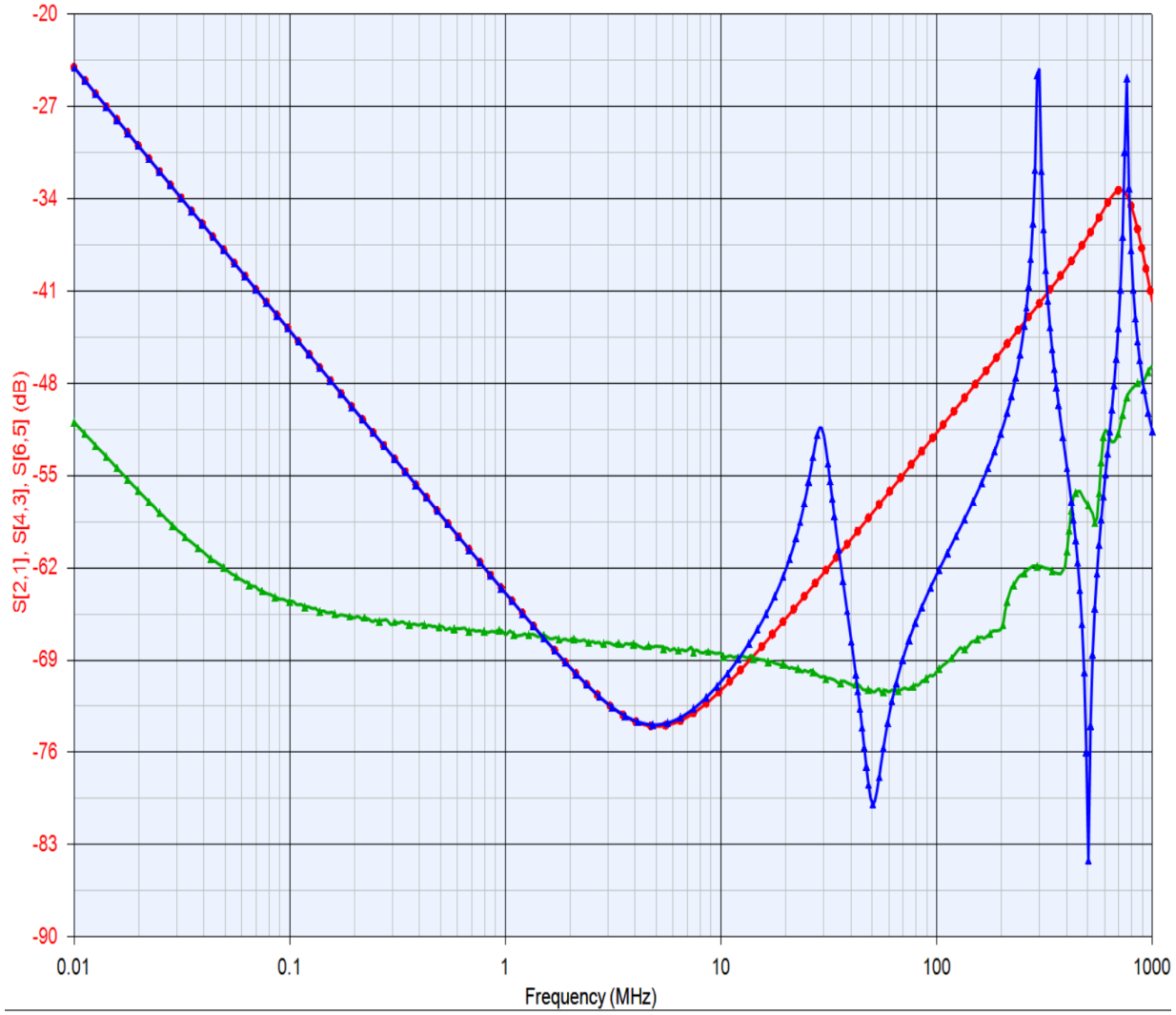
Example Application: Bias Bank

Simulation: Low Inductance Cap vs Std Caps in Bias Bank

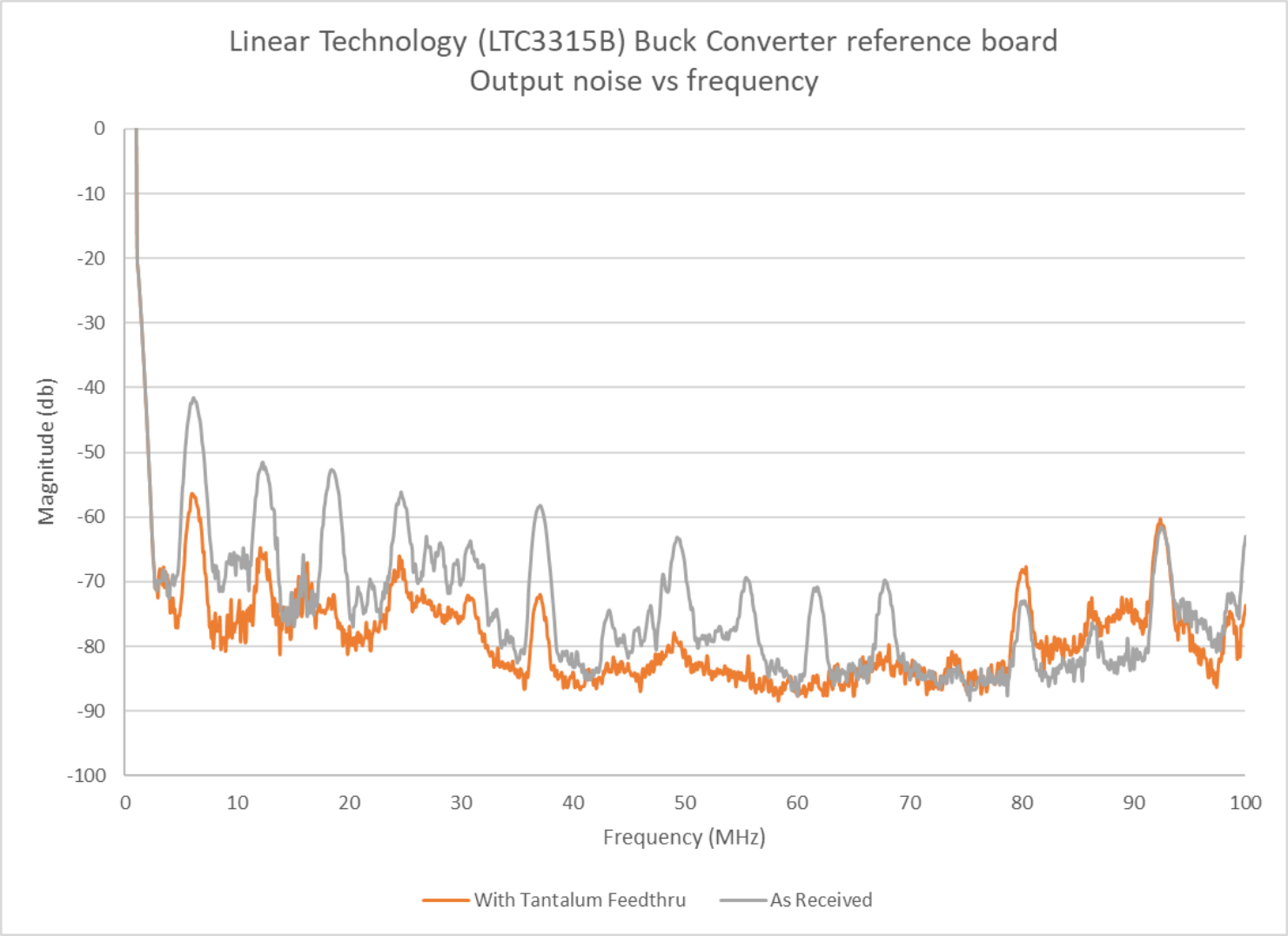
- Red – Bias Circuit as designed
- Blue – Bias Circuit without resistors R6, R5, R14
- Green – Bias Circuit with LIBC
- LIBC provides improved performance at low frequency and high frequency
- Replaces 8 individual components







Buck (DC-DC Conversion) Circuit



FEATURES

Stay tuned for fast moving developments – case sizes, values etc.

- **Low ESL / Low ESR make circuit use attractive**
- **Highest CV/cc of Low Profiles**
- **Excellent performance of noise absorption at GHz**

- **Undertab Terminations Layout:**
  - **High Volumetric Efficiency**
  - **High PCB Assembly Density**
  - **High Capacitance in Smaller Dimensions**
  - **3x Reflow 260°C Compatible**
  - **100% Surge Current Tested**

THANK YOU.

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