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A Better Approach to DC Power Filtering

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Place a microprocessor inside a shielded enclosure and evaluate the performance of different combinations of power filters against X2Y® Technology.
What is X2Y® Technology?

- Symmetrically Balanced Capacitive Circuit.
  - Has same MLCC standard component sizes and capacitance values
  - Has same dielectric, electrode, and termination materials

- Different internal structure
  - A & B electrodes share common reference electrode
  - Reference electrode structure form “quasi” Faraday Cage
  - Structure cancels internal mutual inductance similar to dual coaxial transmission line
  - Several modes of operation (For this paper – CIRCUIT 1)
What is X2Y® Technology? (continued)

- Circuit 1 – Attached differentially across power leads while referenced (G1/G2) to the enclosure.
- Both CM & DM noise enter the structure in opposing directions which cancel on reference electrodes.
- Unless otherwise noted, this is the X2Y comparison configuration.
- DUT and power supply are connected by 3 meter harness.
- RE are measured in a GTEM and recorded with a spectrum analyzer.
- 100kHz – 200MHz a 30dB external pre-amp was used.
Ferrite Bead vs. X2Y®

- **Bead 1** = 160 ohms @ 25MHz; 258 ohms @ 100MHz.
- **Bead 2** = 66 ohms @ 25MHz; 110 ohms @ 100MHz.
- Pi Filter = X-caps - 1206 (0.1uF) and 1812 (0.22uF); CMC = (0.5nH)

Metal Enclosure

(+) Pwr
(-) Pwr

Computer Board

Pi Filter

100KHz – 200MHz

200MHz – 1GHz

Ambient
Y-caps = 1812 (0.22uF)

Y-caps = 1206 (0.1uF)
X-cap & (2) Y-caps vs. X2Y®

- X/2Y = Y-cap 1812 (0.22μF); x-cap 1812 (0.12μF)
- X/2Y = Y-cap 1206 (0.1μF); x-cap 1206 (0.47μF)

Metal Enclosure

(+): Pwr
(-): Pwr

Computer Board

Ambient

No Filter

MLCC (2)Y-caps & (1)X-cap (1206)

(1) X2Y(1206)(0.1uF)

100KHz – 200MHz

200MHz – 1GHz

Ambient
Nominal difference inside vs. outside.
X2Y® (-) Power lead attach to Enclosure vs. Isolated

- Nominal difference when (-) power and chassis are the same.
X2Y® vs. the 4 conventional filters

- Best filtering performance in reducing radiated emissions.
- Smallest layout space to implement.
- Cheapest production cost.
- X2Y® offered 3 different implementation configurations for designers.
Questions?

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